PFEIFFER VACUUM

CombiLine™

Proven Solutions for Roots Pumping Stations!
More Advice. More Competence. More than just Vacuum.

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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 $5 \cdot 10^{-4}$ 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 $5 \cdot 10^{-2}$ millibars

High vacuum:
Further evacuation from $5 \cdot 10^{-2}$ to $5 \cdot 10^{-4}$ 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 $5 \cdot 10^{-2}$ 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™ pumping stations

Contents

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

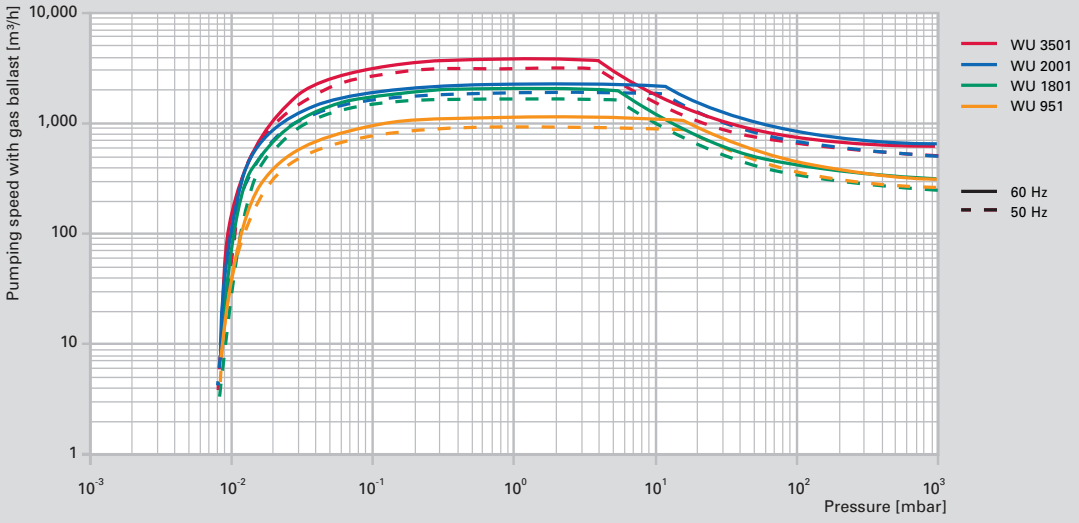
	Okta 500	Okta 1000	Okta 2000	Okta 4000	Okta 6000
UnoLine Plus (BA 251)	WU 471	WU 951	WU 1801	WU 3001	
UnoLine Plus (BA 501)		WU 1001	WU 2001	WU 3501	WU 4801

Technical data

Pumping Station	WU 951	WU 1801	WU 2001	WU 3501
Rotary vane pump	BA 251	BA 251	BA 501	BA 501
Roots pump	Okta 1000	Okta 2000	Okta 2000	Okta 4000
Pumping speed at 1 mbar [m³/h], 50 Hz	950	1,800	1,900	3,400
Pumping speed at 1 mbar [m³/h], 60 Hz	1,150	2,100	2,200	3,900
Connection flange (inlet)[1]	DN 160 ISO-F	DN 160 ISO-F	DN 160 ISO-F	DN 250 ISO-F
Ultimate pressure [mbar], without gas ballast	$< 2 \cdot 10^{-3}$	$< 2 \cdot 10^{-3}$	$< 2 \cdot 10^{-3}$	$< 2 \cdot 10^{-3}$
Ultimate pressure [mbar], with gas ballast	$< 3 \cdot 10^{-2}$	$< 3 \cdot 10^{-2}$	$< 3 \cdot 10^{-2}$	$< 3 \cdot 10^{-2}$
Motor rating, UnoLine Plus, 50 Hz [kW]	11	11	15	15
Motor rating, Okta, 50 Hz [kW]	3	5.5	5.5	11
Motor rating, UnoLine Plus, 60 Hz [kW]	13	13	18	18
Motor rating, Okta, 60 Hz [kW]	3.6	6.6	6.6	13.2
Max. noise level [db(A)], at 1 mbar	80	80	80	80
Weight [kg][2]	940	1,150	2,000	1,750

[1] *Series AD OktaLine pumps: Flange in accordance with DIN PN 16*
[2] *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

Combination of OktaLine™ Roots pump and HenaLine™ rotary vane pump

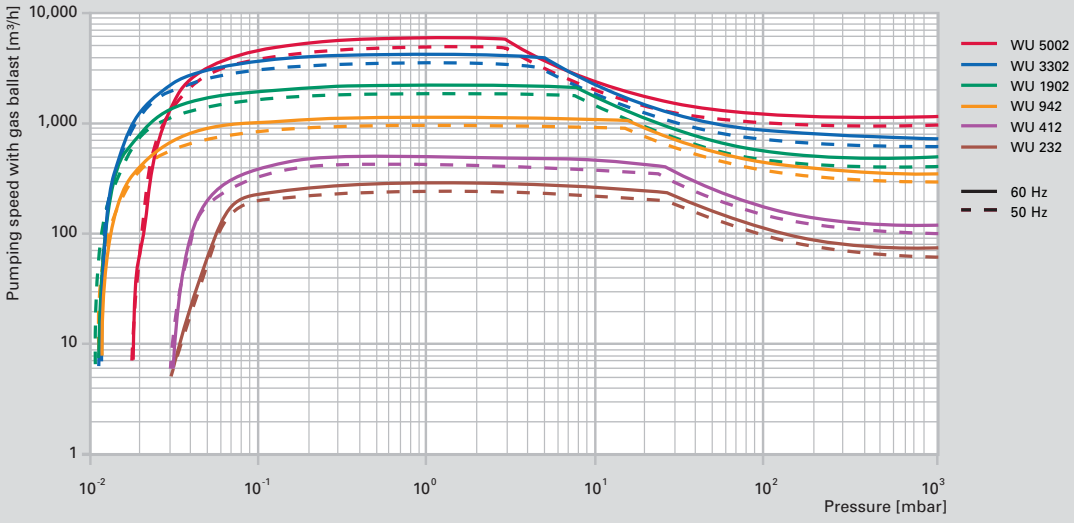
	Okta 250	Okta 500	Okta 1000	Okta 2000	Okta 4000	Okta 6000
Hena 60	WU 232	WU 392	WU 752			
Hena 100	WU 242	WU 412	WU 852			
Hena 200	WU 252	WU 452	WU 912	WU 1702		
Hena 300		WU 462	WU 942	WU 1752	WU 2952	
Hena 400		WU 482	WU 982	WU 1902	WU 3202	WU 3502
Hena 630			WU 1002	WU 1952	WU 3302	WU 4202
Hena 1000				WU 1992	WU 3702	WU 5002

Technical data

Pumping Station	WU 232	WU 412	WU 942	WU 1902	WU 3302	WU 5002
Rotary vane pump	Hena 60	Hena 100	Hena 300	Hena 400	Hena 630	Hena 1000
Roots pump	Okta 250	Okta 500	Okta 1000	Okta 2000	Okta 4000	Okta 6000
Pumping speed at 1 mbar [m³/h], 50 Hz	230	400	940	1,900	3,300	5,000
Pumping speed at 1 mbar [m³/h], 60 Hz	280	500	1,140	2,200	4,000	5,700
Connection flange (inlet)[1]	DN 63 ISO-F	DN 100 ISO-F	DN 160 ISO-F	DN 160 ISO-F	DN 250 ISO-F	DN 250 ISO-F
Ultimate pressure [mbar], without gas ballast	$< 8 \cdot 10^{-3}$	$< 8 \cdot 10^{-3}$	$< 8 \cdot 10^{-3}$	$< 8 \cdot 10^{-3}$	$< 8 \cdot 10^{-3}$	$< 5 \cdot 10^{-2}$
Ultimate pressure [mbar], with gas ballast	$< 5 \cdot 10^{-2}$	$< 5 \cdot 10^{-2}$	$< 3 \cdot 10^{-2}$	$< 3 \cdot 10^{-2}$	$< 3 \cdot 10^{-2}$	$< 5 \cdot 10^{-2}$
Motor rating, Hena, 50 Hz [kW]	1.8	2.5	7.5	11	15	22
Motor rating, Okta, 50 Hz [kW	0.75	1.5	3	5.5	11	15
Motor rating, Hena, 60 Hz [kW]	2.2	3	7.5	15	18.5	30
Motor rating, Okta, 60 Hz [kW]	0.9	1.8	3.6	6.6	13.2	18
Max. noise level [db(A)], at 1 mbar	75	75	80	85	85	85
Weight [kg][2]	240	285	610	1,040	1,440	2,250

[1] Series AD OktaLine pumps: Flange in accordance with DIN PN 16
[2] Approximate values only – will depend upon actual design

Pumping speeds



CombiLine™ WD

CombiLine™ WD Roots pumping stations with two-stage DuoLine™ rotary vane pump

For applications requiring ultimate pressures of up to $5 \cdot 10^{-4}$ 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 coatings
- Research & development
- Photovoltaics
- Vacuum drying

Combination of OktaLine™ Roots pump and DuoLine™ rotary vane pump

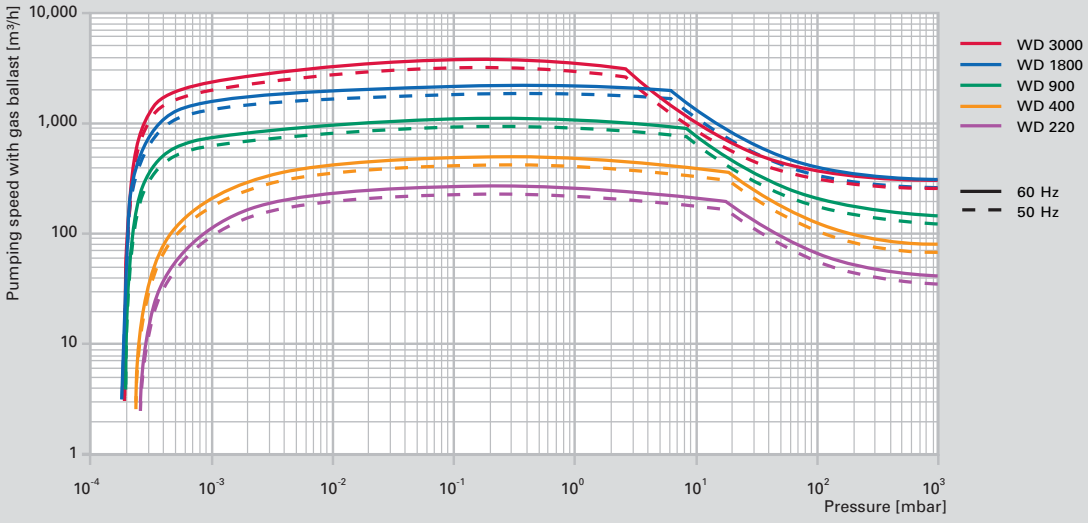
	Okta 250	Okta 500	Okta 1000	Okta 2000	Okta 4000
DUO 35	WD 220	WD 380			
DUO 65	WD 235	WD 400	WD 800		
DUO 125	WD 245	WD 440	WD 900	WD 1600	
DUO 255		WD 470	WD 950	WD 1800	WD 3000

Technical data

Pumping Station	WD 220	WD 400	WD 900	WD 1800	WD 3000
Rotary vane pump	Duo 35	Duo 65	Duo 125	Duo 255	Duo 255
Roots pump	Okta 250	Okta 500	Okta 1000	Okta 2000	Okta 4000
Pumping speed at 1 mbar [m³/h], 50 Hz	220	400	900	1,800	3,000
Pumping speed at 1 mbar [m³/h], 60 Hz	260	470	1,050	2,200	3,600
Connection flange (inlet)[1]	DN 63 ISO-F	DN 100 ISO-F	DN 160 ISO-F	DN 160 ISO-F	DN 250 ISO-F
Ultimate pressure [mbar], without gas ballast	$< 5 \cdot 10^{-4}$	$< 5 \cdot 10^{-4}$	$< 5 \cdot 10^{-4}$	$< 5 \cdot 10^{-4}$	$< 5 \cdot 10^{-4}$
Ultimate pressure [mbar], with gas ballast	$< 5 \cdot 10^{-4}$	$< 5 \cdot 10^{-4}$	$< 5 \cdot 10^{-4}$	$< 5 \cdot 10^{-4}$	$< 5 \cdot 10^{-4}$
Motor rating, Duo, 50 Hz [kW]	1.1	1.5	4	7.5	7.5
Motor rating, Okta, 50 Hz [kW]	0.75	1.5	3	5.5	11
Motor rating, Duo, 60 Hz [kW]	1.3	1.8	4.8	9	9
Motor rating, Okta, 60 Hz [kW]	0.9	1.8	3.6	6.6	13.2
Max. noise level [db(A)], at 1 mbar	75	75	80	80	80
Weight [kg][2]	220	250	530	980	1,180

[1] Series AD OktaLine pumps: Flange in accordance with DIN PN 16
[2] Approximate values only – will depend upon actual design

Pumping speeds



CombiLine™ WH

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

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

	Okta 250	Okta 500	Okta 1000	Okta 2000	Okta 4000	Okta 6000
Hepta 100	WH 250	WH 450	WH 900			
Hepta 200		WH 470	WH 950	WH 1700		
Hepta 300		WH 500	WH 970	WH 1800		
Hepta 400			WH 990	WH 1900	WH 3300	
Hepta 600			WH 1000	WH 2000	WH 3500	WH 5000
UniDry 50 S	WH 240 S	WH 400 S				
UniDry 50 P	WH 240 P	WH 400 P				

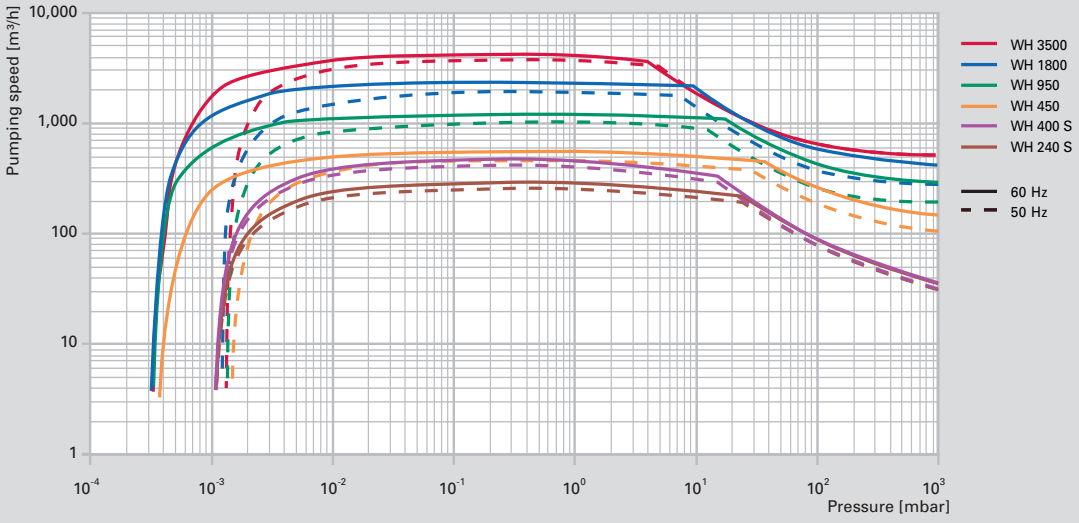
S = standard version, P = process version

Technical data

Pumping Station	WH 240 S	WH 400 S	WH 450	WH 950	WH 1800	WH 3500
Dry-compressing backing pump	UniDry 50 S	UniDry 50 S	Hepta 100	Hepta 200	Hepta 300	Hepta 600
Roots pump	Okta 250	Okta 500	Okta 500	Okta 1000	Okta 2000	Okta 4000
Pumping speed at 1 mbar [m³/h], 50 Hz	240	400	450	950	1,800	3,500
Pumping speed at 1 mbar [m³/h], 60 Hz	290	470	530	1,200	2,280	4,050
Connection flange (inlet)[1]	DN 63 ISO-F	DN 100 ISO-F	DN 100 ISO-F	DN 160 ISO-F	DN 160 ISO-F	DN 250 ISO-F
Ultimate pressure [mbar], at 50 Hz	$< 5 \cdot 10^{-3}$	$< 5 \cdot 10^{-3}$	$< 2 \cdot 10^{-3}$	$< 2 \cdot 10^{-3}$	$< 2 \cdot 10^{-3}$	$< 2 \cdot 10^{-3}$
Ultimate pressure [mbar], at 60 Hz	$< 5 \cdot 10^{-3}$	$< 5 \cdot 10^{-3}$	$< 5 \cdot 10^{-4}$	$< 5 \cdot 10^{-4}$	$< 5 \cdot 10^{-4}$	$< 5 \cdot 10^{-4}$
Motor rating, backing pump, 50 Hz [kW]	3	3	3	5.5	7.5	15
Motor rating, Okta, 50 Hz [kW]	0.75	1.5	1.5	3	5.5	11
Motor rating, backing pump, 60 Hz [kW]	3.6	3.6	4	7.5	9.2	17
Motor rating, Okta, 60 Hz [kW]	0.9	1.8	1.8	3.6	6.6	13.2
Max. noise level [db(A)], at 1 mbar	75	75	80	80	80	80
Weight [kg][2]	360	390	510	700	840	1,500

[1] Series AD OktaLine pumps: Flange in accordance with DIN PN 16
[2] Approximate values only – will depend upon actual design

Pumping speeds



Customized vacuum solutions

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 electron-beam 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

PFEIFFER VACUUM

Leading. Dependable. Customer Friendly.

Pfeiffer Vacuum stands for innovative and custom vacuum solutions worldwide, for German engineering art, competent advice and reliable service.

As the inventor of the turbopump, we have always been consistently setting standards in our industry and this claim to leadership will continue to drive us in the future.

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