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D021-57-880
Issue D

Instruction Manual

Pirani Vacuum Gauges

(For use with 500, 1000, 1700, 2000& 4000)

Description	*Item Number*
PRH10K	D021-59-000
PRM10K	D021-66-000
PRM10KCR	D021-57-000
PRL10K	D021-58-000

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1 INTRODUCTION

1.1 Scope of this manual

This manual provides installation, operation and maintenance instructions for the BOC Edwards Pirani Gauges. Read this manual before attempting to install and operate the gauges.

This manual contains essential safety information which supplements the safety features of the gauges. Safety procedures are highlighted as WARNING and CAUTION instructions. You must obey these instructions. The use of WARNINGS and CAUTIONS is defined below.

> WARNING
> Warnings are given where failure to observe the instruction could result in injury or death to persons.

> CAUTION
> Cautions are given where failure to observe the instruction could result in damage to the equipment, associated equipment and process.

The following symbol appears on the gauges:



From August 2005, BOC Edwards will offer European customers a recycling service.

1.2 General

This range of Pirani gauge heads has been specially developed for use with the BOC Edwards Series 500, 1000, 1700, 2000 & 4000 vacuum measurement and control instructions. The total pressure range covered is 1000 to 10^{-4} mbar. Four gauge heads are used: PRH10K, PRM10K, PRM10KCR (corrosion resistant) and PRL10K. The pressure range of each gauge head is given in the specification.

The gauge heads all operate on the Pirani principle, at a low pressure, the thermal conductivity of any gas varies with pressure. The interior of the gauge head is open to the vacuum system and contains a filament that is electrically heated. The amount of heat lost from the filament (by conduction) to the surrounding gas diminishes as the gas pressure falls so the filament temperature rises. The electrical resistance of the filament is therefore increased. The filament forms

one arm of a Wheatstone bridge which is balanced at atmospheric pressure and becomes unbalanced as the pressure decreases.

This imbalance signal is used in a feedback circuit to adjust the bridge voltage and bring the filament resistance back to its original value. These heads therefore operate in a constant temperature mode and the bridge voltage is a function of pressure.

Each gauge head contains a compensating resistor to minimise the effects of changes in ambient temperature. The gauge heads also contain potentiometer controls to adjust the atmosphere and vacuum settings.

The gauge heads terminate in an NW10 flange connection, and are supplied complete with two metres of connecting lead. Extension leads are available. See Section 7 for ordering numbers. Outline drawings of the gauge heads are shown in Figures 1 and 2.

PRH10K: The high pressure limit of the PRH10K has been extended by mounting the filament horizontally. This makes use of convection currents to transfer heat away from the filament and so improve the high pressure sensitivity. The head is supplied complete with sintered filter.

PRM10K: This device is the basic constant temperature unit in this range of gauge heads and is particularly useful for users requiring a compact head. The gauge offers a wider operating range with more accuracy than the PRE.

PRM10KCR: Having the same dimensions and pressure range as the PRM10K, the PRM10KCR has a stainless steel body and offers improved corrosion resistance.

PRL10K: The low pressure limit of the PRL10K has been achieved by use of a long fine filament. The head is supplied complete with a sintered filter.

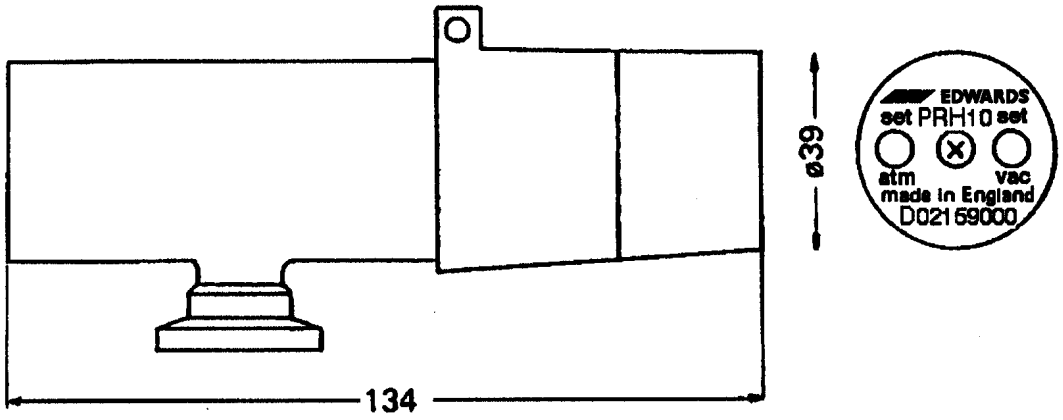


Figure 1 - PRH10K gauge head

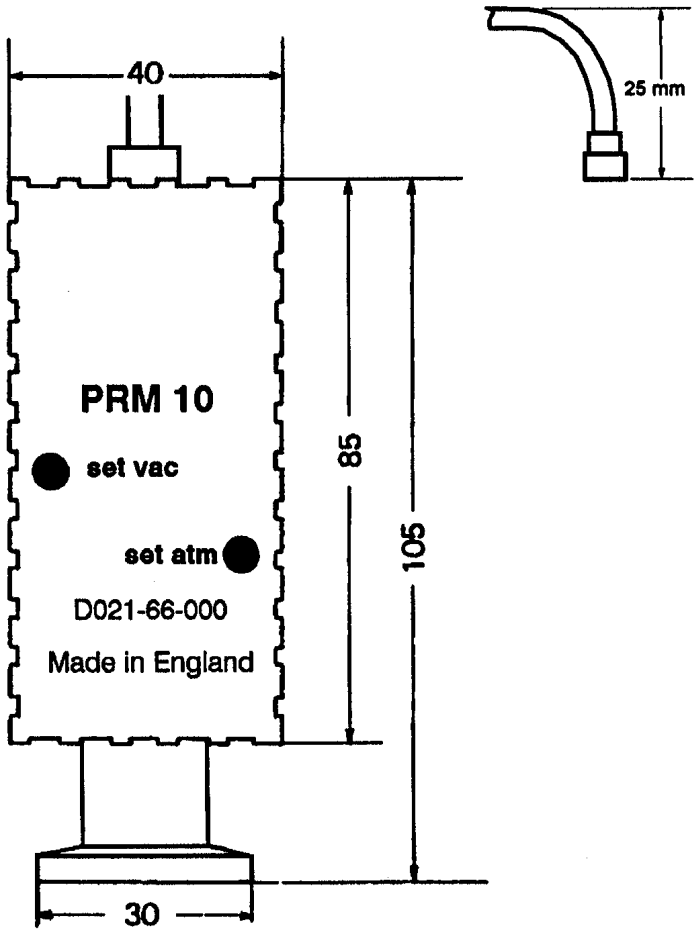


Figure 2 - PRH/PRM/PRL gauge heads

2 TECHNICAL DATA

2.1 Pressure range

PRH10K	1000 to 10^{-3} mbar
PRM10K	200 to 10^{-3} mbar
PRM10KCR	200 to 10^{-3} mbar
PRL10K	10 to 10^{-4} mbar

2.2 Mechanical data

External Dimensions

Length overall

PRH10K	134 mm
PRM10K	105 mm
PRM10KCR	105 mm
PRL10K	105 mm

Lead (integral) 2 m

Weight

PRH10K	360 g
PRM10K	240 g
PRM10KCR	270 g
PRL10K	245 g

Gauge tube volume

PRH10K	65 cm^3
PRM10K	4.3 cm^3
PRM10KCR	4.3 cm^3
PRL10K	4.3 cm^3

2.3 Materials exposed to vacuum system

The materials listed below are used in the construction of the gauge heads and will be exposed to vacuum when in use.

PRH10K:

Stainless steel (AISI 304), PTFE, gold plated tungsten, phosphor bronze, tungsten and nickel.

PRM10K:

Aluminium (HE30TF), platinum/10% rhodium, PTFE, nickel, phosphor bronze and ceramic.

PRM10KCR:

Stainless steel (AISI 304), platinum/10% rhodium, PTFE, nickel and phosphor bronze.

PRL10K:

Aluminium (HE30TF), gold plated tungsten, PTFE, phosphor bronze and nickel.

2.4 Operating conditions

Filament operating temperature PRM, PRL and PRH	130 °C
Maximum internal pressure	2 bar absolute

3 INSTALLATION

3.1 Unpacking and inspection

Remove all packing materials and protective covers and check the gauge head for damage. If the gauge is damaged, notify your supplier and the carrier in writing within three days; state the Item Number of the gauge together with your order number and your supplier's invoice number. Retain all packing materials for inspection. Do not use the gauge if damaged.

3.2 General

> CAUTION
>
> Never vent a vacuum system by disconnecting a Pirani gauge head. The result turbulence may cause filament damage.

Mount gauge heads as close as possible to the point at which the pressure is to be measured. Use a short branch tube with an internal diameter no less than that of the gauge head. Long, narrow and angled connections can cause a significant reading error.

Mount the gauge heads with the face of the NW10 flange horizontal. The body tubes of the gauge heads except the PRH10K will then be vertical, as required. Always mount the body tube of the PRH10K horizontally; in any other attitude re-adjustment will be required and the high pressure sensitivity will be reduced.

The PRH10K and PRL10K are fitted with a phosphor bronze sintered filter in the throat of the vacuum connection. This reduces both the amount of contamination reaching the filament and the effect of turbulence on the filament.

3.3 Connection to the vacuum system

> WARNING
>
> The internal pressure of the gauge heads must not exceed 2 bar absolute, (1 bar gauge). It is possible to inadvertently pressurise the PRH10K when operating with argon and other high molecular weight gases as the indicated pressure is lower than the true pressure.

WARNING

Do not use these gauge heads to measure the pressure of explosive or flammable gases and gas mixtures. The sensing element normally operates at a temperature of approximately 130 °C (depending on ambient temperature). It is possible that malfunction or momentary transients could raise the filament above the ignition temperature of combustible mixtures which might then explode.

The gauge heads terminate in NW10 flanges. To connect to a branch tube terminating in a NW10 flange a centring ring with O ring and a clamp will be required.

BOC Edwards offer a full range of vacuum connections and pipeline components which are described in our catalogue.

3.4 Connection to the control unit

CAUTION

Do not connect or disconnect the gauge head from the control unit when the unit power is on. This may result in damage to the filament.

Plug the lead into the back panel socket on the control unit, using the optional extension lead if required. Secure the lead to a support a short distance above the gauge head to avoid straining the vacuum connection. Switch on the power to the control unit.

4 OPERATION

WARNING

Do not use the Pirani gauges to measure the pressure of explosive or flammable gases or mixtures. The gauge contains a heated filament which could promote the explosion or fire of such gases.

WARNING

When measuring gases of high molecular weight the pressure indicated can be well below the true pressure. Ensure that the gauge is not over-pressurised when using heavy gases.

CAUTION

Never vent a vacuum system by disconnecting a Pirani gauge. The resulting turbulence may cause filament damage.

CAUTION

Although the filament operates at 130 °C above ambient it is possible that higher temperatures may be experienced under fault conditions or during transients.

4.1 Adjustment of PRH, PRL and PRM gauges

The 'set atm' and 'set vac' adjustment potentiometers on the gauge heads are factory adjusted prior to despatch by should be checked on installation and periodically if most accurate operation is required.

Check the adjustment at any time using the following adjustment procedure. When operating the gauge head in a contaminating atmosphere, a periodic check is recommended.

If necessary reference should be made to the operating instructions of the appropriate controller for a description of the operation procedure to check the adjustment of the gauge head.

4.1.1 1000 Series control unit

1. Connect the gauge head to the vacuum system and control unit as described above. Allow at least 15 minutes for the instrument to stabilise.

2. With the system pressure at atmospheric, select the appropriate input for display and then press 'C'. A number in the range + 99 mV to - 99 mV (or '+ E' if outside this range) is displayed which is a measure of the deviation of the bridge voltage from a factory determined setting.

3. Adjust the reading to zero by turning the gauge head 'set atm' potentiometer.

4. Reduce the system pressure (as indicated by another gauge head) to 1 x 10^{-4} mbar (or below) for PRH10K and PRM10K/ PRM10KCR or 1 x 10^{-5} (or below) for PRL10K. The control unit should again display a reading in the range + 99 mV to - 99 mV, showing the bridge voltage deviation at vacuum.

5. Adjust the gauge head 'set vac' potentiometer until the reading is zero.

6. Repeat steps 2 to 5 until the reading at both atmospheric pressure and vacuum is zero.

4.1.2 2000 Series control unit

1. Connect the gauge head to the vacuum system and control unit as described above. Allow at least 15 minutes for the instrument to stabilise.

2. With the system pressure at atmospheric, select the display type 'DIAGNOSTIC INTERNAL', then select 'manual read gauges' followed by the gauge head number and 'diagnostic'.

3. Adjust the gauge head 'set atm' potentiometer until the display shows values indicated below:

PRH10K	-3432 mV
PRM10K	-3330 mV
PRM10KCR	-3330 mV
PRL10K	-3500 mV

4. Reduce the system pressure (as indicated by an independent pressure gauge) to 1 x 10^{-4} mbar (or below) for PRH10K and PRM10K/PRM10KCR or 1 x 10^{-5} mbar (or below) for PRL10K.

5. Adjust the 'set vac' potentiometer until the display shows -64 mV, (for all gauge heads).

6. Repeat steps 2 to 5 until the reading at both atmospheric pressure and vacuum are correct.

4.2 Adjustment of PRM gauges

4.2.1 500 Series control unit

1. Connect the gauge to the vacuum system and plug in its connector to the 500 Series controller.

2. With the system at atmospheric pressure, note the instrument reading and if necessary adjust the 'set atm' potentiometer on the gauge head to set the needle on the 'atm' mark.

3. Pump down to 1 x 10^{-3} mbar, check the reading and if necessary adjust the 'set vac' potentiometer until the meter reads 10^{-3} mbar.

4. Recheck the 2 and 3 above.

   If there is insufficient range of adjustment on either potentiometer, the gauge head should be returned to BOC Edwards under the BOC Edwards Exchange/ Replacement service.

4.3 Recorder outputs

Graphs showing the recorder output versus indicated pressure for the BOC Edwards Pirani module for different gauge heads are given in the respective Controller instructions.

5 MAINTENANCE

WARNING

Cleaning solvents may produce fumes that are toxic and/or flammable. Such solvents should only be used in well ventilated areas away from electronic equipment or flames.

CAUTION

The interior of the gauge tube must not be cleaned as damage to the filament may occur. If contamination is suspected the gauge should be returned to BOC Edwards for exchange/replacement.

5.1 General

In normal use the gauge heads do not require maintenance, except for cleaning the filters on the PRH and PRL gauges, but extended operation in a contaminating atmosphere may change the gauge head adjustment. If this is suspected, the recommended procedure is to return the gauge head to BOC Edwards exchange/replacement service.

5.2 Cleaning the Filter - PRH and PRL gauges only

Switch off the power supply and remove the gauge from the vacuum system.

The filter must be removed for cleaning. It must not be cleaned in position in the body tube.

The filter is located in the flange end of the body tube and is retained by a circlip. Using a pair of circlip pliers remove the circlip being careful not to mark the body tube wall.

The filter should first be degreased using a proprietary solvent, then washed repeatedly in clean water and finally with methanol to remove all traces of water. The filter should be thoroughly dried.

Reassemble the filter into the body tube and replace the circlip.

6 STORAGE AND DISPOSAL

6.1 Storage

Store in a cool dry place.

6.2 Disposal

Dispose of the gauge head and any components safely in accordance with all local and national safety and environmental requirements.

Alternatively, you may be able to recycle the gauge and/or cables; contact BOC Edwards or your supplier for advice (also see below).

The gauge and associated cables are within the scope of the European Directive on Waste Electrical and Electronic Equipment, 2002/96/EC. From August 2005, BOC Edwards will offer European customers a recycling service for the gauge/cables at the end of the product's life. Contact BOC Edwards for advice on how to return the gauge/cables for recycling.

Particular care must be taken if the gauge has been used in a hazardous environment.

7 SPARES AND ACCESSORIES

7.1 Introduction

BOC Edwards products, spares and accessories are available from BOC Edwards companies in Belgium, Brazil, Canada, France, Germany, Hong Kong, Italy, Japan, Korea, Switzerland, United Kingdom, U.S.A., and a world wide network of distributors. The majority of these centres employ Service Engineers who have undergone comprehensive BOC Edwards training courses.

Order spare parts and accessories from your nearest BOC Edwards company or distributor. When you order, please state for each part required:

- Model and Item Number of your equipment
- Serial number (if any)
- Item Number and description of part

7.2 Accessories and spares

The following accessories and spares for the Pirani Vacuum Gauge Heads are available from BOC Edwards:

Ordering number

Product description	Item Number
Pirani gauge head PRH10K	D021-59-000
Pirani gauge head PRM10K	D021-66-000
Pirani gauge head PRM10KCR	D021-57-000
Pirani gauge head PRL10K	D021-58-000
Sintered filter NW10 ‘O’ ring carrier for PRM10K and PRM10KCR gauge heads	D021-58-020

7.2.1 Extension leads for PRL/PRM/PRH10K

5 m	D368-17-005
15 m	D368-17-015
30 m	D368-17-030

APPENDIX 1

Electronic interface FCC68/RJ45 Type 8 way

Pin Allocation Function

1	Power supply positive voltage
2	Power supply common
3	Gauge signal output/set point trip level
4	Gauge identification signal
5	Signal common
6	Set point open drain transistor output
7	Read set point trip level
8	No connection

BOC EDWARDS

Form HS1

Return of BOC Edwards Equipment - Procedure

INTRODUCTION

Before returning your equipment, you must warn BOC Edwards if substances you used (and produced) in the equipment can be hazardous. This information is fundamental to the safety of our Service Centre employees and will determine the procedures employed to service your equipment.

Complete the Declaration (HS2) and send it to BOC Edwards before you dispatch the equipment. It is important to note that this declaration is for BOC Edwards internal use only, and has no relationship to local, national or international transportation safety or environmental requirements. As the person offering the equipment for shipment, it is your responsibility to ensure compliance with applicable laws.

GUIDELINES

- Equipment is '**uncontaminated**' if it has not been used, or if it has only been used with substances that are not hazardous. Your equipment is '**contaminated**' if it has been used with any substances classified as hazardous under EU Directive 67/548/EEC (as amended) or OSHA Occupational Safety (29 CFR 1910).
- If your equipment has been used with radioactive substances, biological or infectious agents, mercury, polychlorinated biphenyls (PCB's), dioxins or sodium azide, you must decontaminate it before you return it to BOC Edwards. You must send independent proof of decontamination (for example a certificate of analysis) to BOC Edwards with the Declaration (HS2). Phone BOC Edwards for advice.
- If your equipment is contaminated, you must either:
  - Remove all traces of contamination (to the satisfaction of laws governing the transportation of dangerous/hazardous substances).
  - Or, properly classify the hazard, mark, manifest and ship the equipment in accordance with applicable laws governing the shipment of hazardous materials.

Note: Some contaminated equipment may not be suitable for airfreight.

PROCEDURE

1. Contact BOC Edwards and obtain a Return Authorisation Number for your equipment.
2. Complete the Return of BOC Edwards Equipment - Declaration (HS2).
3. If the equipment is contaminated, you must contact your transporter to ensure that you properly classify the hazard, mark, manifest and ship the equipment, in accordance with applicable laws governing the shipment of contaminated/hazardous materials. As the person offering the equipment for shipment, it is your responsibility to ensure compliance with applicable law. **Note: Equipment contaminated with some hazardous materials, such as semiconductor by-products, may not be suitable for airfreight - contact your transporter for advice.**
4. Remove all traces of hazardous gases: pass an inert gas through the equipment and any accessories that will be returned to BOC Edwards. Where possible, drain all fluids and lubricants from the equipment and its accessories.
5. Seal up all of the equipment's inlets and outlets (including those where accessories were attached) with blanking flanges or, for uncontaminated product, with heavy gauge tape.
6. Seal equipment in a thick polythene/polyethylene bag or sheet.
7. If the equipment is large, strap the equipment and its accessories to a wooden pallet. If the equipment is too small to be strapped to a pallet, pack it in a suitable strong box.
8. Fax or post a copy of the Declaration (HS2) to BOC Edwards. The Declaration must arrive before the equipment.
9. Give a copy of the Declaration (HS2) to the transporter. You must tell your transporter if the equipment is contaminated.
10. Seal the original Declaration in a suitable envelope: attach the envelope securely to the outside of the equipment package, in a clear weatherproof bag.
    WRITE YOUR RETURN AUTHORISATION NUMBER CLEARLY ON THE OUTSIDE OF THE ENVELOPE OR ON THE OUTSIDE OF THE EQUIPMENT PACKAGE.

BOC EDWARDS

Form HS2

Return of BOC Edwards Equipment - Declaration

Return Authorisation Number:

You must:

- Know about all of the substances which have been used and produced in the equipment before you complete this Declaration
- Read the Return of BOC Edwards Equipment - Procedure (HS1) before you complete this Declaration
- Contact BOC Edwards to obtain a Return Authorisation Number and to obtain advice if you have any questions
- Send this form to BOC Edwards before you return your equipment

SECTION 1: EQUIPMENT

Equipment/System Name_____

Part Number _____

Serial Number_____

Has the equipment been used, tested or operated ?

YES ❑ Go to Section 2 NO ❑ Go to Section 4

IF APPLICABLE:

Tool Reference Number_____

Process _____

Failure Date_____

Serial Number of Replacement Equipment_____

SECTION 2: SUBSTANCES IN CONTACT WITH THE EQUIPMENT

Are any substances used or produced in the equipment:

- Radioactive, biological or infectious agents, mercury, poly chlorinated biphenyls (PCBs), dioxins or sodium azide? (if YES, see Note 1) YES ❑ NO ❑
- Hazardous to human health and safety? YES ❑ NO ❑

Note 1 : BOC Edwards will not accept delivery of any equipment that is contaminated with radioactive substances, biological/infectious agents, mercury, PCB's, dioxins or sodium azide, unless you:

- Decontaminate the equipment
- Provide proof of decontamination

YOU MUST CONTACT BOC EDWARDS FOR ADVICE BEFORE YOU RETURN SUCH EQUIPMENT

SECTION 3: LIST OF SUBSTANCES IN CONTACT WITH THE EQUIPMENT

Substance name	Chemical Symbol	Precautions required (for example, use protective gloves, etc.)	Action required after a spill, leak or exposure

SECTION 4: RETURN INFORMATION

Reason for return and symptoms of malfunction _____

_____

If you have a warranty claim:

- who did you buy the equipment from ? _____
- give the supplier's invoice number_____

SECTION 5: DECLARATION

Print your name:_____Print your job title:_____

Print your organisation:_____

Print your address:_____

_____

Telephone number: _____Date of equipment delivery: _____

I have made reasonable enquiry and I have supplied accurate information in this Declaration. I have not withheld any information, and I have followed the Return of BOC Edwards Equipment - Procedure (HS1).

Note: Please print out this form, sign it and return the signed form as hard copy.

Signed: _____Date_____

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