# Series 423

## I-Mag® Cold Cathode Ionization Vacuum Sensor

# Instruction Manual

*Instruction manual part number 104230020*
*Revision C- May 2020*

# Series 423

## I-Mag® Cold Cathode Ionization Vacuum Sensor

This instruction manual is for use with Series 423 I-Mag® Cold Cathode Ionization Vacuum Sensor. A list of applicable catalog numbers is provided on the following page.


***Customer Service / Technical Support:***

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# Instruction Manual

# Series 423 I-Mag® Cold Cathode Ionization Vacuum Sensor

## Catalog numbers for Series 423 I-Mag Cold Cathode Ionization Vacuum Sensor

### Sensor Assembly

I-Mag Cold Cathode Sensor with NW40 ISO-KF..... 104230001
I-Mag Cold Cathode Sensor with 2.75 in. OD CF..... 104230002
I-Mag Cold Cathode Sensor with 1 in. OD Tube..... 104230003
I-Mag Cold Cathode Sensor with NW25 ISO-KF..... 104230004

**Measurement ranges:**
Torr: $1 \times 10^{-11}$ to $1 \times 10^{-2}$
mbar: $1 \times 10^{-11}$ to $1 \times 10^{-2}$
Pascal:$1 \times 10^{-9}$ to 1.0

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# Chapter 1

## *General Information*

### 1.1 Receiving Inspection

On receipt of the equipment, inspect all material for damage. Confirm that the shipment includes all items ordered. If items are missing or damaged, submit a claim as stated below for a domestic or international shipment, whichever is applicable.

If materials are missing or damaged, the carrier that made the delivery must be notified within 15 days of delivery, or in accordance with Interstate Commerce regulations for the filing of a claim. Any damaged material including all containers and packaging should be held for carrier inspection. Contact MKS Instruments, Inc. Customer Support for assistance if your shipment is not correct for reasons other than shipping damage.

### 1.2 International Shipment

Inspect all materials received for shipping damage and confirm that the shipment includes all items ordered. If items are missing or damaged, the airfreight forwarder or airline making delivery to the customs broker must be notified within 15 days of delivery. The following illustrates to whom the claim is to be directed.

- If an airfreight forwarder handles the shipment and their agent delivers the shipment to customs, the claim must be filed with the airfreight forwarder.
- If an airfreight forwarder delivers the shipment to a specific airline and the airline delivers the shipment to customs, the claim must be filed with the airline.

Any damaged material including all containers and packaging should be held for carrier inspection. Contact MKS/Granville-Phillips Customer Support for assistance if your shipment is not correct for reasons other than shipping damage.

### 1.3 Warranty

MKS Instruments, Inc. provides an eighteen (18) month warranty from the date of shipment for new MKS Products. The MKS Instruments, Inc. General Terms and Conditions of Sale provides the complete and exclusive warranty for MKS products. This document is located on our web site at www.mksinst.com, or may be obtained by contacting an MKS Customer Service Representative.

### 1.4 Certification

MKS Instruments, Inc. certifies that this product met its published specifications at the time of shipment from the factory.

## 1.5 Customer Service / Technical Support

Some minor problems are readily corrected on site. If the product requires service, contact the MKS Technical Support Department at +1-833-986-1686. If the product must be returned to the factory for service, request a Return Material Authorization (RMA) from MKS. Do not return products without first obtaining an RMA. In some cases a hazardous materials disclosure form may be required. The MKS Customer Service Representative will advise you if the hazardous materials document is required.

When returning products to MKS, be sure to package the products to prevent shipping damage. Shipping damage on returned products due to inadequate packaging is the Buyer's responsibility.

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# Chapter 2
# *Safety*

## 2.1 Safety Introduction

**START BY READING THESE IMPORTANT SAFETY INSTRUCTIONS AND NOTES** collected here for your convenience and repeated with additional information at appropriate points throughout this instruction manual.

These safety alert symbols in this manual or on the Product mean caution - personal safety, property damage or danger from electric shock. Read these instructions carefully.

| | |
|---|---|
| ⚠ DANGER | Danger indicates a hazardous situation which, if not avoided, **will result in death or serious injury.** |
| ⚠ WARNING | Warning indicates a hazardous situation which, if not avoided, **could result in death or serious injury**. |
| ⚠ CAUTION | Caution indicates a hazardous situation or unsafe practice which, if not avoided, **may result in minor or moderate personal injury**. |
| NOTICE | Indicates a situation or unsafe practice which, if not avoided, **may result in equipment damage**. |

**Notice**

**These instructions do not and cannot provide for every contingency that may arise in connection with the installation, operation, or maintenance of this product. If you require further assistance, contact MKS.**

**This product was designed and tested to offer reasonably safe service provided it is installed, operated, and serviced in strict accordance with these safety instructions.**

**⚠ WARNING**

**Safety Precautions**

**Failure to comply with these instructions may result in serious personal injury, including death, or property damage.**

**Always observe and follow all safety notices that are provided throughout this instruction manual and on the product.**

These safety precautions must be observed during all phases of operation, installation, and service of this product. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. MKS disclaims all liability for the customer's failure to comply with these requirements.

- *Read Instructions* – Read all safety and operating instructions before operating the product.
- *Retain Instructions* – Retain the Safety and Operating Instructions for future reference.
- *Heed Warnings* – Adhere to all warnings on the product and in the operating instructions.
- *Follow Instructions* – Follow all operating and maintenance instructions.
- *Accessories – Do not* use accessories not recommended in this manual as they may be hazardous.

**WARNING**

**Electrical Shock or Personal Injury**

**The service and repair information in this manual is for the use of Qualified Service Personnel. To avoid possible electrical shock or personal injury, do not perform any procedures in this manual or perform any servicing on this product unless you are qualified to do so.**

**WARNING**

**Electrical Shock or Fire**

**To reduce the risk of fire or electric shock, do not expose this product to rain or moisture.**

**Objects and Liquid Entry - Never push objects of any kind into this product through openings as they may touch dangerous voltage points or short out parts that could result in a fire or electric shock. Be careful not to spill liquid of any kind onto the products.**

## 2.2 Responsibility

It is the responsibility of the Customer to comply with all local, state, and federal ordinances, regulations, and laws applicable to the installation, operation and service of this equipment.

It is the responsibility of the end user to provide sufficient lighting at work to meet local regulations.

Operation and Service of this equipment in strict accordance with the methods and procedures supplied by MKS is the responsibility of the Customer.

MKS assumes no liability, whatsoever, for any personal injuries or damages resulting from the operation or service of this equipment in any manner inconsistent or contrary to the methods supplied in MKS literature including, but not limited to, manuals, instructions, bulletins, communications, and recommendations.

For emergencies and for product safety related matters, contact the MKS Customer Service Department. See Section 1.5 or Section 6.5 for detailed information regarding how to contact MKS Customer Service Representatives.

## 2.3 Grounding Requirements

See Grounding, Section 4.1 in the Installation chapter for more detailed requirements regarding gauge and system grounding.

**WARNING**

**Proper Grounding**

**All components of a vacuum system used with this or any similar high voltage product must be maintained at Earth ground for safe operation.**

**Be aware that grounding this product does not guarantee that other components of the vacuum system are maintained at Earth ground.**

**Verify that the vacuum port to which the Series 342/343 Mini-Ion Gauge Module is mounted is electrically grounded. It is essential for personnel safety as well as proper operation that the envelope of the gauge be connected to a facility ground. See Section  for detailed grounding instructions.**

**Connect power cords only to properly grounded outlets or sources.**

Grounding is very important! Be certain that ground circuits are correctly used on your ion gauge power supplies, gauges, and vacuum chambers, regardless of their manufacturer. Safe operation of vacuum equipment requires grounding of all exposed conductors of the gauges, the controller and the vacuum system. LETHAL VOLTAGES may be established under some operating conditions unless correct grounding is provided.

Ion producing equipment, such as ionization gauges, mass spectrometers, sputtering systems, etc., from many manufacturers may, under some conditions, provide sufficient electrical conduction via a plasma to couple a high voltage electrode potential to the vacuum chamber. If exposed conductive parts of the gauge, controller, and chamber are not properly grounded, they may attain a potential near that of the high voltage electrode during this coupling. Potential fatal electrical shock could then occur because of the high voltage between these exposed conductors and ground.

## 2.4 High Voltage

High Voltage is present in the unit when electrical power is applied to the electronics enclosure. Hazardous voltages may still be present for some time after disconnecting power to the electronics enclosure. Refer to the Installation and Service chapters for more information.

**⚠ WARNING**

**High Voltage**

**Be aware that when high voltage is present in any vacuum system, a life threatening electrical shock hazard may exist unless all exposed conductors are maintained at Earth ground.**

**This hazard is not unique to this product.**

**⚠ WARNING**

**High Voltage**

**All conductors in, on, or around the vacuum system that are exposed to potential high voltage electrical discharges must either be shielded at all times to protect personnel or must be connected to Earth ground at all times.**

**⚠ WARNING**

**High Voltage**

**Be aware that an electrical discharge through a gas may couple dangerous high voltage directly to an ungrounded conductor almost as effectively as would a copper wire connection. A person may be seriously injured or even killed by merely touching an exposed ungrounded conductor at high potential.**

**This hazard is not unique to this product.**

**⚠ CAUTION**

**Do not connect or disconnect any electrical connectors while power is applied to the equipment (hot swapping). Doing so may cause damage to the equipment or severe electrical shock to personnel. This hazard is not unique to this product.**

## 2.5 Over Pressure Conditions

**WARNING**

**Explosive Environment**

**Do not use the Series 423 Sensor in an environment of explosive or combustible gases or gas mixtures. Operation of any electrical instrument in such an environment constitutes a definite safety hazard. Do not use the product to measure the pressure of explosive gases or gas mixtures.**

**WARNING**

**Potential Automatic Operation**

**It is the installer's responsibility to ensure that the automatic signals provided by the product are always used in a safe manner. Carefully check the system programming before switching to automatic operation.**

**WARNING**

**Vacuum Chamber High Pressures**

**Where an equipment malfunction could cause a hazardous situation, always provide for fail-safe operation. As an example, in an automatic backfill operation where a malfunction might cause high internal pressures, provide an appropriate pressure relief device.**

Danger of injury to personnel and damage to equipment exists on all vacuum systems that incorporate gas sources or involve processes capable of pressuring the system above the limits it can safely withstand.

For example, danger of explosion in a vacuum system exists during backfilling from pressurized gas cylinders because many vacuum devices such as ionization gauge tubes, glass windows, glass belljars, etc., are not designed to be pressurized.

Install suitable devices that will limit the pressure from external gas sources to the level that the vacuum system can safely withstand. In addition, install suitable pressure relief valves or rupture disks that will release pressure at a level considerably below that pressure which the system can safely withstand.

Suppliers of pressure relief valves and pressure relief disks can be located via an online search. ***Confirm that these safety devices are properly installed before installing and operating the product.***

Ensure the following precautions are complied with at all times:

(1) the proper gas cylinders are installed,

(2) the gas cylinder valve positions are correct on manual systems,

(3) and the automation is correct on automated gas delivery systems.

**⚠ CAUTION**

**Vacuum gauges with compression fittings may be forcefully ejected if the vacuum system is pressurized.**

## 2.6 Damage Requiring Service

Disconnect the product from all power sources and refer servicing to Qualified Service Personnel under the following conditions:

- **a.** When any cable or plug is damaged.
- **b.** If any liquid has been spilled onto, or objects have fallen into the product.
- **c.** If the product has been exposed to rain or water.
- **d.** If the product does not operate normally even if you follow the operating instructions. Adjust only those controls that are covered by the operation instructions. Improper adjustment of other controls may result in damage and will often require extensive work by a qualified technician to restore the product to its normal operation.
- **e.** If the product has been dropped or the enclosure has been damaged.
- **f.** When the product exhibits a distinct change in performance. This indicates a need for service.

**Notice**

**Do not substitute parts or modify the instrument.**

**Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to the product. Return the product to a service facility designated by MKS for service and repair to ensure that safety features are maintained. Do not use this product if it has unauthorized modifications.**

**Notice**

**Safety Check - Upon completion of any service or repairs to this product, ask the Qualified Service Person to perform safety checks to determine that the product is in safe operating order.**

See Service Guidelines, Section 1.5 for detailed information regarding how to contact MKS Customer Service Representatives.

# Chapter 3

## *Specifications*

### 3.1 General Description

The Series 423 I-Mag® Vacuum Sensors are an inverted magnetron design cold cathode ionization gauge with a wide pressure measurement range 10-10 to 10-2 Torr. No adjustment in emission current or filament voltage is required, and there is no need to degas the gauge and no filaments to burn out. The sensor tubes can be mounted in any position without affecting the reading.

### 3.2 Intended Use

The 423 Sensors are for vacuum system pressure measurement. These instruments are to be used only in accordance with the instructions in this operation manual.

#### 3.2.1 Improper Use

- Removal of any factory installed components.
- Modifying any factory installed components.
- Removal of any labeling or warranty seals.
- Operation of this device in any condensing vapor or liquid, or explosive environment.

### 3.3 Transportation

- Reuse the original shipping container.
- Replace all of the dust caps on all ports prior to shipping.

### 3.4 Storage

- Store the Sensor indoors between -40 $^{o}$C to +70 $^{o}$C (-40 $^{0}$F to 158 $^{0}$F).
- Bag the assembly in a sealed or shrink wrapped bag with desiccant.
- All of the components should be bagged and boxed together along with the instructions for future reference.

## 3.5 Specifications

*Table 3-1 Specifications for the Series 423 I-Mag Sensor*

| Parameter | Specification |
|---|---|
| **Performance** | |
| Measurement Range for $N_2$ / Air (1) | Torr: 1 x $10^{-11}$ to 1 x $10^{-2}$<br>mbar: 1 x $10^{-11}$ to 1 x $10^{-2}$<br>Pascal: 1 x $10^{-9}$ to 1.0 |
| Accuracy | +/- 5% operating |
| **Physical** | |
| Vacuum Connection | NW40 ISO-KF, .75 in. OD CF, 1 in. OD Tube, or NW25 ISO-KF |
| Electrical Connection | 9 pin sub-miniature “D” type |
| Case Materials | BS plastic, stainless steel, aluminum, Ceramic 5 (magnets) |
| Materials exposed to vacuum | SS 304, SS 302, aluminum, glass, Inconel® X-750, alumina ceramic |
| Weight | 0.8 kg (1.8 lb) |
| Dimensions | 66 mm (2.6 in) diameter, 86 mm (3.4 in) high |
| Internal volume | 15 $cm^2$ (0.9 $in^2$) |
| Mounting Orientation | Any. However, avoid mounting the gauge directly below the chamber to prevent sputtered material or other debris falling into the gauge. |
| Operating Temperature | 0 $^oC$ to +70 $^oC$ (32 $^0F$ to 158 $^0F$) ambient, indoor use only, ordinary protection from moisture |
| Operation humidity | 0 to 90% |
| Gauge bake out temperature with electronics removed | 500 $^oC$ for CF flanged unit, without cable and magnet |
| Gauge Replacement | Field replaceable |
| Controller compatibility | Series 146, 421, 929, 937, 941, 953 |
| Specifications and dimensions are subject to change without notice. | |

(1) Do NOT use this product with flammable or explosive gases.

# Chapter 4
# *Installation*

## 4.1 Sensor Location

**Notice**

**Install the gauge on the vacuum chamber where it is protected from physical damage and high heat.**

**See Section 2.5, Over Pressure Conditions, for important safety information before mounting the gauge.**

Locate the I-MAG Sensor where it can measure process chamber or manifold pressure. Install it away from pumps, other vibration sources, and gas sources to give the most representative values. The magnetic field of the Sensor should also be kept away from ion or electron beam sources.

Locate and orient the I-MAG Sensor where contamination is least likely. If it is installed directly above a diffusion pump, for example, oil vapor could contaminate the cathode, anode, or other vacuum exposed components, causing the calibration to shift.

The I-MAG Sensor can be installed with the body set in any direction. Operating position does not affect accuracy. Installing it with the vacuum port facing down is optimal as this helps prevent contaminants falling into it.

## 4.2 Connecting the Sensor

Mount the Sensor to a grounded vacuum system.

**WARNING**

**Proper Grounding**

**Improper grounding could cause product failure or personal injury.**

- Follow ground network requirements for the facility.
- Maintain all exposed conductors at Earth ground.
- Make sure the vacuum port to which the gauge is mounted is properly grounded.
- See the grounding cautions in Section 2.3.

**CAUTION**

**Do not connect or disconnect any electrical connectors while power is applied to the equipment (hot swapping). Doing so may cause damage to the equipment or severe electrical shock to personnel. This hazard is not unique to this product.**

If the I-MAG Sensor has a CF flange, remove the magnet first to allow clearance for bolt installation. When replacing the magnet, note that it is keyed to the sensor body to protect the feed through pins from damage. The pins should be straight and centered.

Use an all-metal clamp to mount a KF 25 or KF 40 flanged sensor body. Connect the cable to the Sensor and to your controller before turning on your system. Tighten the thumb screw on top of the cable to make sure it is securely in place and for strain relief.

Connect the power/communications cable to a compatible MKS Controller such as a Series 146, 421, 929, 937, 941, 953.

# Chapter 5

# *Operation*

## 5.1 Sensor Configuration and Operation

Refer to the instruction manual provided with the MKS Controller to configure and operate the 423 Sensor.

## 5.2 Starting the Sensor

The I-MAG Sensor starts quickly in the rough to medium vacuum ranges. In the UHV pressure range, starting may be delayed by several minutes. Use an MKS IgniTorr™ Cold Cathode Starting Device to help significantly reduce starting time (see Accessories).

## 5.3 Operating the Sensor

Operation at pressures above $10^{-3}$ Torr for extended periods will increase the likelihood of contamination.

High voltage should be disabled at pressures above $10^{-2}$ Torr to prevent sputtering.

## 5.4 Preparing for Bakeout

Loosen the thumb screw on top of the cable and remove it. Loosen the two flathead screws located on top of the Sensor, and then remove the magnet. The remainder of the Sensor is ready to be baked out to 500°C if using a CF flange or to 150°C if using a KF flange.

# Chapter 6

## *Service & Maintenance*

## 6.1 Customer Service / Technical Support

Some minor problems are readily corrected on site. If the product requires service, contact the MKS Technical Support Department at +1-833-986-1686. If the product must be returned to the factory for service, request a Return Material Authorization (RMA) from MKS. Do not return products without first obtaining an RMA. In some cases a hazardous materials disclosure form may be required. The MKS Customer Service Representative will advise you if the hazardous materials document is required.

When returning products to MKS, be sure to package the products to prevent shipping damage. Shipping damage on returned products as a result of inadequate packaging is the Buyer's responsibility.

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## 6.2 Service Guidelines

Some minor difficulties are readily corrected in the field.

Because the product contains static-sensitive electronic parts, the following precautions must be followed when troubleshooting:

- Use a grounded, conductive work surface. Wear a high impedance ground strap for personnel protection.
- Use conductive or static dissipative envelopes to store or ship static sensitive devices or printed circuit boards.
- Do not operate the product with static sensitive devices or other components removed from the product.
- Do not handle static sensitive devices more than absolutely necessary, and only when wearing a ground strap.
- Do not use an ohmmeter for troubleshooting MOS circuits. Rely on voltage measurements.
- Use a grounded, electrostatic discharge safe soldering iron.

*NOTE: This product is designed and tested to offer reasonably safe service provided it is installed, operated, and serviced in strict accordance with the safety instructions.*

**WARNING**

**High Voltage**

**High voltages present within the electronics enclosure are capable of causing injury or death. To avoid electric shock, wait 3 minutes after power is removed before touching any component within the electronics enclosure.**

**The service and repair information in this manual is for the use of Qualified Service Personnel. To avoid shock, do not perform any procedures in this manual or perform any servicing on this product unless you are qualified to do so.**

**CAUTION**

**Product Modifications**

**Do not substitute parts or modify the instrument.**

**Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to the product. Return the product to a service facility designated by MKS for service and repair to ensure that safety features are maintained. Do not use this product if it has unauthorized modifications.**

## 6.3 Damage Requiring Service

Disconnect this product from all power sources, and refer servicing to Qualified Service Personnel if any the following conditions exist:

- The gauge cable, power-supply cord, or plug is damaged.
- Liquid has been spilled onto, or objects have fallen into, the product.
- The product has been exposed to rain or water.
- The product does not operate normally even if you have followed the Operation Instructions. Adjust only those controls that are covered in the instruction manual. Improper adjustment of other controls may result in damage and require extensive work by a qualified technician to restore the product to its normal operation.
- The product has been dropped or the enclosure has been damaged.
- The product exhibits a distinct change in performance. This may indicate a need for service.

**CAUTION**

**Replacement Parts**

**When replacement parts are required, be certain to use the replacement parts that are specified by MKS, or that have the same characteristics as the original parts. Unauthorized substitutions may result in fire, electric shock or other hazards.**

**⚠ CAUTION**

**Safety Check**

**Upon completion of any service or repairs to this product, ask the Qualified Service Person to perform safety checks to determine that the product is in safe operating order.**

## 6.4 Contaminated 423 Sensor

If pressure readings appear to be erratic, the Sensor tube may be contaminated. Inspect it visually. If contamination is visible, you should replace the internal components with an Internal Rebuild Kit (see Accessories).

Depending on the degree of contamination and application of the sensor, the internal parts may be cleaned - either ultrasonically, with mild abrasives, or chemically.

### 6.4.1 Disassembly

Tools required: clean tweezers and smooth-jaw, needle-nose pliers. Wear cleanroom gloves during all handling and cleaning procedure.

See Figure 6-1 for disassembly and cleaning, and Figure 6-2 for final reassembly.

**⚠ CAUTION**

**Delicate Internal Components**

**Do not bend the anode (8) or the leaf spring (9) on the ion current feed through pin (13) when disassembling or assembling the Sensor; they are very fragile and could break.**

1. Loosen the thumb screw on top of the sensor cable and then remove it. Loosen the two flat head screws (15). Remove the magnet (14).
2. Using the smooth-jaw, needle-nose pliers, firmly grab the compression spring (1) at the tip closest to the flange.
3. Pull on the compression spring while rotating it to free it from the formed groove of the sensor body (7). Continue to pull until the compression spring is completely free.
4. Carefully remove the remaining components from the sensor body.

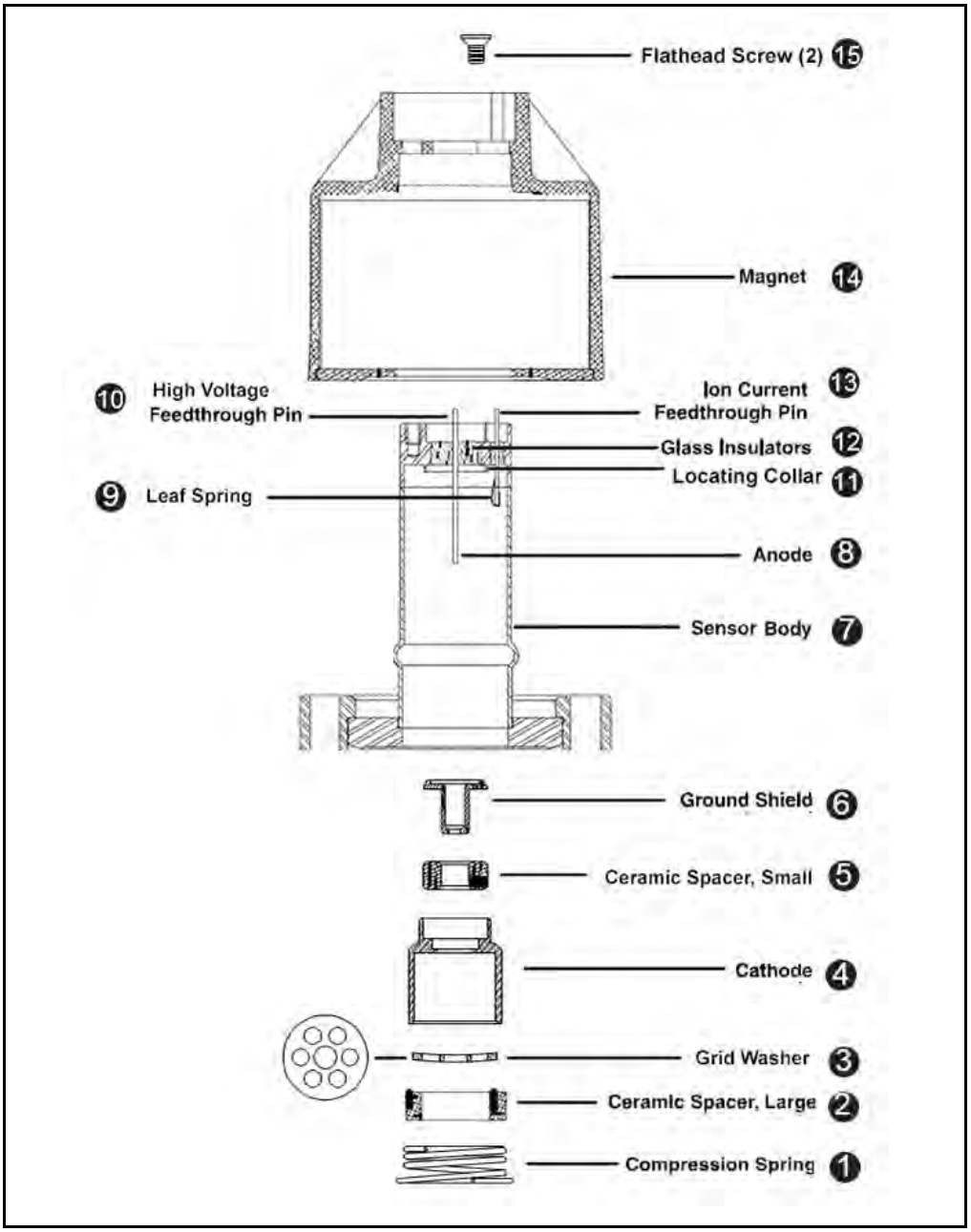


*Figure 6-1: 423 I-Mag Sensor Assembly Illustration*

### 6.4.2 Cleaning the Components

**⚠ CAUTION**

**Delicate Internal Components**

**Do not use chemicals to clean the anode (8); mild abrasives or ultrasonic cleaning are acceptable.**

1. If ultrasonic cleaning, use high quality detergents compatible with aluminum, such as ALCONOX®.
2. Scrubbing with mild abrasives can remove most contamination.
3. Scotch-Brite™ or a fine emery cloth may be effective. Rinse with alcohol.
4. Clean aluminum and ceramic parts chemically in a wash, such as a 5 to
5. 20% sodium hydroxide solution (not for semiconductor processing), at room temperature (20 °C) for one minute. Follow with a preliminary rinse of deionized water. Remove the black residue left on aluminum parts due to this process in a 50 to 70% nitric acid dip for about 5 minutes.
6. Each of the above cleaning methods should be followed with multiple rinses of deionized water. Dry all internal components and the sensor body (7) in a clean oven. The two ceramic spacers, (2) and (5), are slightly porous and will require longer drying time in the oven to drive off the absorbed water.

### 6.4.3 Reassemble the Sensor

1. Check the anode (8). It should be straight and centered with the sensor body (7) for proper operation.
2. Roll the sensor body on a flat surface and look for any radial run out motion.
3. Install the ground shield 6 using tweezers. Make sure that at the groove of its larger diameter, the ground shield interlocks with the locating collar 11.
4. Slide the small ceramic spacer 5 over the small end of the ground shield 6. Check that the leaf spring 9 will contact the base of the cathode 4 as shown to the right. If not, remove the small ceramic spacer and the ground shield. Gently bend the leaf spring towards the anode and ceramic spacer.
5. Slide the cathode 4, the grid washer 3, and the large ceramic spacer 2 into place. The grid washer has a concave shape. Refer to the figure to see its installation orientation.
6. Insert the small end of the compression spring 1 into the sensor body 7. Using your thumbs, push the larger end of the spring into the sensor body until it is contained within the tube's inside diameter. Using the smooth-jaw, needle-nose pliers, work the compression spring down into the sensor body until it is fully seated in the formed groove.
7. Inspect the ground shield 6 and the grid washer 3 to verify they are centered with respect to the anode 8. If adjustment is needed, gently reposition the grid washer/cathode assembly, taking care not to scratch the grid washer.

**8.** Measure the resistance between the ion current feed through pin 13 and the grid washer 3 to verify that the leaf spring 9 is in contact with the cathode 4. The measurement should indicate a short circuit between them. There should be an open circuit between the ion current feed through pin 13 and both the high voltage feed through pin 10 and sensor body 7.

**9.** The I-MAG Sensor is ready for installation. If it is not immediately installed, cover the flange with a clean vacuum grade cap / flange protector.

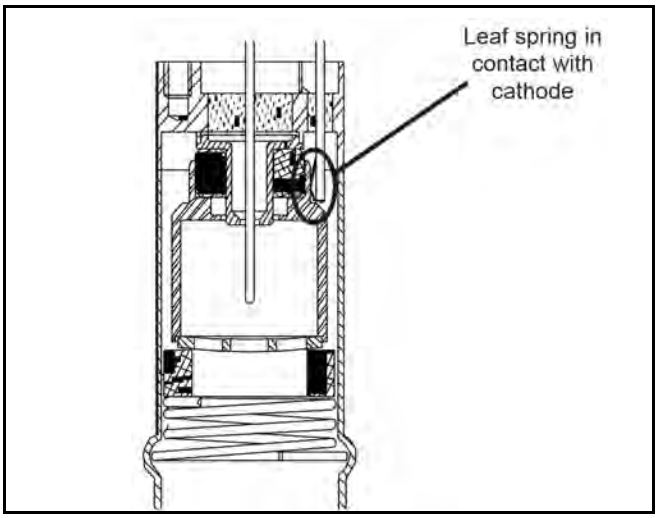


*Figure 6-2: Proper Installation of Leaf Spring and Cathode (Step 8)*

## 6.5 Accessories and Spare Parts

*Table 6-1: Accessories and Spare Parts*

| Part/Item | Part # |
|---|---|
| **IgniTorr™ Cold Cathode Starting Device** | |
| 120V | 100006850 |
| 220V | 100007090 |
| **I-MAG® Cold Cathode Cable** | |
| 2 ft | 100002505 |
| 10 | 100007873 |
| 25 | 100007874 |
| 50 | 100002395 |
| Custom | 100008759 |
| **Internal Rebuild Kit**<br>Cathode, Grid washer, Ground shield, Ceramic spacers, Small spring, Large spring | 100002353 |

# Series 423

## I-Mag® Cold Cathode Ionization Vacuum Sensor


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# Instruction Manual


*Instruction manual part number 104230020*
*Revision C - May 2020*