COMBILINE™

Proven Solutions for Roots Pumping Stations!

PFEIFFER VACUUM
What's the added value for you?

Just imagine you have to evacuate a volume of 630 cubic meters. This is equivalent to the cubical content of a single-family home. Systems with chambers of this size are being built today for electron-beam welding of components with weights of up to 50 tons and dimensions of up to 12·6·5 meters.

With a 40-kilowatt beam, it is possible to achieve weld depths of up to 100 millimeters in steel and 150 millimeters in aluminum. To do this necessitates a vacuum of $5 \times 10^{-4}$ millibars.

Fast evacuation times are necessary in order to be able to work cost-effectively. To do that, the vacuum technology has to satisfy certain requirements:

**Low and medium vacuum:**
Evacuation from 1,000 to $5 \times 10^{-2}$ millibars

**High vacuum:**
Further evacuation from $5 \times 10^{-2}$ to $5 \times 10^{-4}$ millibars

Electron-beam welding technology is employed in such highly innovative sectors as the aerospace industry.
Pfeiffer Vacuum – Your ideal partner!

■ 40 years of experience in building pumping stations
■ High level of competence
■ Innovative, absolutely reliable products
■ High level of technology
■ Pressure range from atmosphere to high vacuum
■ Standard pumping stations and customized solutions
■ Support in designing your vacuum system
■ Magnetically coupled pumping stations also available – hermetically tight and maintenance free

That’s true added value for you! We provide you with individual support, we train you and we offer on-site service worldwide.
Now things are getting exciting! Our engineers have developed the following solution:

A maximum of 30 minutes has been stipulated for evacuating from 1,000 to \(5 \times 10^{-2}\) millibars. To achieve this, four large vacuum pumping stations are employed, each consisting of one rotary vane pump and two large Roots pumps. The maximum combined pumping speed of all pumping stations totals 40,000 cubic meters per hour at a pressure of 0.1 millibar.

In the high-vacuum range, it is necessary to do more than just evacuate the volume. Both the vapors produced in connection with the welding process as well as the gases desorbing from the 450 square-meter surface area have to be pumped.

An oil diffusion pump having a pumping speed of 40,000 liters per second is employed for evacuation. The water vapor is captured by a special cooling trap, which freezes out the water onto its extremely cold surfaces (below –120 °Celsius).

Further components from the Pfeiffer Vacuum product portfolio are required for operating the system, such as pressure gauges, electrical control systems and installation elements.

Given the nature of these applications, intensive collaboration with the customer is necessary early on in designing the system in order to achieve optimal solutions.

This is one of many examples that shows how much more advice and service you get from us – especially in connection with highly complex applications involving corrosive gases or dust.

**What is a pumping station?**

Pumping stations are combinations of individual pumps. They can include the following major components:

- Roots pumps
- Rotary vane pumps
- Turbopumps
- Dry pumps
- Liquid ring pumps
- Cryopumps
- Diffusion pumps
- Vacuum gauges
- Analytical equipment
- Pumping station control systems (including PLC versions) and bus connections

Electron-beam welding can be performed in large vacuum chambers whose volume is comparable to that of a single-family home.
**CombiLine™ WU Roots pumping stations**

- Ultimate pressure up to $2 \times 10^{-3}$ mbar
- Cost-effective solution
- Hardening, casting, melting, vacuum drying and degassing

**CombiLine™ WU Roots pumping stations**

- Ultimate pressure up to $8 \times 10^{-3}$ mbar
- Cost-effective solution
- Metallurgy, load-locks, helium leak detection, electron-beam welding

**CombiLine™ WD Roots pumping stations**

- Ultimate pressure up to $5 \times 10^{-4}$ mbar
- Backing station for high-vacuum pumps
- Metallurgy, coating, research & development, photovoltaics, vacuum drying

**CombiLine™ WH Roots pumping stations**

- Ultimate pressure up to $2 \times 10^{-3}$ mbar
- Dry, oil-free suction chamber
- Coating, metallurgy, vacuum drying, degassing, photovoltaics

**Customized vacuum solutions**

- Multi-stage versions
- Ultimate pressure ≤ $10^{-3}$ mbar
- High-vacuum pumping stations
- Photovoltaics, die-casting, space simulation, coating
COMBILINE™ WU

CombiLine™ WU Roots pumping stations with single-stage UnoLine™ Plus rotary vane pump

For applications requiring ultimate pressures of up to $2 \cdot 10^{-3}$ mbar

These pumping station versions are employed in the field of metallurgy. The major applications include hardening, casting or melting materials. Further typical applications consist of vacuum drying and degassing.

Applications
- Vacuum drying and degassing
- Metallurgy
  - Hardening
  - Sintering
  - Soldering
  - Casting
  - Melting
Combination of OktaLine™ Roots pump and UnoLine™ Plus rotary vane pump

<table>
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<tr>
<th>Technical data</th>
<th>WU 951</th>
<th>WU 1801</th>
<th>WU 2001</th>
<th>WU 3501</th>
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<td>BA 501</td>
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<td>Okta 2000</td>
<td>Okta 2000</td>
<td>Okta 4000</td>
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<td>&lt; 2 · 10⁻³</td>
<td>&lt; 2 · 10⁻³</td>
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<td>&lt; 3 · 10⁻²</td>
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1) Approximate values only – will depend upon actual design

Pumping speeds
COMBILINE™ WU

CombiLine™ WU Roots pumping stations
with single-stage HenaLine™ rotary vane pump

For applications requiring ultimate pressures of up to \(8 \cdot 10^{-3}\) mbar

One typical field of application for these pumping stations is helium leak detection, which affords fast identification and localization of even minute leaks.

These pumping stations play an important role in connection with fast evacuation of load-lock chambers for the purpose of inserting or removing components. Further application options include electron-beam welding and surface coating.

Applications

- Metallurgy
  - Hardening
  - Sintering
  - Soldering
  - Casting
  - Melting
- Helium leak detection
- Evacuating load-lock chambers
  - Electron-beam welding
  - Coating
## Technical data

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<td>&lt; 3 · 10⁻²</td>
<td>&lt; 3 · 10⁻²</td>
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<td>Max. noise level [dB(A)], at 1 mbar</td>
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<td>Motor rating, Hena, 50 Hz [kW]</td>
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<td>Motor rating, Okta, 50 Hz [kW]</td>
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<td>Motor rating, Okta, 60 Hz [kW]</td>
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<td>1.8</td>
<td>3.6</td>
<td>3.6</td>
<td>13.2</td>
<td>18</td>
</tr>
<tr>
<td>Max. noise level [dB(A)], at 1 mbar</td>
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<td>75</td>
<td>80</td>
<td>85</td>
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<tr>
<td>Weight [kg]</td>
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<td>285</td>
<td>610</td>
<td>1,040</td>
<td>1,440</td>
<td>2,250</td>
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</table>

1) Approximate values only – will depend upon actual design

### Pumping speeds

![Pumping speed graph](image)
CombiLine™ WD Roots pumping stations with two-stage DuoLine™ rotary vane pump

For applications requiring ultimate pressures of up to 5 \times 10^{-4} \text{ mbar}

These are classical pumping stations for a broad range of applications in the coating segment. The pumping stations are especially suitable as backing stations for high-vacuum pumps.

Possible applications for these pumping stations include the application of anti-wear coatings on lathe tools and drills, decorative coatings for gemstones, as well as optical coatings for eyeglass lenses or architectural glass.

A further field of application consists of metallurgy, where hardening or nitriding enables the properties of the material to be modified.

**Applications**

- **Metallurgy**
  - Hardening
  - Sintering
  - Soldering
  - Casting
  - Melting
  - Degassing
- **Coating**
  - Wear protection
  - Decorative coatings
  - Thermal protection coatings
  - Optical coating
- **Research & development**
- **Photovoltaics**
- **Vacuum drying**
## Technical data

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<th>Rotary vane pump</th>
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<td>Okta 500</td>
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<td>Pumping speed at 1 mbar [m³/h], 50 Hz</td>
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<td>400</td>
<td>900</td>
<td>1,800</td>
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<tr>
<td>Pumping speed at 1 mbar [m³/h], 60 Hz</td>
<td>260</td>
<td>470</td>
<td>1,050</td>
<td>2,200</td>
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<td>Connection flange (inlet)</td>
<td>DN 63 ISO-F</td>
<td>DN 100 ISO-F</td>
<td>DN 160 ISO-F</td>
<td>DN 160 ISO-F</td>
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<td>Ultimate pressure [mbar], without gas ballast</td>
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<td>&lt; 5 · 10⁻⁴</td>
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<td>Ultimate pressure [mbar], with gas ballast</td>
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<td>&lt; 5 · 10⁻⁴</td>
<td>&lt; 5 · 10⁻⁴</td>
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<td>Max. noise level [db(A)], at 1 mbar</td>
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<td>Weight [kg]</td>
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<td>980</td>
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1) Approximate values only – will depend upon actual design

### Pumping speeds

![Pumping speed graph](image-url)
COMBILINE™ WH

CombiLine™ WH Roots pumping stations with HeptaDry™/UniDry™ dry-compressing pump

For applications requiring ultimate pressures of up to $2 \times 10^{-3}$ mbar

Suitable for an especially broad spectrum of potential applications. They range from applications in the chemical industry to complex industrial applications right through to production systems for photovoltaics.

One major characteristic of this series is the dry, oil-free backing pump. This enables media to be pumped that can react with pump fluid.

Applications

- Coating
- Metallurgy
- Vacuum drying
- Degassing
- Workpiece cleaning
- Photovoltaics
Combination of OktaLine™ Roots pump and HeptaDry™/UniDry™ dry-compressing pump

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<th>Okta 250</th>
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Technical data

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<td>Okta 1000</td>
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<td>3,500</td>
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<td>470</td>
<td>530</td>
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<td>4,050</td>
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<td>&lt;2·10⁻³</td>
<td>&lt;2·10⁻³</td>
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<td>&lt;5·10⁻³</td>
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<td>&lt;5·10⁻⁴</td>
<td>&lt;5·10⁻⁴</td>
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<td>5.5</td>
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<td>700</td>
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</table>

1) Approximate values only – will depend upon actual design

Pumping speeds
For applications requiring extremely high pumping speeds and/or ultimate pressures of $< 10^{-3}$ mbar, what you get are multi-stage pumping stations, as well as versions that incorporate Pfeiffer Vacuum turbopumps for high-vacuum environments. We develop and build custom solutions that are tailored to your specific application.

Our real-world examples show applications from all fields of employment, such as evacuating space simulation or electronbeam welding chambers. Highly successful versions are in use in the fields of glass coating and solar technology.

We are also achieving clear successes using our new Vacu² multi-stage vacuum method for the die-casting process.

### Applications
- Solar technology
- Die-casting
- Space simulation
- Coating
- Research & development
- Metallurgy
Pump selection

Depending upon the application in question, we offer you
- Circulatory oil-lubricated single- or two-stage rotary vane pumps (including magnetically coupled versions)
- Liquid ring pumps
- Dry-compressing backing pumps (including magnetically coupled versions)
- Roots pumps (including magnetically coupled versions)
- Turbopumps (including magnetically levitated versions)
- Oil diffusion pumps
- Cryopumps
- Scroll and diaphragm pumps

Competence

- Complete design of vacuum systems
- Exact component dimensioning on the basis of calculation programs developed in-house at Pfeiffer Vacuum
- When design data are stipulated, we provide you with the calculation of:
  - Pumping speeds
  - Evacuation times
  - Conductivities
  - Intermediate pressures
  - Gas exit temperatures
  - Cooling effects

Accessories

The following accessories can be integrated:
- Electrical control systems (PLC)
- Measurement equipment/mass spectrometers
- Pressure regulation facilities
- Heat exchangers and condensers
- Soundproofing encapsulations for indoor and outdoor installation
- Silencers
- Liquid separators
- Dust separators
- Flushing devices
- Vibration isolation
VACUUM SOLUTIONS FROM A SINGLE SOURCE
Pfeiffer Vacuum stands for innovative and custom vacuum solutions worldwide, technological perfection, competent advice and reliable service.

COMPLETE RANGE OF PRODUCTS
From a single component to complex systems:
We are the only supplier of vacuum technology that provides a complete product portfolio.

COMPETENCE IN THEORY AND PRACTICE
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