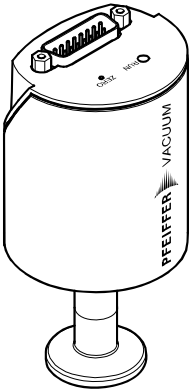


OPERATING INSTRUCTIONS

EN

Translation of the original instructions

CCR 361 … CCR 365

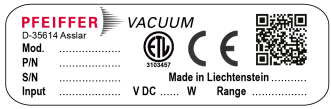
Ceramic Capacitance Gauge

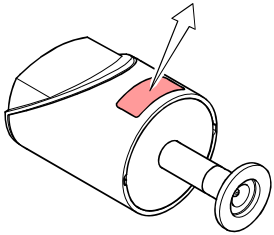
PFEIFFER VACUUM

BG 5135 BEN / D (2019-05)

Product Identification

In all communications with Pfeiffer Vacuum, please specify the information given on the product nameplate. For convenient reference copy that information into the space provided below.





Validity

This document applies to products with the following part numbers:

Type	Part number	Flange	Torr	Pascal	hPa
CCR 361	PT R27 600	½" tube	10^{-1} … 1000 (F.S.)	1.33×10^{1} … 133'322 (F.S.)	1.33×10^{-1} … 1333 (F.S.)
	PT R27 601	DN 16 ISO-KF			
	PT R27 602	DN 16 CF-R			
	PT R27 603	8 VCR®			
CCR 362	PT R27 610	½" tube	10^{-2} … 100 (F.S.)	1.33×10^{0} … 13'332.2 (F.S.)	1.33×10^{-2} … 133 (F.S.)
	PT R27 611	DN 16 ISO-KF			
	PT R27 612	DN 16 CF-R			
	PT R27 613	8 VCR®			
CCR 363	PT R27 620	½" tube	10^{-3} … 10 (F.S.)	1.33×10^{-1} … 1'333.22 (F.S.)	1.33×10^{-3} … 13.3 (F.S.)
	PT R27 621	DN 16 ISO-KF			
	PT R27 622	DN 16 CF-R			
	PT R27 623	8 VCR®			
CCR 364	PT R27 630	½" tube	10^{-4} … 1 (F.S.)	1.33×10^{-2} … 133.322 (F.S.)	1.33×10^{-4} … 1.3 (F.S.)
	PT R27 631	DN 16 ISO-KF			
	PT R27 632	DN 16 CF-R			
	PT R27 633	8 VCR®			
	PT R27 635	½" tube	2×10^{-4} … 2 (F.S.)	2.67×10^{-2} … 266.644 (F.S.)	2.67×10^{-4} … 2.67 (F.S.)
	PT R27 636	DN 16 ISO-KF			
CCR 365	PT R27 640	½" tube	10^{-5} … 0.1 (F.S.)	1.33×10^{-3} … 13.3322 (F.S.)	1.33×10^{-5} … 0.13 (F.S.)
	PT R27 641	DN 16 ISO-KF			
	PT R27 642	DN 16 CF-R			
	PT R27 643	8 VCR®			
	PT R27 646	DN 16 ISO-KF	0.25×10^{-5} … 0.25 (F.S.)	3.33×10^{-3} … 33.3305 (F.S.)	3.33×10^{-5} … 0.33 (F.S.)

The part number (No) can be taken from the product nameplate.

If not indicated otherwise in the legends, the illustrations in this document correspond to CCR 361 gauges with the DN 16 ISO-KF vacuum connection. They apply to other vacuum connections by analogy.

We reserve the right to make technical changes without prior notice.

All dimensions in mm.

Intended Use

The Ceramic Capacitance Gauges of the CCR 36X series are intended for absolute pressure measurement of gases in their respective pressure ranges (→ 🗎 3).

Function

The Ceramic Capacitance Gauge consists of a capacitive sensor element made of aluminum oxide ceramics and electronics which convert the capacitance into a DC voltage output signal.

The output signal is linear to the measured pressure and independent of the gas type.

Trademark

VCR® Swagelok Marketing Co.

Patents

EP 1070239 B1, 1040333 B1

US Patents 6528008, 6591687, 7107855, 7140085

Scope of Delivery

1× gauge CCR 36X
1× pin for adjusting settings via buttons
1× Calibration Test Report
1× Operating Instructions German
1× Operating Instructions English
1× Operating Instructions French

Contents

For cross-references within this document, the symbol (→ 🗎 XY) is used.

1 Safety

1.1 Symbols Used

DANGER

Information on preventing any kind of physical injury.

WARNING

Information on preventing extensive equipment and environmental damage.

Caution

Information on correct handling or use. Disregard can lead to malfunctions or minor equipment damage.

Notice

1.2 Personnel Qualifications

Skilled personnel

All work described in this document may only be carried out by persons who have suitable technical training and the necessary experience or who have been instructed by the end-user of the product.

1.3 General Safety Instructions

- Adhere to the applicable regulations and take the necessary precautions for the process media used.

  Consider possible reactions with the product materials.
- Adhere to the applicable regulations and take the necessary precautions for all work you are going to do and consider the safety instructions in this document.
- Before beginning to work, find out whether any vacuum components are contaminated. Adhere to the relevant regulations and take the necessary precautions when handling contaminated parts.

Communicate the safety instructions to all other users.

1.4 Liability and Warranty

Pfeiffer Vacuum assumes no liability and the warranty becomes null and void if the end-user or third parties

- disregard the information in this document
- use the product in a non-conforming manner
- make any kind of interventions (modifications, alterations etc.) on the product
- use the product with accessories not listed in the product documentation.

The end-user assumes the responsibility in conjunction with the process media used.

Gauge failures due to contamination are not covered by the warranty.

2 Technical Data

Measurement range	→ "Validity"
Accuracy [1)]	
PT R27 600 … PT R27 636	0.20% of reading
PT R27 646	0.25% of reading
PT R27 640 … PT R27 643	0.50% of reading
Temperature effect on zero	
PT R27 600 … PT R27 623	0.0050% F.S./ °C
PT R27 630 … PT R27 636	0.015% F.S./ °C
PT R27 640 … PT R27 646	0.020% F.S./ °C
Temperature effect on span	
PT R27 600 … PT R27 636	0.01% of reading / °C
PT R27 640 … PT R27 646	0.03% of reading / °C
Resolution	0.003% F.S.
Gas type dependence	none
Output signal analog (measuring signal)	
Voltage range	–5 … +12 V
Measuring range	0 … +10V
Relationship voltage-pressure	linear
Output impedance	0 Ω (short-circuit proof)
Loaded impedance	>10 kΩ
Response time	
PT R27 600 … PT R27 636	30 ms
PT R27 646	30 ms
PT R27 640 … PT R27 643	130 ms
Gauge identification	Resistance 13.2 kΩ referenced to supply common

[1)] Non-linearity, hysteresis, repeatability in the calibrated range at 25 °C ambient operating temperature without temperature effects after operation of 2 h.

Supply

DANGER

The gauge may only be connected to power supplies, instruments or control devices that conform to the requirements of a grounded protective extra-low voltage (PELV). The connection to the gauge has to be fused.

Supply voltage	
at the gauge	+14 … +30 VDC
ripple	≤1 V_{pp}
Current consumption	<500 mA (max. starting current)
Power consumption (depending on supply voltage)	≤1 W
Internal fuse	1 AT (slow), automatic reset (Polyfuse)

The gauge is protected against reverse polarity of the supply voltage.

Electrical connection	15-pin D-Sub, male
Sensor cable	5-pin plus shielding
Cable length	≤100 m (0.14 mm² conductor)

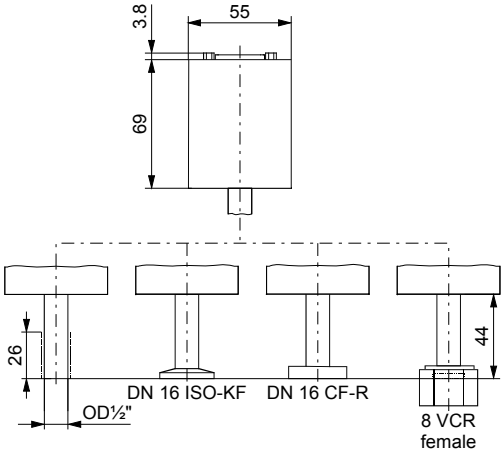
For longer cables, larger conductor cross-sections are required (R_{cable} ≤1.0 Ω).

Grounding concept	
Vacuum flange - signal common	→ "Power Connection"
Supply common - signal common	conducted separately; for differential measurement (10 Ω)

Materials exposed to vacuum	
Flange, tube	stainless steel AISI 316L
Sensor and diaphragm	ceramics (Al_2O_3 ≥99.5%)
Sensor–diaphragm connection	glass ceramics solder
Ceramics–metal connection	AgTiCu hard solder, Vacon 70 (28% Ni, 23% Co, 49% Fe)
Internal volume	≤3.6 cm^3
Admissible pressure (absolute)	
PT R27 600 … PT R27 603	300 kPa
PT R27 610 … PT R27 636	200 kPa
PT R27 640 … PT R27 646	130 kPa
Bursting pressure (absolute)	500 kPa

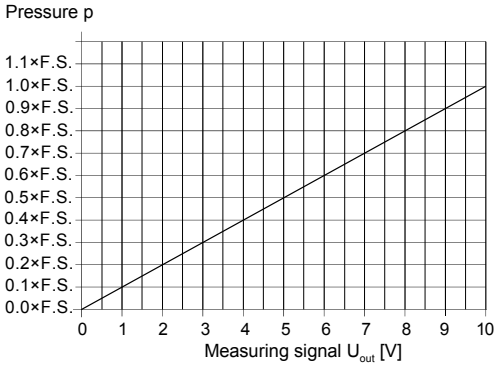
Admissible temperatures	
Storage	–40 °C … +65 °C
Operation	+5 °C … +50 °C
Bakeout (not in operation)	≤110 °C at the flange
Relative humidity	≤80% at temperatures ≤+31 °C decreasing to 50% at +40°C
Use	indoors only, altitude up to 2000 m NN
Degree of protection	IP 30

Dimensions [mm]



Weight	≤370 g

Analog Measuring Signal vs. Pressure



$$p = (U_{out} / 10\ V) \times c\ (F.S.)$$

Conversion Torr ↔ Pascal

	Torr	hPa [2)]	Pa [2)]
c	1.00	1013.25 / 760 = 1.3332…	101325 / 760 = 133.3224…

Example: Gauge with 10 Torr F.S.
Measuring signal U_{out} = 6 V

$$p = (6\ V / 10\ V) \times 10\ Torr$$
$$= 0.6 \times 10\ Torr = \mathbf{6\ Torr}$$

[2)] Source: NPL (National Physical Laboratory)
Guide to the Measurement of Pressure and Vacuum,
ISBN 0904457x / 1998

3 Installation

WARNING

WARNING: fragile components

The ceramic sensor may be damaged by impacts.

Do not drop the product and prevent shocks and impacts.

3.1 Vacuum Connection

DANGER

DANGER: overpressure in the vacuum system >100 kPa

Injury caused by released parts and harm caused by escaping process gases can result if clamps are opened while the vacuum system is pressurized.

Do not open any clamps while the vacuum system is pressurized. Use the type clamps which are suited to overpressure.

DANGER

DANGER: overpressure in the vacuum system >250 kPa

KF flange connections with elastomer seals (e.g. O-rings) cannot withstand such pressures. Process media can thus leak and possibly damage your health.

Use O-rings provided with an outer centering ring.

DANGER

DANGER: protective ground

Products that are not correctly connected to ground can be extremely hazardous in the event of a fault.

Electrically connect the gauge to the grounded vacuum chamber. This connection must conform to the requirements of a protective connection according to EN 61010:

- CF and VCR flanges fulfill this requirement.
- For gauges with a KF flange, use a conductive metallic clamping ring.
- For gauges with a ½" tube, take appropriate measures to fulfill this requirement.

Caution

Caution: vacuum component

Dirt and damages impair the function of the vacuum component.

When handling vacuum components, take appropriate measures to ensure cleanliness and prevent damages.

Caution

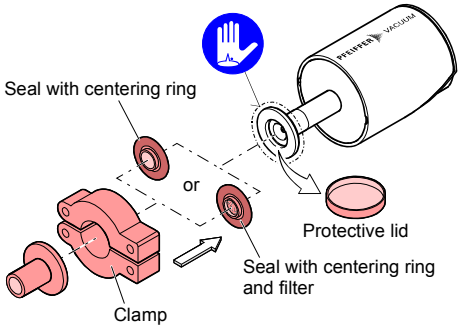
Caution: dirt sensitive area

Touching the product or parts thereof with bare hands increases the desorption rate.

Always wear clean, lint-free gloves and use clean tools when working in this area.

Mount the gauge so that no vibrations occur. The gauge may be mounted in any orientation. To keep condensates and particles from getting into the measuring chamber preferably choose a horizontal to upright position and possibly use a seal with a centering ring and filter. If adjustment should be possible after the gauge has been installed, be sure to install it so that the buttons can be accessed with a pin (→ 🗎 18).

Remove the protective lid and connect the product to the vacuum system.



Keep the protective lid.

3.2 Power Connection

Make sure the vacuum connection is properly made (→ 13).

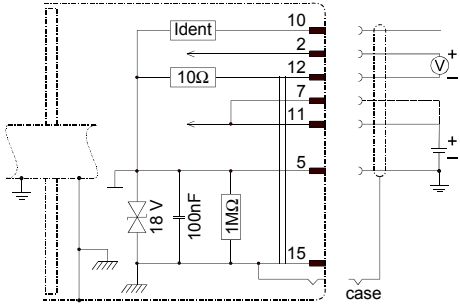
DANGER

The gauge may only be connected to power supplies, instruments or control devices that conform to the requirements of a grounded protective extra-low voltage (PELV). The connection to the gauge has to be fused.

Ground loops, differences of potential, or EMC problems may affect the measurement signal. For optimum signal quality, please do observe the following notes:

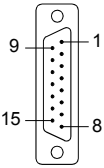
- Connect the cable shield to ground on one side via the chassis ground. Do not connect the other side of the shield.
- Connect the supply common with protective ground directly at the power supply.
- Use differential measurement input (signal common and supply common conducted separately).
- Potential difference between supply common and housing ≤18 V (overvoltage protection).

❶ If no sensor cable is available, make one according to the following diagram.



Electrical connection

Pin 2	Signal Output
Pin 5	Supply common, GND
Pin 7, 11	Supply
Pin 10	Gauge identification
Pin 12	Signal common
Pin 15	Housing (Chassis Ground)
case	Connector case



D-Sub,15-pin
female
soldering
side

- Pins 1, 3, 4, 6, 8 and 9 are not assigned in the gauge.
- Do not connect pin 13 and 14

❷ Connect the sensor cable to the gauge and secure it using the lock screws.

❸ Connect the sensor cable to the controller.

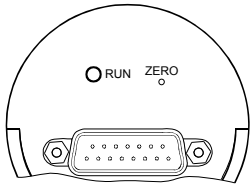
4 Operation

Put the gauge into operation.

Warm-up time

- for general purpose reading (within specifications) >¼ hour
- for zero adjustment and precision measurement >2 hours

4.1 Displays



LED	State	Meaning
<RUN>	lit	Measurement mode
	flashing	Other mode, error, under/overrange

4.2 Zeroing the Gauge

The gauge is factory calibrated while "standing upright" (→ "Calibration Test Report").

We recommend performing a zero adjustment, when the gauge is operated for the first time.

Due to long time operation or contamination, a zero drift could occur and zero adjustment may become necessary.

For adjusting the zero, operate the gauge under the same constant ambient conditions and in the same mounting orientation as normally.

The output signal (measuring signal) is depending on the mounting orientation. The signal difference between the vertical and horizontal mounting orientation is:

F.S.	ΔU / 90°
1000 hPa	≈2 mV
100 hPa	≈10 mV
10 hPa	≈50 mV
1 hPa	≈300 mV
0.1 hPa	≈1.8 V

If the gauge is operated via a controller, the zero of the whole measuring system has to be adjusted on the controller: first, adjust the zero of the gauge and then, the zero of the controller.

4.2.1 <ZERO> Adjustment

❶ Evacuate the gauge to a pressure according to the table below:

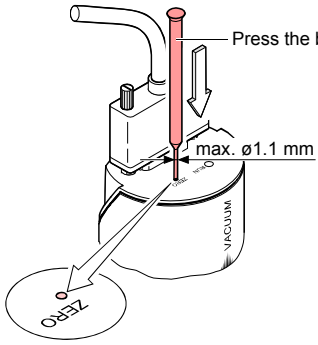
	Recommended final pressure for zero adjustment		
CCR 361	<5×10^{-2} Torr	<7×10^{-2} hPa	<7×10^{-2} mbar
CCR 362	<5×10^{-3} Torr	<7×10^{-3} hPa	<7×10^{-3} mbar
CCR 363	<5×10^{-4} Torr	<7×10^{-4} hPa	<7×10^{-4} mbar
CCR 364	<5×10^{-5} Torr	<7×10^{-5} hPa	<7×10^{-5} mbar
CCR 365*)	<1×10^{-5} Torr	<1×10^{-5} hPa	<1×10^{-5} mbar
CCR 365**)	<5×10^{-6} Torr	<7×10^{-6} hPa	<7×10^{-6} mbar

*) 0.25 Torr (F.S.) **) 0.1 Torr (F.S.)

If the final pressure in the gauge is too high for zero adjustment (>25% of the F.S.), the zero cannot be reached and the <RUN> LED flashes. If this is the case, activate the factory setting and adjust the zero again (→ 🗎 22).

❷ Operate the gauge for at least 2 hours (until the signal is stable).

❸ Briefly press the <ZERO> button with a pin (max. ø1.1 mm). The zero adjustment runs automatically. The <RUN> LED flashes until the adjustment (duration ≤8 s) is completed.



After zero adjustment the gauge automatically returns to measurement mode. The <RUN> LED lit.

The zero can also be adjusted via the RS232C interface.

The <RUN> LED flashes if

- the signal output is negative (< -20 mV) when the final pressure has been attained
- the zero adjustment has failed.

4.2.2 <ZERO> Adjustment with Ramp Function

The ramp function allows to adjust the zero at a known reference pressure within the measurement range of the gauge.

It also permits to adjust an offset of the characteristic curve in order to

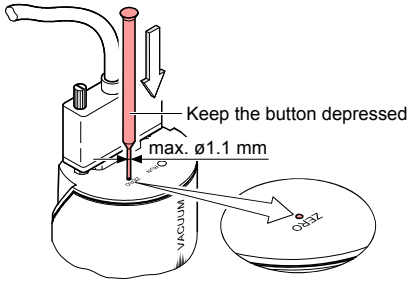
- compensate for the offset of the measuring system or
- obtain a slightly positive zero for a 0 … 10 V AD-converter.

The offset should not exceed 2% of the F.S. (+200 mV). At a higher positive offset, the upper limit of the measuring range is exceeded.

Recommended procedure for adjusting the offset of a measuring system: → Notice 19.

❶ Operate the gauge for at least 15 minutes (until the signal is stable).

❷ Push the <ZERO> button with a pin (max. ø1.1 mm) and keep it depressed. The <RUN> LED starts flashing. After 5 s, the zero adjustment value, starting at the current output value, keeps continually changing (ramp) until the button is released or until the setting limit (max. 25% F.S.) is reached. The corresponding output signal is delayed by about 1 s.



❸ Push the <ZERO> button again:

Fine adjustment within 0...3 s:	the zero adjustment value changes by one unit (push <ZERO> button in intervals of 1 s)
Change of direction within 3...5 s:	the zero adjustment changes its direction (the flashing frequency of the <RUN> LED changes briefly)

If the <ZERO> button is released for more than 5 s, the gauge returns to the measurement mode.

The zero adjustment with ramp function can also be adjusted via the RS232C interface.

The <RUN> LED flashes if the signal output is negative.

4.3 Activating the Factory Setting (Factory Reset)

All user defined parameters (e.g. zero, filter) are restored to their default values.

Loading of the default parameters is irreversible.

Loading the default parameters:

❶ Put the gauge out of operation.

❷ Keep the <ZERO> button depressed for at least 5 s while the gauge is being put into operation (Power ON).

5 Deinstallation

WARNING

WARNING: fragile components

The ceramic sensor may be damaged by impacts.

Do not drop the product and prevent shocks and impacts.

DANGER

DANGER: contaminated parts

Contaminated parts can be detrimental to health and environment.

Before beginning to work, find out whether any parts are contaminated. Adhere to the relevant regulations and take the necessary precautions when handling contaminated parts.

Caution

Caution: vacuum component

Dirt and damages impair the function of the vacuum component.

When handling vacuum components, take appropriate measures to ensure cleanliness and prevent damages.

Caution

Caution: dirt sensitive area

Touching the product or parts thereof with bare hands increases the desorption rate.

Always wear clean, lint-free gloves and use clean tools when working in this area.

1. Vent the vacuum system.
2. Put the gauge out of operation.
3. Unfasten the lock screws and disconnect the sensor cable.
4. Remove the gauge from the vacuum system and install the protective lid.

6 Maintenance, Repair

Under clean operating conditions, the product requires no maintenance.

Gauge failures due to contamination are not covered by the warranty.
We recommend checking the zero at regular intervals (→ 19).

Pfeiffer Vacuum assumes no liability and the warranty becomes null and void if any repair work is carried out by the end-user or third parties.

7 Returning the Product

WARNING

WARNING: forwarding contaminated products

Contaminated products (e.g. radioactive, toxic, caustic or microbiological hazard) can be detrimental to health and environment.

Products returned to Pfeiffer Vacuum should preferably be free of harmful substances. Adhere to the forwarding regulations of all involved countries and forwarding companies and enclose a duly completed declaration of contamination *).

*) Form under www.pfeiffer-vacuum.com

Products that are not clearly declared as "free of harmful substances" are decontaminated at the expense of the customer.

Products not accompanied by a duly completed declaration of contamination are returned to the sender at his own expense.

8 Disposal

DANGER

DANGER: contaminated parts

Contaminated parts can be detrimental to health and environment.

Before beginning to work, find out whether any parts are contaminated. Adhere to the relevant regulations and take the necessary precautions when handling contaminated parts.

WARNING

WARNING: substances detrimental to the environment

Products or parts thereof (mechanical and electric components, operating fluids etc.) can be detrimental to the environment.

Dispose of such substances in accordance with the relevant local regulations.

Separating the components

After disassembling the product, separate its components according to the following criteria:

- Contaminated components

  Contaminated components (radioactive, toxic, caustic or biological hazard etc.) must be decontaminated in accordance with the relevant national regulations, separated according to their materials, and disposed of.

- Other components

  Such components must be separated according to their materials and recycled.

Conversion Table

	mbar	bar	Pa	hPa	kPa	Torr mm HG
mbar	1	1×10^{-3}	100	1	0.1	0.75
bar	1×10^{3}	1	1×10^{5}	1×10^{3}	100	750
Pa	0.01	1×10^{-5}	1	0.01	1×10^{-3}	7.5×10^{-3}
hPa	1	1×10^{-3}	100	1	0.1	0.75
kPa	10	0.01	1×10^{3}	10	1	7.5
Torr mm HG	1.332	1.332×10^{-3}	133.32	1.3333	0.1332	1

1 Pa = 1 N/m^2

ETL Listed

ETL LISTED

The products CCR 361 … CCR 365

- conform to the UL Standard UL 61010-1
- are certified to the CSA Standard CSA C22.2 # 61010-1

EU Declaration of Conformity

CE

We, Pfeiffer Vacuum, hereby declare that the equipment mentioned below comply with the following directives:

- 2014/30/EU, OJ L 96/79, 29.3.2014
  (EMC directive; Directive relating to electromagnetic compatibility)
- 2011/65/EU, OJ L 174/88, 1.7.2011
  (RoHS directive; Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment)

Ceramic Capacitance Gauge

CCR 361 … CCR 365

Standards

Harmonized and international/national standards and specifications:

- EN 61000-6-2:2005 (EMC: generic immunity standard)
- EN 61000-6-3:2007 + A1:2011 (EMC: generic emission standard)
- EN 61010-1:2010 (Safety requirements for electrical equipment for measurement, control and laboratory use)
- EN 61326-1:2013 (EMC requirements for electrical equipment for measurement, control and laboratory use)

Manufacturer / Signature

Pfeiffer Vacuum GmbH, Berliner Straße 43, D-35614 Asslar

Aßlar, 18 April 2016

Dr. Ulrich von Hülsen
Managing director

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

Benefit from our know-how and our portfolio of training opportunities!
We can support you with your plant layout and provide first-class on-site-service worldwide.

Are you looking for a perfect vacuum solution? Please contact us

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PFEIFFER VACUUM

ba51135ben/d