

IKR 070

Cold Cathode Gauge, Metal sealed

Operating Instructions

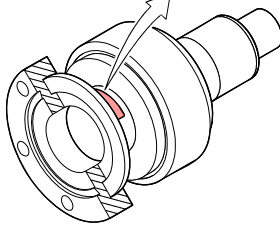
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BG 5033 BEN / A (2013-11)

Product Identification

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

Pfeiffer Vacuum, D-35614 Asslar
Typ:.....
No:.....
F-No:.....



Validity

This document applies to products with part number

PT R20 501 (DN 40 ISO-KF)
PT R20 502 (DN 40 CF-F)

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

Intended Use

The above Cold Cathode Gauges have been designed for vacuum measurement in the pressure range of 1×10^{-11} ... 5×10^{-3} hPa.

They are used together with a Pfeiffer Vacuum measurement and control unit of the type TPG 300.

Functional Principle

Over the whole measurement range, the measuring signal is output as logarithm of the pressure.

The IKR 070 functions with a cold cathode ionization measurement circuit (according to the inverted magnetron principle).

Safety

Symbols Used

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.

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.

Note

General Safety Information

- Adhere to the applicable regulations and take the necessary precautions for the process media used.
- Consider possible reactions between the materials (→ Technical Data) and the process media.
- Consider possible reactions (e.g. explosion) of the process media due to the heat generated by the product.
- 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.

DANGER

DANGER: magnetic fields

Strong magnetic fields can disturb electronic devices like heart pacemakers or impair their function.

Maintain a safety distance of ≥ 10 cm between the magnet and the heart pacemaker or prevent the influence of strong magnetic fields by anti-magnetic shielding.

Communicate the safety instructions to all other users.

Responsibility 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 corresponding 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.

Technical Data

Admissible temperatures	-40 °C ... +250 °C (without cable)
Storage	+5 °C ... +80 °C (with normal cable)
Operation	+5 °C ... +250 °C (with high temperature cable)
Relative humidity	max. 80% at temperatures up to +31 °C, decreasing to 50% at +40 °C
Use	indoors only altitude up to 2000 m

Measurement range (air, N ₂)	1×10^{-11} ... 5×10^{-3} hPa
Gas type dependence	→ Appendix

Protection type	IP 40
Overpressure	≤ 900 kPa, for inert gases and temperatures < 55 °C only

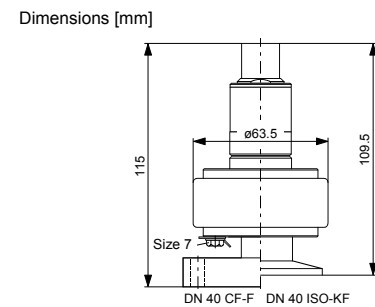
Radiation resistance	10^9 rad
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Operating voltage (in measuring chamber)	≤ 3.3 kV
Operating current (in measuring chamber)	≤ 700 μ A

Electrical connection	
Connector	triaxial
Type	triaxial cable

Cable length between gauge and measurement unit	≤ 500 m
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Materials on the vacuum side	
Vacuum connection	stainless steel (1.4306)
Measuring chamber	stainless steel (1.4306)
Feedthrough isolation	ceramic (Al ₂ O ₃)
Internal seal	Ag
Anode	Mo
Ignition aid	stainless steel (1.4310)
Internal volume	≈ 20 cm ³



Weight	600 g (DN 40 ISO-KF) 850 g (DN 40 CF-F)
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Installation

Vacuum Connection

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

DANGER

When using KF vacuum connections with elastomer sealing rings (e.g. O-rings), the sealing ring must be equipped with an outer centering ring at overpressures > 250 kPa. At overpressures > 100 kPa a clamp only to be opened and closed by means of a tool (e.g. hose clip clamping ring) has to be used.

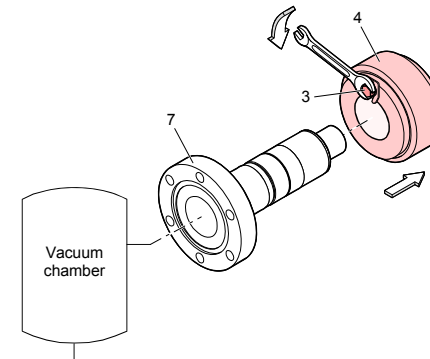
If the IKR 070 Cold Cathode Gauge may come into contact with charged particles (plasma, ion beam etc.), make sure its vacuum connections is galvanically connected to the vacuum chamber and do always use conductive metallic centering rings and clamps.

When CF vacuum connections are made, it can be advantageous to temporarily remove the magnet unit (→ next section).

The gauge can be mounted in any orientation. However, it should be mounted so that no particles can get into the measuring chamber (→ Technical data for space requirements).

Removing the Magnet Unit

(CF vacuum connection only)



For reasons of tolerance, the same magnet unit has to be used again when reassembling the gauge.

Tools required

- Allen wrench AF 1.5
- Open-end wrench AF 7

Procedure

(→ figure 1, next page)

- Unfasten the hex head screw (3) on the magnet unit (4) and remove the magnet unit.

The magnetic force and the tendency to tilt make it more difficult to separate the magnet unit and the measuring chamber (7).

- Make the vacuum connection between the gauge and the vacuum system.

- Mount the magnet unit and lock it with the hex head screw (3).

Electrical Connection

- Install the gauge to the grounded vacuum chamber.
- Connect the gauge to the Pfeiffer Vacuum measurement unit (→ operating instructions of measurement boards used).

Operation

The gauge is ready for operation as soon as it has been connected.

Gas type Dependence

The measuring signal depends on the type of gas being measured. The value displayed is accurate for dry air, N₂, O₂ and CO. It can be converted for other gases. This can be done by entering the corresponding calibration factor on the Pfeiffer Vacuum measurement unit (→ Appendix).

Ignition Delay

An ignition delay occurs when the cold cathode gauges are turned on. The delay time increases at low pressures, and is typically:

1×10^{-7} hPa	≈ 0.1 minute
1×10^{-8} hPa	≈ 1 minute
1×10^{-9} hPa	≈ 5 minutes
1×10^{-10} hPa	≈ 20 minutes
1×10^{-11} hPa	≈ 90 minutes

Contamination

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

Cold cathode gauges are subject to contamination. The degree of contamination and subsequently the accuracy of the measured value depend on:

- the pressure in the vacuum chamber
- contaminants inside the vacuum chamber (vapors, process particles, etc.)
- the measurement current
- the operating time

To avoid extensive contamination switch the gauge on only at pressures of $< 10^{-2}$ hPa.

If the gauge is frequently operated at pressures between 3×10^{-5} hPa and 1×10^{-2} hPa, use measurement boards which limit the current to a maximum of 100 μ A (→ Operating instructions of Pfeiffer Vacuum measurement boards for TPG 300).

Contamination generally has the effect that the pressure indication is too low. If the contamination is severe, instability occurs. Contamination layers can peel off in the measuring chamber and cause short circuits.

Depending on the operating conditions, cleaning may therefore be necessary after a few days or after a few years.

Disassembly

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.

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

Procedure

- Turn the gauge off.
- Detach the connection cable.
- Remove the gauge from the vacuum chamber.

Cover the flange with the protective lid supplied for this purpose.

Maintenance

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

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.

Cleaning the Gauge / Changing Parts

Tools required

- Allen wrench AF 3
- Open-end wrench AF 7
- Pliers for circlip
- Polishing cloth (grain 400) or Scotch-Brite
- Tweezers
- Mounting tool for ignition aid
- Cleaning alcohol

Disassembling the Gauge

(→ figure 1, next page)

Precondition

- Gauge removed from vacuum system

Procedure

- Unfasten the hex head screw (3) on the magnet unit (4) and remove the magnet unit.

The magnetic force and the tendency to tilt make it more difficult to separate the magnet unit and the measuring chamber (7).

For reasons of tolerance, the same magnet unit has to be used again when reassembling the gauge.

- Remove the circlip (5) and the pole insert (6) from the measuring chamber (7).

- Carefully unscrew triaxial connector, 2 hex socket screws (1a) and remove the plastic part (2a).

- Remove the 4 (or 2) hex socket screws (8) incl. the lock washers (8a) on the back of the measuring chamber (7).

- Carefully remove the following items in this order: pressure piece (9), washer (10b), complete anode (10), metal seal (11) and centering ring (12).

The parts can now be cleaned or replaced individually.



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Cleaning the Gauge

Procedure

STOP DANGER

Adhere to the relevant regulations and take the necessary precautions when handling and disposing of cleaning agents.

Cleaning the measuring chamber and the pole insert:

- 1 Clean the inside walls of the measuring chamber and the pole insert to a bright finish. Use a polishing cloth.

Caution

Sealing surfaces must only be worked concentrically.

- 2 Rinse the measuring chamber and the pole insert with alcohol.
- 3 Dry both.

Cleaning or replacing the anode (10):

- 1 Remove the old ignition aid (10a), for example with tweezers.
- 2 Rub the anode pin to a bright finish by means of a polishing cloth.

Caution

Do not bend the anode.
Do not carry out mechanical work on the ceramic part.

- 3 Rinse the anode with cleaning alcohol.
- 4 Dry the anode.
- 5 Insert the new ignition aid (10a) into the mounting tool.
- 6 Carefully press the anode (cleaned or new) centered and parallel to the tool axis into the ignition aid and insert it to a depth of ≈ 15 mm. The final position is established only after the anode is installed.

Assembling the Gauge

Procedure


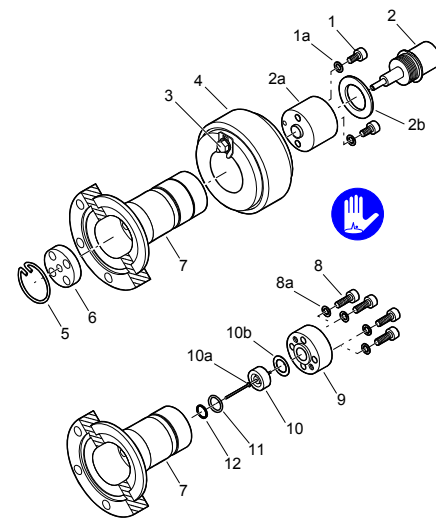
- 1 Insert new metal seal (11) with the centering ring (12) centered into the measuring chamber (7). Sealing surface, seal and ceramic part must be clean (\rightarrow figure 1).
- 2 Carefully insert the anode (10) incl. ignition aid (10a) into the measuring chamber.
- 3 Place the pressure piece (9) incl. washer (10b) on the measuring chamber (7) and tighten the screws (8) incl. lock washers (8a) uniformly until the stop position is reached.
- 4 Position the ignition aid (10a): slide the mounting tool over the anode pin until the mechanical stop is reached.
- 5 Remove particles in the measuring chamber by blowing with dry nitrogen (while the flange of the measuring chamber is pointing downward).
- 6 Slide the pole insert (6) into the measuring chamber (7) up to the mechanical stop (\rightarrow figure 1).
- 7 Place the circlip (5) snugly fitting on the pole insert.
 Visually check that the anode pin is centered over the hole of the pole insert (tolerated eccentricity ≤ 0.5 mm).
- 8 If possible perform a leak test (leak rate $< 10^{-9}$ hPa l/s).
- 9 Place plastic piece (2a) onto the chamber (7), tighten both hex socket screws (1) including the locking washers (1a) and screw in the triaxial connector (2) carefully.
- 10 Mount the magnet unit (4) and lock it with the screw (3).

Figure 1



Troubleshooting

Problem	Possible cause	Correction
The measurement values indicated are too low	Gauge contaminated	Clean the gauge

Spare Parts

When ordering spare parts, always indicate:

- all information on the nameplate
- description and ordering number according to spare parts list

	Position \rightarrow figure 1	Ordering number
Maintenance kit		BN 846 241-T
Metal seal, HNV100 9x1.6	(11)	
Centering ring	(12)	
Ignition aid	(10a)	
Washer	(10b)	
Repair kit		BN 846 240-T
Anode complete	(10)	
Washer	(10b)	
Metal seal, HNV100 9x1.6	(11)	
Centering ring	(12)	
Ignition aid	(10a)	

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 ¹⁾.

¹⁾ 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.

Disposal

STOP 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

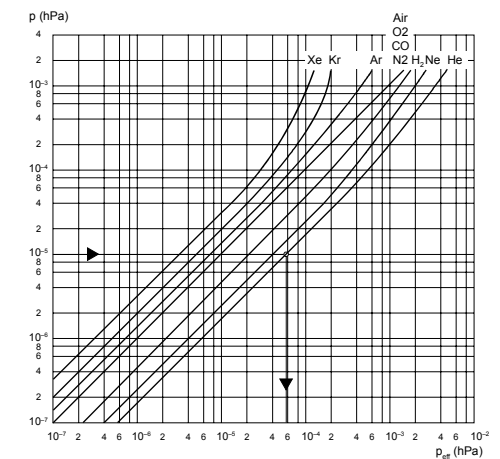
	mbar	bar	Pa	hPa	kPa	Torr mm HG
mbar	1	1×10^{-3}	100	1	0.1	0.75
bar	1×10^3	1	1×10^5	1×10^3	100	750
Pa	0.01	1×10^{-5}	1	0.01	1×10^{-3}	7.5×10^{-3}
hPa	1	1×10^{-3}	100	1	0.1	0.75
kPa	10	0.01	1×10^3	10	1	7.5
Torr mm HG	1.332	1.332×10^{-3}	133.32	1.3332	0.1332	1

1 Pa = 1 N/m²

Appendix

Gas Type Dependence

Indicated pressure
(Gauge calibrated for air)



In the range below 10^{-5} hPa the pressure indication is linear.
For gases other than air the pressure can be determined by means of a simple conversion formula:

$$p_{\text{eff}} = C \times \text{displayed pressure}$$

where	Gas type	C
	Air (N ₂ , O ₂ , CO)	1.0
	Xe	0.4
	Kr	0.5
	Ar	0.8
	H ₂	2.4
	Ne	4.1
	He	5.9

These conversion factors are average values.



A mixture of gases and vapors is often involved. In this case accurate determination is only possible with a partial pressure measuring instrument, e.g. a Pfeiffer Vacuum quadrupole mass spectrometer.

PFEIFFER VACUUM

Berliner Straße 43
D-35614 Asslar
Germany
Tel +49 (0) 6441 802-0
Fax +49 (0) 6441 802-1202
info@pfeiffer-vacuum.de
www.pfeiffer-vacuum.com