Instruction Manual

Active Inverted Magnetron Gauge

Description	Item Number
AIM-S-NW25	NRA737000

Original Instructions

EDWARDS

Official Distributor in Australia

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Declaration of Conformity

We, Edwards Limited,
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declare under our sole responsibility, as manufacturer and person within the EU authorised to assemble the technical file, that the product(s)

Active Inverted Magnetron Gauge
AIM-S-NW25 NRA737000

to which this declaration relates is in conformity with the following standard(s) or other normative document(s)

EN61326-2-3: 2013 (Class B Emissions, Basic Immunity)	Electrical equipment for measurement, control and laboratory Use. EMC requirements. Particular requirements. Test configuration, operational conditions and performance criteria for transducers with integrated or remote signal conditioning
EN50581: 2012	Technical Documentation for the Assessment of Electrical and Electronic Products with respect to the Restriction of Hazardous Substances

following the provisions of

2014/30/EU	Electromagnetic Compatibility (EMC) Directive
2012/19/EU	Waste from Electrical and Electronic Equipment (WEEE) Directive
2011/65/EU	Restriction of Certain Hazardous Substances (RoHS) Directive

L G Marini

Larry Marini, Senior Technical Manager

19.08.2015, Eastbourne

Date and Place

This product has been manufactured under a quality management system certified to ISO 9001:2008

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GEC/ 2020-AVI-GCN-0011

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Publication Title	Publication number
Vacuum Pump and Vacuum System Safety	P300-20-000

1 INTRODUCTION

1.1 Scope

This manual provides installation, operation and maintenance instructions for the Edwards AIM Gauge (Active Inverted Magnetron Gauge). You must use the AIM Gauge as specified in this manual.

Read this manual before you attempt to install, operate and maintain the Edwards AIM Gauge. Important safety information is 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 people.

CAUTION

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

The units used throughout this manual conform to SI international system of measurement followed by imperial units in parenthesis; SI (imperial).

The following warning symbols appear on the AIM Gauge:

Edwards offer European customers a recycling service.

1.2 Description

The AIM Gauge, shown in Figure 1, is an inverted magnetron gauge head and gauge controller in a single compact unit. The gauge operates as a cold cathode ionisation gauge, in which the pressure is measured indirectly as a function of the current which flows in a Townsend discharge maintained in the body tube.

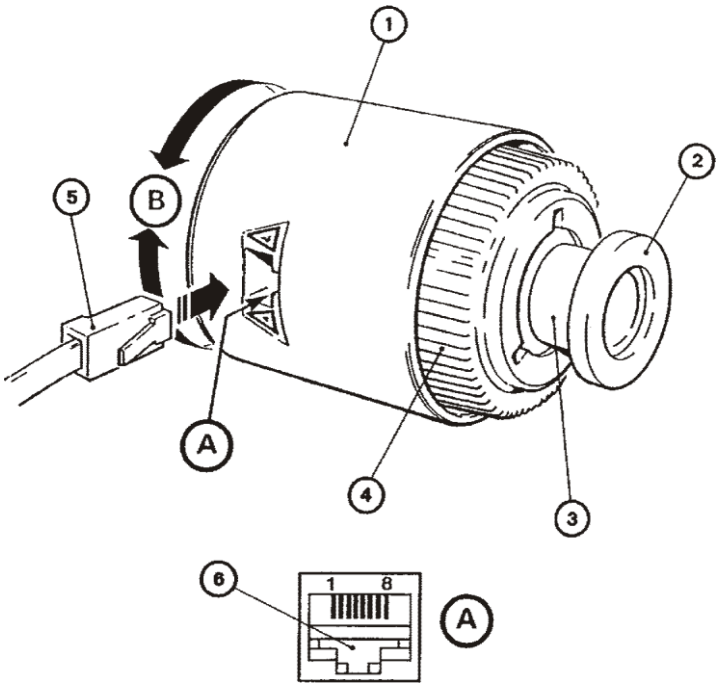
Two versions of AIM Gauge are available; the ‘S’ gauge and the ‘SL’ gauge. The ‘SL’ gauge has a very low external magnetic field and is suitable for use with sensitive analytical instrumentation.

The measurement range of the AIM Gauge is 1 x 10^{-8} to 1 x 10^{-2} mbar. The AIM Gauge vacuum connection is a NW25 flange.

The AIM Gauge requires a 13.5 to 36 V d.c. Power supply; it has a 2 to 10 V d.c. analogue output which is related to pressure. The AIM Gauge is compatible with all of the Edwards AGCs (Active Gauge Controllers) and with the appropriate versions of the Edwards AGDs (Active Gauge Displays). Alternatively, you can use an independent power supply for the AIM Gauge and you can read the AIM Gauge output signal with a voltmeter or an analogue-to-digital converter.

We recommend that you do not operate the AIM Gauge unless the pressure in the vacuum system is 1 x 10^{-2} mbar or lower. A gauge enable signal is used to control the operation of the AIM Gauge; refer to Section 4.2 for more information.

Figure 1 - General View of the AIM Gauge (showing NW25 flange)



1. End-cap
2. Body tube
3. Cable connector plug
4. Vacuum flange
5. Magnet housing
6. AIM Gauge connector socket

An 8-way electrical connector socket on the AIM Gauge (Figure 1, item 6) is used to connect the AIM Gauge to your AGC, AGD or electrical supply and voltmeter. Electrical cables fitted with suitable connector plugs are available as accessories.

A gauge identification signal is available on the electrical connector; this signal is used by Edwards AGCs to identify which type of Active Gauge is connected.

The AIM Gauge has self-monitoring fault detection circuits. When these circuits detect that the AIM Gauge is not operating correctly, an error signal is set; this error signal is available on the electrical connector. The device which sets the error signal is a FET transistor which acts like a switch. When no error is detected, the output of the transistor is on (closed or low impedance). When the fault detection circuits detect an error, the transistor output changes to off (open or high impedance).

Note: *If you use an Edwards AGC controller or AGD display, the AIM Gauge error signal is not used.*

1.3 Gas dependency

The ionisation of the gas in the vacuum system is dependent on both the pressure and the physical properties of the gas. Therefore, the output signal of the AIM Gauge is gas dependent.

The output signal voltage to pressure conversions in Table 2 apply for nitrogen and dry air.

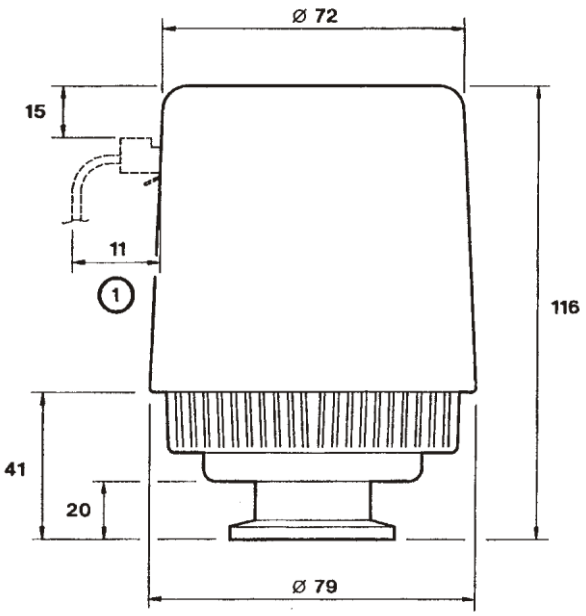
Calibration graphs for use with argon, neon, krypton, helium and carbon dioxide are available on request; contact your supplier or Edwards.

2 TECHNICAL DATA

2.1 Mechanical Data

Dimensions	See Figure 2
Mass	
AIM-S NW25	810 g
AIM-SL-NW25	860 g
Volume of gauge tube	26 cm^3
Enclosure rating	IP40 and IP403

Figure 2 - Dimensions (mm)



1. Clearance required for electrical cable

2.2 Performance, Operating and Storage Conditions

Ambient temperature	
Operation	5 to 60 °C
Storage	0 to 70 °C
Ambient humidity (operation)	10 to 90% (non-condensing)
Maximum operating altitude	2000m
Maximum internal pressure	6 bar absolute (5 bar gauge)
Pressure measurement range	1 x 10^{-8} to 1 x 10^{-2} mbar
Pollution category	EN61010 Category 2

2.3 Electrical Data

Electrical supply	
Voltage	+13.5 to +36 V d.c.
Max voltage ripple	1 V peak to peak
Max source resistance	50 W
Maximum power consumption	3.5 W
Electrical connector	FCC68/RJ45 type, 8-way
Pressure output signal	
Range	2 ≤ output ≤ 10 V d.c.
Error range	output < 2 V d.c. or output > 10 V
dDimensions(mm).c	
Impedance	0.1 Ω
Min load impedance	10 kΩ
Max current source	1 µA
Gauge enable	
Control sense	Active low
Active level	< 1.3 V
Control impedance	12 kW pull-up to positive supply
Error output	
External load rating	40 V d.c., 100 mA max
Back EMF suppression diode*	
Min. surge rating	1 A
Min. reverse voltage rating	100 V
Gauge identification resistance	100 kW ± 2%

* Required when you see an external d.c. relay connected to the error output.

2.4 Materials Exposed to Vacuum

Stainless steel (AISI 304 and 306)

Fluoroelastomer

Soda lime glass.

3 INSTALLATION

3.1 Unpck and Inspect

WARNING

Magnetic Field may interfere with pacemakers. Maintain a distance of minimum 10 cm between the magnet and the heart pacemaker. You can also use anti-magnetic shield to prevent the influence of strong magnetic field.

Remove all packing materials and protective covers and check the AIM Gauge.

If the AIM Gauge is damaged, notify your supplier and the carrier in writing within three days; state the Item Number of the AIM Gauge together with your order number and your supplier's invoice number. Retain all packing materials for inspection. Do not use the AIM Gauge if it is damaged.

If the AIM Gauge is not to be used immediately, replace the protective covers. Store the AIM Gauge in suitable conditions as described in Section 6.

3.2 Fit the AIM Gauge to the Vacuum System

The AIM Gauge can be mounted in any orientation. To avoid the build- up of debris or condensable material in the body tube of the AIM Gauge (which will probably cause pressure measurement errors), we recommend that you install the AIM Gauge vertically as shown in Figure 2.

Use an 'O' ring / centring ring or Co-Seal and clamp to connect the NW25 flange of the AIM Gauge to a similar flange on your vacuum system.

If required, you can turn the end-cap (relative to the magnet housing) so that the electrical connection socket is in a convenient position on your system; refer to Figure 1 and use the following procedure: hold the magnet housing (4) and turn the end-cap (1) in a clockwise or anticlockwise direction (arrow B) until the electrical connection socket (6) is in the required position.

3.3 Electrical Connections

WARNING

If the AIM Gauge malfunctions, the AIM Gauge pressure output may be incorrect. If such a failure could cause injury to people or damage equipment, you must install a suitable control system to indicate the failure and, if necessary, to close down your process system.

When using a cable longer than 30 m, full compliance with European Standards requires an in-line surge suppressor (please refer to Section 7.3).

3.3.1 Connect to Edwards Controllers or AGD Display

Connect the AIM Gauge to the controller or display with a cable which is terminated in suitable connectors. Suitable cables are available from Edwards (refer to Section 7).

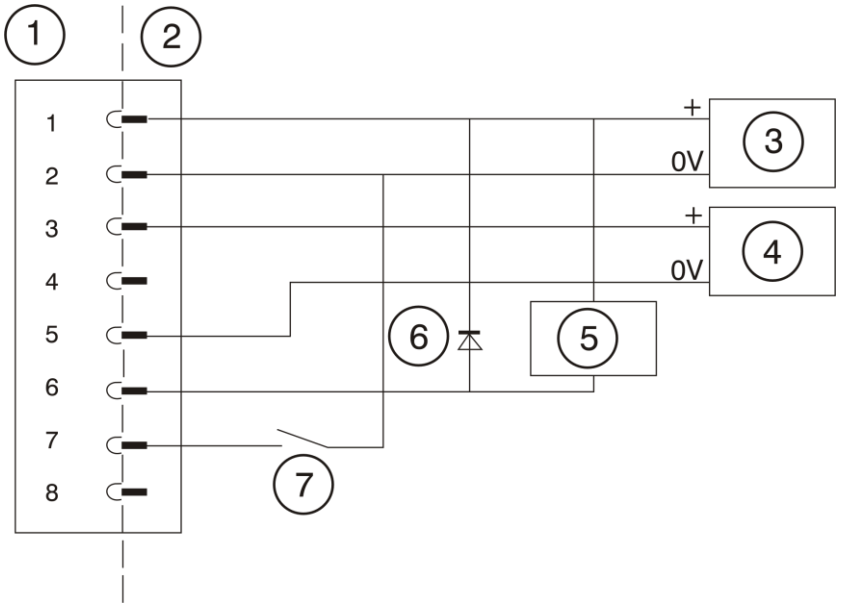
3.3.2 Connect to Your Own Supply and Control Equipment

Note: *Do not connect the electrical supply common (pin 2) to the signal common (pin 5). If you do, the AIM Gauge pressure output signal will be inaccurate.*

A schematic diagram of the recommended electrical connections to the AIM Gauge is shown in Figure 3.

The pins on the AIM Gauge electrical connection socket are used as shown in Table 1. The specification of the electrical supply, d.c. relay and back EMF suppression diode are given in Section 2.

Figure 3 - Schematic Diagram of Typical Electrical Connections



1. AIM Gauge electrical connector socket
2. Cable electrical connector plug
3. Electrical supply
4. Voltmeter
5. D.C. relay (optional)
6. Back EMF suppression diode (optional)
7. Gauge enable switch

Table 1 - Pins on the AIM Gauge Electrical Connector Socket

Pin Number	Use
1	Electrical supply positive voltage
2	Electrical supply common
3	Pressure measurement output signal
4	Gauge identification signal
5	Signal common
6	Error output signal
7	Gauge enable
8	No connection

The connection to pin 6 is optional. Make the connection to pin 6 if you want to connect the error signal to a d.c. relay: you must connect a suppression diode between pins 1 and 6 to protect the AIM Gauge from transient voltages generated when the d.c. relay is switched off.

Connect a switch between pins 2 and 7 to enable and disable the gauge (refer to Section 4.2). If you want to measure the gauge identification signal (which identifies the AIM Gauge), measure the resistance between pins 4 and 5.

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4 OPERATION

4.1 Safety

WARNING

Do not use the AIM Gauge to measure the pressure of explosive or flammable gases or mixtures.

WARNING

Never operate the AIM Gauge when it is disconnected from the vacuum system or when there are explosive or flammable gases in the surrounding atmosphere or the vacuum system. High voltages (up to 3kV) are generated inside the body tube of the AIM Gauge; these could cause injury to people or could be a source of ignition.

WARNING

The AIM Gauge incorporates magnets. Keep away from heart pacemakers, computers, credit cards and any other magnetically sensitive devices.

4.2 Enable and Disable the AIM Gauge

CAUTION

Do not operate the AIM Gauge for long periods when the system pressure is above 1 x 10^{-2} mbar. If you do, the anode pin can be damaged and the AIM Gauge can be severely contaminated.

We recommend that you only enable the gauge when the system pressure is lower than 1 x 10^{-2} mbar and that you disable the gauge when the system pressure is 1 x 10^{-2} mbar or higher.

If you have connected the AIM Gauge to an AGC or AGD, refer to the corresponding instruction manual for details of how to enable (switch on) and disable (switch off) the AIM Gauge.

Otherwise, to enable (switch on) the AIM Gauge, connect pin 7 to pin 2 (or to ground). To disable (switch off) the AIM Gauge, disconnect pin 7 from pin 2 (or from ground).

4.3 Pressure Measurement

If you connected the AIM Gauge to a Edwards AGC controller or AGD display, the pressure measured by the AIM Gauge is shown on the display.

If you connected the signal output of the AIM Gauge to a voltmeter, convert the measured voltage to the corresponding pressure value: refer to Table 2.

If necessary, adjust the pressure reading to compensate for the RMM of the gas in your vacuum system (refer to Section 1.3).

Table 2 - Pressure and Voltage Characteristics for Nitrogen and Dry Air

Pressure (mbar)	Output voltage (V)	Pressure (torr)
1.0×10^{-8}	2.00	7.5×10^{-9}
2.4×10^{-8}	2.50	1.8×10^{-8}
5.8×10^{-8}	3.00	4.3×10^{-8}
8.2×10^{-8}	3.20	6.1×10^{-8}
1.2×10^{-7}	3.40	8.7×10^{-8}
1.6×10^{-7}	3.60	1.2×10^{-7}
2.3×10^{-7}	3.80	1.7×10^{-7}
3.2×10^{-7}	4.00	2.4×10^{-7}
4.4×10^{-7}	4.20	3.3×10^{-7}
5.9×10^{-7}	4.40	4.5×10^{-7}
7.9×10^{-7}	4 .60	5.9×10^{-7}
1.0×10^{-6}	4.80	7.6×10^{-7}
1.3×10^{-6}	5.0 0	9.5×10^{-7}
1.6×10^{-6}	5.20	1.2×10^{-6}
2.0×10^{-6}	5.40	1.5×10^{-6}
2.5×10^{-6}	5.60	1.9×10^{-6}
3.1×10^{-6}	5.80	2.4×10^{-6}
3.9×10^{-6}	6.00	2.9×10^{-6}
4.9×10^{-6}	6.20	3.7×10^{-6}
6.1×10^{-6}	6.40	4.6×10^{-6}
7.5×10^{-6}	6.60	5.6×10^{-6}
9.3×10^{-6}	6.80	7.0×10^{-6}
1.1×10^{-5}	7.00	8.6×10^{-6}
1.4×10^{-5}	7.20	1.0×10^{-5}
1.7×10^{-5}	7.40	1.3×10^{-5}
2.1×10^{-5}	7.60	1.6×10^{-5}
2.6×10^{-5}	7.80	1.9×10^{-5}
3.1×10^{-5}	8.00	2.4×10^{-5}
3.9×10^{-5}	8.20	2.9×10^{-5}
4.8×10^{-5}	8.40	3.6×10^{-5}
6.1×10^{-5}	8.60	4.6×10^{-5}
8.0×10^{-5}	8.80	6.0×10^{-5}
1.1×10^{-4}	9.00	8.4×10^{-5}
1.8×10^{-4}	9.20	1.3×10^{-4}
2.9×10^{-4}	9.40	2.2×10^{-4}
5.4×10^{-4}	9.60	4.0×10^{-4}
1.5×10^{-3}	9.80	1.1×10^{-3}
1.0×10^{-2}	10.00	7.5×10^{-3}

4.4 Error Output Signal

Note: *The error signal output is not used if you connect the AIM Gauge to an Edwards AGC controller or AGD display.*

The error output signal indicates when the AIM Gauge is operating correctly. If required, you can use the error output signal to control the operation of your vacuum system. The signal is open (that is, the output of the FET transistor is off):

- For 1.5 seconds after the AIM Gauge is switched on.
- When the pressure output signal is out of range, that is the signal is < 1.5 V or > 10.7 V.
- When the discharge from the AIM Gauge has failed to strike (ignite); that is, if the voltage after switch-on fails to rise above 2.5 V.

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5 MAINTENANCE

5.1 Introduction

WARNING

Do not disconnect the electronics and magnet housing from the body tube when the body tube is connected to the vacuum system. If there is a plasma discharge in the vacuum system near the body tube, the body tube can become electrically charged.

WARNING

Disconnect the cable from the AIM Gauge before you remove the AIM Gauge from the vacuum system. High voltages are generated inside the AIM Gauge.

The internal components of the AIM Gauge are shown in Figure 4. The AIM Gauge is designed so that you can easily clean these components, or use the spares listed in Section 7 to replace these components. Refer to the following sections for details of the maintenance procedures, which you should do when necessary.

5.2 Replace the Body Tube

Refer to Figure 4 and use the following procedures to replace the body tube:

5.2.1 Remove the AIM Gauge from the Vacuum System

1. Switch off the AIM Gauge electrical supply and ensure that the vacuum system is at atmospheric pressure.
2. Disconnect the cable connector plug (Figure 1, item 5) from the AIM Gauge and remove the AIM Gauge from the vacuum system.

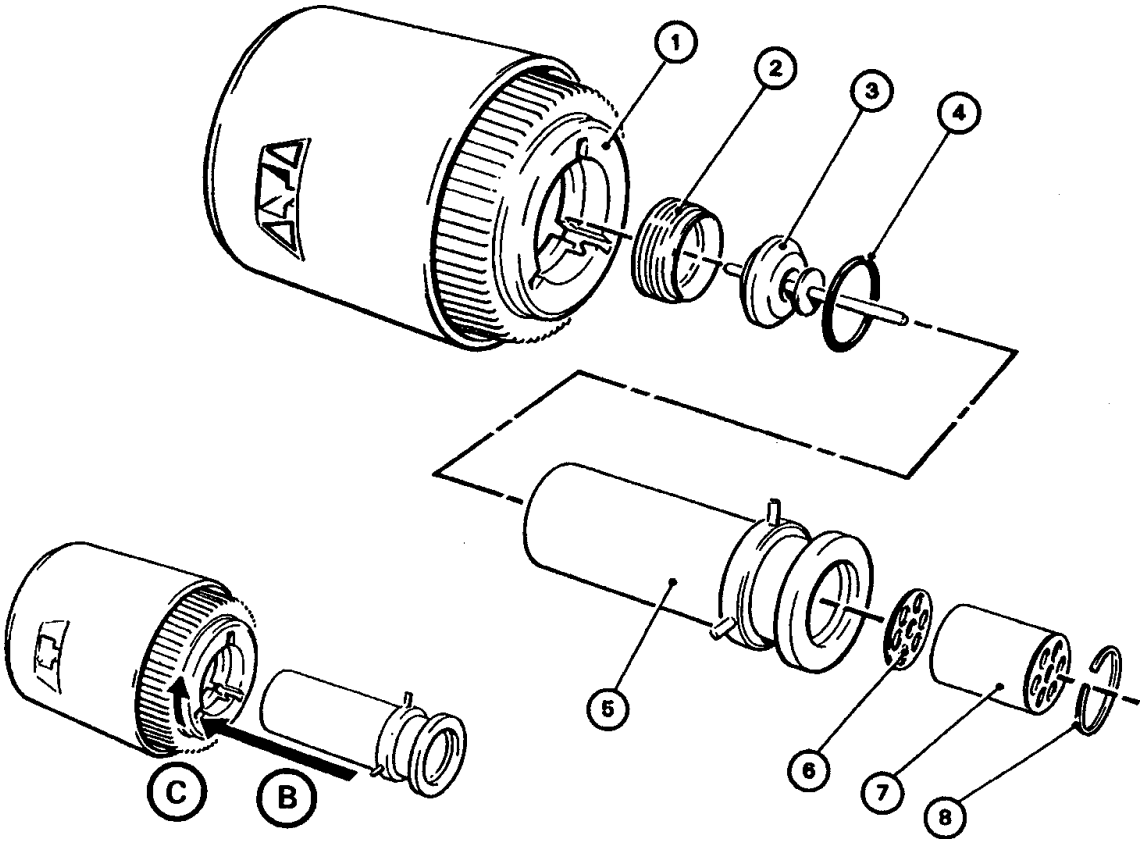
5.2.2 Fit the New Body Tube

1. Hold the magnet housing (1) and turn the body tube (5) anticlockwise (when viewed from the vacuum flange) to unlock the bayonet fitting. Remove the body tube from the magnet housing.
2. Slide the new body tube into the magnet housing (1) (as shown by arrow B).
3. Hold the magnet housing (1) and turn the body tube (5) clockwise (when viewed from the vacuum flange) to lock the bayonet fitting (as shown by arrow C).

5.2.3 Refit the AIM Gauge to the Vacuum System

Refit the AIM Gauge to the vacuum system as described in Section 3.2 and refit the cable connector plug to the socket on the AIM Gauge (Figure 1, item 6).

Figure 4 - Exploded View of the AIM Gauge



1. Magnet housing
2. Collar
3. Anode assembly
4. “O” ring
5. Body tube
6. Cathod plate
7. Cathode tube
8. Circlip

5.3 Replace the Electrode Assembly

Refer to Figure 4 in the following procedure.

1. Remove the AIM Gauge from the vacuum system as described in Section 5.2.1.
2. Remove the body tube from the AIM Gauge as described in Step 1 of Section 5.2.2.
3. Fit the flat spanner supplied in the electrode assembly kit (refer to Section 7) to the two lugs in the end of the collar (2), then turn the collar anticlockwise to unscrew the collar from the body tube (5) and remove the anode assembly (3) and the 'O' ring (4).
4. Use circlip pliers to remove the circlip (8) from the vacuum flange end of the body tube (5), then remove the cathode tube (7) and the cathode plate (6).
5. Fit the new cathode plate (6) and cathode tube (7) into the body tube and secure with the circlip (8).
6. Fit the new 'O' ring (4) and anode assembly (3) into the body tube (5); ensure that the orientation of the anode assembly is correct.
7. Refit the collar (2) to the body tube. Locate the flat spanner on the two lugs on the collar and turn the collar clockwise until it is fully secured in the body tube.
8. Refit the body tube (5) to the magnet housing (1) as described in Steps 2 and 3 of Section 5.2.2. Refit the AIM Gauge to the vacuum system as described in Section 5.2.3.

5.4 Replacing the Electronics and Magnet Housing

The magnet housing and end-cap contain the AIM Gauge control electronics. Replace the complete unit as described below.

1. Remove the AIM Gauge from the vacuum system as described in Section 5.2.1.
2. Remove the body tube from the AIM Gauge as described in Step1 of Section 5.2.2.
3. Dispose of the old magnet housing and end-cap (refer to Section 6).
4. Fit the body tube to the new magnet housing and end-cap as described in Steps 2 and 3 of Section 5.2.2. Refit the AIM Gauge to the vacuum system as described in Section 5.2.3.

5.5 Clean the Internal Components

Refer to Figure 4 in the following procedure.

1. Remove the internal components from the magnet housing as described in Steps 1 to 4 of Section 5.3.
2. The anode assembly (3) has two brackets mounted close to the disk on the anode. Use a strip of fine emery paper to clean the gap between the disk and the brackets.
3. Use a fine screwdriver or feeler gauge and ensure that the gaps are a minimum of 0.25 mm.
4. Degrease the cathode plate (6), cathode tube (7), body tube (5) and anode assembly (3) in a suitable degreasing agent.
5. Thoroughly soak the components in a suitable laboratory detergent.
6. Rinse the components in clean water to remove the detergent.
7. Rinse the components in methanol to remove all of the water, then thoroughly dry the components.
8. Refit the components in the magnet housing as described in Steps 5 to 8 of Section 5.3.

5.6 Fault Finding

The AIM Gauge has self-monitoring fault detection circuits which close an error output signal when the gauge is not operating correctly. You can use the error signal output to determine if a fault has been detected, as described in Section 4.4.

If the AIM Gauge does not operate correctly, ensure that the electrical connections are correct (refer to Section 3) and ensure that your electrical supply is suitable for the AIM Gauge (refer to Section 2).

6 STORAGE AND DISPOSAL

6.1 Storage

Return the AIM Gauge to its protective packaging and store the AIM Gauge in clean dry conditions until required for use. Do not exceed the storage temperature conditions specified in Section 2.

When required for use, prepare and install the AIM Gauge as described in Section 3.

6.2 Disposal

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

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

The AIM Gauge and associated cables are within the scope of the European Directive on Waste Electrical and Electronic Equipment. Edwards will offer European customers a recycling service for the AIM Gauge/cables at the end of the product's life. Contact Edwards for advice on how to return the AIM Gauge/cables for recycling.

Particular care must be taken if the AIM Gauge has been contaminated with dangerous process substances or if the AIM Gauge has been overheated or has been in a fire. Fluoroelastomers are used in the AIM Gauge; these are safe in normal use, but can decompose into dangerous breakdown products if heated to 260 °C and above.

6.3 Return the equipment or components for service

Before you send your equipment to us for service or for any other reason, you must send us a completed Declaration of Contamination of Vacuum Equipment and Components – Form HS2. The HS2 form tells us if any substances found in the equipment are hazardous, which is important for the safety of our employees and all other people involved in the service of your equipment. The hazard information also lets us select the correct procedures to service your equipment.

We provide instructions for completing the form in the Declaration of Contamination of Vacuum equipment and Components – Procedure HS1.

Download the latest documents from www.edwardsvacuum.com/HSForms/, follow the procedure in HS1, fill in the electronic HS2 form, print it, sign it, and return the signed copy to us.

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7 SPARES AND ACCESSORIES

7.1 Introduction

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

Order spare parts and accessories from the nearest Edwards company or distributor. When ordering, state for each part required:

- Model and Item Number of the equipment
- Serial number
- Item Number and description of part

7.2 Spares

Spare	Item Number
Electronics and magnet housing	
AIM-S-NW25	D14545800
AIM-SL-NW25	D14548800
Body tube	D14545801
Electrode assembly kit*	D14545802

* The electrode assembly kit contains one each of the following components: cathode plate, cathode tube, circlip, ‘O’ ring, anode assembly, collar, flat spanner.

7.3 Accessories

Cable length		Code
0.5m	18 inches	D40001005
1m	3 feet	D40001010
3m	10 feet	D40001030
5m	15 feet	D40001050
10m	30 feet	D40001100
15m	50 feet	D40001150
25m	80 feet	D40001250
50m	150 feet	D40001500
100m	325 feet	D40001999
Surge suppressor		D4000600

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