MS-50 ARGON Manual Addendum AR

1.0 Introduction

The MS-50 Argon is a mass spectrometer-based leak detector which uses argon as a tracer gas. It is built upon the same platform as a MS-50 leak detector, which uses helium as a tracer gas, but with particular modifications to provide the capability to detect argon rather than helium.

The MS-50 Argon is particularly suitable for applications or environments where the use of helium as a tracer gas is not practical. As argon molecules are larger than helium molecules, the MS-50 Argon can be an ideal leak detector for leak testing of parts made of highly porous materials. In such an application, while helium molecules might easily pass through the material, making accurate leak detection difficult, the larger argon molecules would be less likely to permeate the material. Consequently, the use of argon as a tracer gas will facilitate the accurate detection and location of real leaks in the part being tested, and minimize the possibility of mistaking material porosity for an actual leak.

Although helium is normally found in the atmosphere at only about 5 ppm, there are some environments in which the helium concentration may be much higher. In facilities where a large amount of helium, either in liquid or gaseous form, is used for other processes and released into the environment, the ambient helium level may rise considerably. In such an environment, the high atmospheric helium concentration may cause a leak detector using helium as a tracer gas to exhibit high background level and inhibit the ability to perform accurate leak detection. The MS-50 Argon is an ideal leak detector for use in an environment with a high ambient helium concentration.

This manual addendum highlights those features, specifications, parts and maintenance issues for the MS-50 Argon which differ from the standard MS-50 Leak Detector. This addendum is intended to be used as a supplement to the *MS-50 Operations and Maintenance Manual*. Please refer to the *MS-50 Operations ans Maintenance Manual* for any issues not covered by this addendum.

2.0 MS-50 Argon Features

Start-Up

The MS-50 Argon automatically initiates a start-up procedure when power is turned on. This procedure consists of turbo pump acceleration, self-diagnostic checks, high vacuum system status check, system offset measurement, background argon measurement, and turning on the mass spectrometer filament.

Testable Masses

Argon Mass 40

Internal Calibrator

Internal temperature compensated argon leak standard between 10^{-6} to 10^{-5} std cc/sec. Integral automated solenoid valve and quick disconnect for re-certification. Thermal sensor for temperature compensation. Traceable to NIST.

Tuning and Calibration

One-button automatic tuning and calibration in Direct Flow Mode for Argon using the internal temperature compensated argon leak standard.

Cal-Check

Provides one-button, automatic checking of system calibration.

Auto Zero

Allows the operator to cancel out, or "zero", any residual argon in the system introduced through the test port or test object. This feature is particularly useful in the MS-50 Argon, as the argon content of air is normally nearly 1%. Operators may use this feature during leak testing to "zero" normal atmospheric argon, thus gaining full use of the 10^{-8} std cc/sec leak rate range.

Flow Modes

Direct Flow Mode only.

The MS-50 Argon, unlike the standard MS-50, uses only Direct Flow mode. Contrary to helium, argon does not back-diffuse readily, thus making it unsuitable for use in a Reverse Flow mode.

Leak Rate Measurement Units

Std cc/sec, mBar l/sec or Pascal m^3/sec.
Argon or air equivalent units may be selected.

> Note: Argon leak rates and air equivalent leak rates differ very little. It is important to note which units are selected. If Argon units have been selected, "Argon" will be displayed next to the leak rate bar graph on the MS-50 Argon monitor. If air equivalent units have been selected, nothing will be displayed next to the leak rate bar graph.

Cold Trap (OPTIONAL)

The unit is equipped with a cold trap which is filled with liquid nitrogen. The purpose of using a cold trap in the inlet to the vacuum system of the mass spectrometer is to condense vapors such as water and oil and to entrap these vapors by condensation onto a cold surface. This reduces the vapor pressure of these constituents t a negligible value. Cryogenic pumping is desirable, because it is not a pump for argon tracer gas; it is a very selective pump source. For example, the vapor pressure of water at 20^0C is 17.5 torr. However, water vapor pressure is approximately 10^{-15} torr at the temperature of -196^0C (-320^0F) for liquid nitrogen. The lower the temperature of the cold trap, the more effective it is in reducing pumpdown time and assuring a clean vacuum system. Good practice requires that the refrigerant liquid in the cold trap be kept at a reasonable level. If the cold trap is neglected and allowed to go dry, there should be no alarm. The most notable effect would be the inability of the mass spectrometer system to maintain adequately low pressures during leak testing operations. However, such neglect should not become a routine operating practice since the operating efficiency of the mass spectrometer system is considerable reduced. Some systems are designed to eliminate the need for a cold trap in specific applications. However, systems fitted with cold traps should not be routinely operated without filling the trap.

3.0 MS-50 Argon Performance Specifications

***Sensitivity**

<1 x 10^{-8} std cc/sec

***Resolution**

40 at Mass 40

The MS-50 Argon's extremely high resolution at mass 40 provides the ability to distinguish between argon and the numerous other mass peaks in this region, thus enabling accurate argon leak detection.

***Response Time**

1-3 minutes in Direct Flow Mode

Time to Test

< 6 seconds on a blank port to a pre-selected range in the Direct Flow mode

Leak Ranges

10^{0} to 10^{-8} std cc/sec in vacuum test modes
10^{0} to 10^{-4} std cc/sec in Gross mode
10^{-5} to 10^{-8} std cc/sec in Fine (Direct) mode
10^{-2} to 10^{-5} std cc/sec in Sniff mode

Maximum Inlet Pressure

100 Torr	Gross Test Mode
20 mTorr	Fine (Direct) Test Mode

*Performance determined in accordance with the standards of the American Vacuum Society

4.0 Operating the MS-50 Argon

The operation of the MS-50 Argon is essentially identical to the operation of the standard MS-50 Leak Detector. This section of the manual addendum outlines any differences in the operation of the MS-50 Argon. Please refer to the *MS-50 Operations and Maintenance Manual* for any operational issues not covered in this addendum.

4.1 Amplifier (Amp) Gains

The amplifier gain G2 (Reverse flow mode gain) is not applicable to the MS-50 Argon, as it does not use Reverse Flow Mode.

4.2 Vacuum Testing

The most sensitive leak rate range available during vacuum testing on the MS-50 Argon Leak Detector is the 10^{-8} std cc/sec range. Leak testing below this range is not practical because of the high atmospheric content of argon.

The MS-50 Argon Leak Detector is a direct flow only system. Vacuum testing may be performed in either Gross mode or Fine (Direct) mode, with either automatic or manual ranging. In manual ranging, the MS-50 Argon will test in Gross mode if the selected leak rate range is between the 10^{0} to 10^{-4} std cc/sec ranges. Fine (Direct flow) testing will occur if the leak rate range is set from the 10^{-5} to 10^{-8} std cc/sec ranges.

In automatic ranging, the operational sequence of the MS-50 Argon is identical to that of the standard MS-50 set for Direct Flow only, except that the ranging is limited to the 10^{-8} std cc/sec range. Please refer to the *MS-50 Operations and Maintenance Manual*, Section 3.2.3, for a full description of the test sequence. (Obviously, "argon" should be substituted for "helium" when referring to these sections.)

4.3 Sniff Testing

The MS-50 Argon sniff testing procedure is identical to that of the standard MS-50, except that the high level of atmospheric argon makes it necessary to limit the most sensitive sniffing range to 10^{-5}. The auto zero feature may be used to "zero" out any atmospheric argon which is drawn into the sniffer probe, allowing full use of the 10^{-5} std cc/sec leak rate range during sniffing. Please refer to the MS-50 Operations and Maintenance Manual, Section 3.2.4, for a full description of Sniff Testing.

4.4 Tuning and Calibration

The MS-50 Argon automatic tuning procedure uses the internal temperature-compensated argon leak, and optimizes all mass spectrometer voltages for a maximum argon signal. The system initially performs a coarse tune to determine the approximate argon peak location. Once this peak location is determined, the MS-50 Argon performs a fine tune, adjusting the peak tuning voltages in 0.2 volt increments. These small tuning voltage increments, combined with the advanced design of the MS-50 Argon mass spectrometer, provide extremely high resolution.

After the optimum tuning voltages are determined, the MS-50 Argon measures the system background and the internal argon calibrator. The system gain is then adjusted, compensating for temperature and system background.

Users who are accustomed to the standard MS-50 tuning and calibration procedure may notice that the MS-50 Argon automatic tuning and calibration procedure takes several minutes longer. This is normal, and is a result of the more stringent tuning and resolution requirements for accurately detecting argon.

The Tune sequence is initiated in the same manner as the standard MS-50. Please refer to the *MS-50 Operations and Maintenance Manual*, Section 3.3.1.

4.5 Cal Check

The Cal Check sequence in the MS-50 Argon is identical to that in the standard MS-50, except that it takes slightly longer and does not set the Reverse Flow Gain (G2). Please refer to the *MS-50 Operations and Maintenance Manual*, Section 3.3.2.

4.6 Scan

The MS-50 Argon Scan feature may be used during leak testing to quickly check if a leak rate indication is due to the presence of argon, or if it is the result of a poorly tuned mass spectrometer. This feature is particularly useful in an argon leak detector, as there are many other mass peaks near the argon peak in the mass spectrum.

The scan feature "detunes" the mass spectrometer, scanning the peak voltages either several volts higher or several volts lower than the tuned peak. The high resolution of the MS-50 Argon (40 at Mass 40) allows the distinction between argon and adjacent peaks.

To use the Scan feature, press and hold either of the **SCAN** buttons on the User Panel while the MS-50 Argon is in a leak test mode. Pressing and holding the Scan "Up" arrow will alter the mass spectrometer tuning voltages by +6 volts. Pressing and holding the Scan "Down" arrow will alter the mass spectrometer tuning voltages by -6 volts. Releasing either button will return the mass spectrometer tuning voltages to the normal levels.

On an optimally tuned mass spectrometer, the displayed leak rate (either from background argon or argon from a leak) will decrease substantially when the Scan feature is enabled. This decrease in leak rate is an indication that the leak rate signal is actually due to the presence of argon. It is recommended that both the Scan Up and Scan Down buttons be used for this test.

If the leak rate does not decrease markedly when the Scan feature is enabled, the mass spectrometer is not properly tuned. The Automatic Tune feature should be used to re-tune the mass spectrometer return the MS-50 Argon to its optimal performance.

4.7 Gross Mode Calibration

Gross mode calibration in the MS-50 Argon covers the range between 10×10^{0} std cc/sec and 0.6×10^{-4} std cc/sec. Calibration of the Gross mode is performed manually and requires an external argon calibrator.

To calibrate the MS-50 Argon in Gross Mode:

1. Place the MS-50 Argon in **Vac** mode, with the keyswitch on **Set**.

2. Set the MS-50 Argon to **Manual Ranging** on a range between 10^{0} and 10^{-4} std cc/sec, corresponding to the value of the external calibrator. An external calibrator in the 10^{-2} or 10^{-3} std cc/sec ranges is recommended.

3. Install the external calibrator in the MS-50 Argon test port. If the calibrator has a shut-off valve, make sure that the valve is fully open.

4. Press **START**. Allow the MS-50 Argon to pump down and begin leak testing. Wait for the leak rate to stabilize.

5. When the leak rate is stable, use the **Amp Gain** Up/Down arrows on the front service panel to adjust the Gross Mode gain setting (G1). The gain should be set such that the leak rate displayed on the MS-50 Argon Leak Rate bar graph matches the known value of the external argon calibrator.

6. Press **VENT** and remove the external calibrator.

4.8 Test Parameters

The MS-50 Argon test parameters are identical to those of the standard MS-50, with the exception of those parameters noted below. Please refer to the *MS-50 Operations and Maintenance Manual*, Section 3.4. The section numbers in parenthesis below refer to subsections in the MS-50 Manual Section 3.4.

a. Reverse Crossover (Section 3.4.4)
The MS-50 Argon does not use Reverse Flow mode. The Reverse Crossover is not applicable to this system.

b. Reverse Rough Close Delay (Section 3.4.9)
This timer is not applicable to the MS-50 Argon

c. Flow Modes (Section 3.4.17)
The MS-50 Argon operates in the Direct Flow Mode only. It is not possible to set the system to operate in 'Reverse Flow Mode Only' or "Reverse and Direct (Combined)' mode.

d. Gas Type (Section 3.4.21)
This function allows the operator to select between **Air Equivalent** or **Direct Reading (Argon)**. If argon is selected, an "Argon" indication will be displayed next to the leak rate bar graph on the main MS-50 Argon screen.

e. Helium Type (Mass Type) (Section 3.4.22)
The corresponding screen in the MS-50 Argon will display "SYSTEM SET TO DETECT ARGON". It is not possible to change this setting. The MS-50 Argon can not be used to detect any other masses.

5.0 Maintenance

This section of the MS-50 Argon Manual Addendum identifies differences between maintenance requirements and procedures between the MS-50 Argon and the standard MS-50 Leak Detector. Please refer to the *MS-50 Operations and Maintenance Manual*, Chapter 4, for issues not covered in this section.

5.1 Periodic Maintenance

Please refer to the *MS-50 Operations and Maintenance Manual*, Section 4.2, for a schedule of periodic maintenance. This schedule of maintenance applies to the MS-50 Argon Leak Detector, with the exception of the frequency of re-calibration for the internal calibrator. It is recommended that the internal calibrator in the MS-50 Argon be re-calibrated *at least* semi-annually. Refer to the certification label on the internal calibrator for the next recommended date of re-certification.

5.2 Cleaning the Mass Spectrometer

The MS-50 Argon Mass Spectrometer is highly specialized for use in detecting argon with high resolution. If it is necessary to remove the mass spectrometer for cleaning, great care should be taken, both in the handling of the magnets and the re-assembling of the spectrometer.

The mass spectrometer magnets used in the MS-50 Argon are very strong (approximately 6000 Gauss). Extreme care should be taken in handling the magnets, particularly around magnetic metals or materials which may be damaged by exposure to a strong magnetic field.

!!CAUTION!!

DO NOT PLACE FINGERS OR ANY OTHER BODY PARTS BETWEEN THE MAGNETS AND ANY MAGNETIC MATERIALS. The magnets and the magnetic material may be drawn very quickly together, possibly resulting in injury.

DO NOT PLACE THE MAGNETS NEAR ANY OBJECTS WHICH MAY BE DAMAGED BY EXPOSURE TO A STRONG MAGNETIC FIELD. Keep the MS-50 Argon magnets away from the CRT screen, magnetically encoded cards, or any other objects which may be damaged by exposure.

KEEP THE MS-50 ARGON MAGNETS AWAY FROM OTHER MAGNETIC MATERIALS. The MS-50 Argon magnets may be drawn very quickly toward magnetic metals or other magnetic materials. Hard impact with another surface may cause the MS-50 Argon magnets to crack.

The MS-50 Argon Mass Spectrometer makes use of very precise beam alignment plates in order to achieve the high resolution for argon. Consequently, the alignment of these beam alignment plates, or “slit” plates, is critical. It is not recommended that the MS-50 Argon Source or Collector be disassembled. The entire assemblies may be safely removed from the mass spectrometer for cleaning, but the source and collector themselves should not be disassembled.

The alignment of the MS-50 Argon Mass Spectrometer magnets is also critical to achieving proper system sensitivity and resolution. It is highly recommended that the magnets and the mounting plate assembly be removed as one, and that the MAGNETS NOT BE REMOVED FROM THE MOUNTING PLATE. Maintaining the magnet and plate assembly as one will not only facilitate re-assembly of the mass spectrometer, but will also help minimize damage to the magnets.

!!CAUTION!!

When cleaning or servicing mass spectrometer components, it is imperative that standard precautions be taken to protect the collector assembly against static discharge (i.e., wrist strap with grounding cord, static-dissipative table mat, static shielding bag) are employed. DO NOT TOUCH THE COLLECTOR PINS, FLANGE OR ASSEMBLY WITHOUT A PROPERLY GROUNDED STATIC WRIST STRAP. Failure to employ proper static precautions may result in damage to the collector operational amplifier, which will seriously impair the system's ability to detect leaks.

Refer to Figure AR-1 for an exploded view of the MS-50 Argon Mass Spectrometer.

To remove and clean the mass spectrometer:

1. Vent the vacuum system per Section 4.3.3 of the *MS-50 Operations and Maintenance Manual* and turn off power to the unit.

2. Remove the mass spectrometer assembly from the system:

   - Using a properly grounded static guard wrist strap, disconnect the electrical connectors from the Source and Collector.
   - Remove the screws holding the stabilizing bracket to the system frame. Loosen and remove the KF clamp between the mass spectrometer and the high vacuum manifold.

- Remove the entire mass spectrometer assembly. Place on a non-metallic, static safe surface.

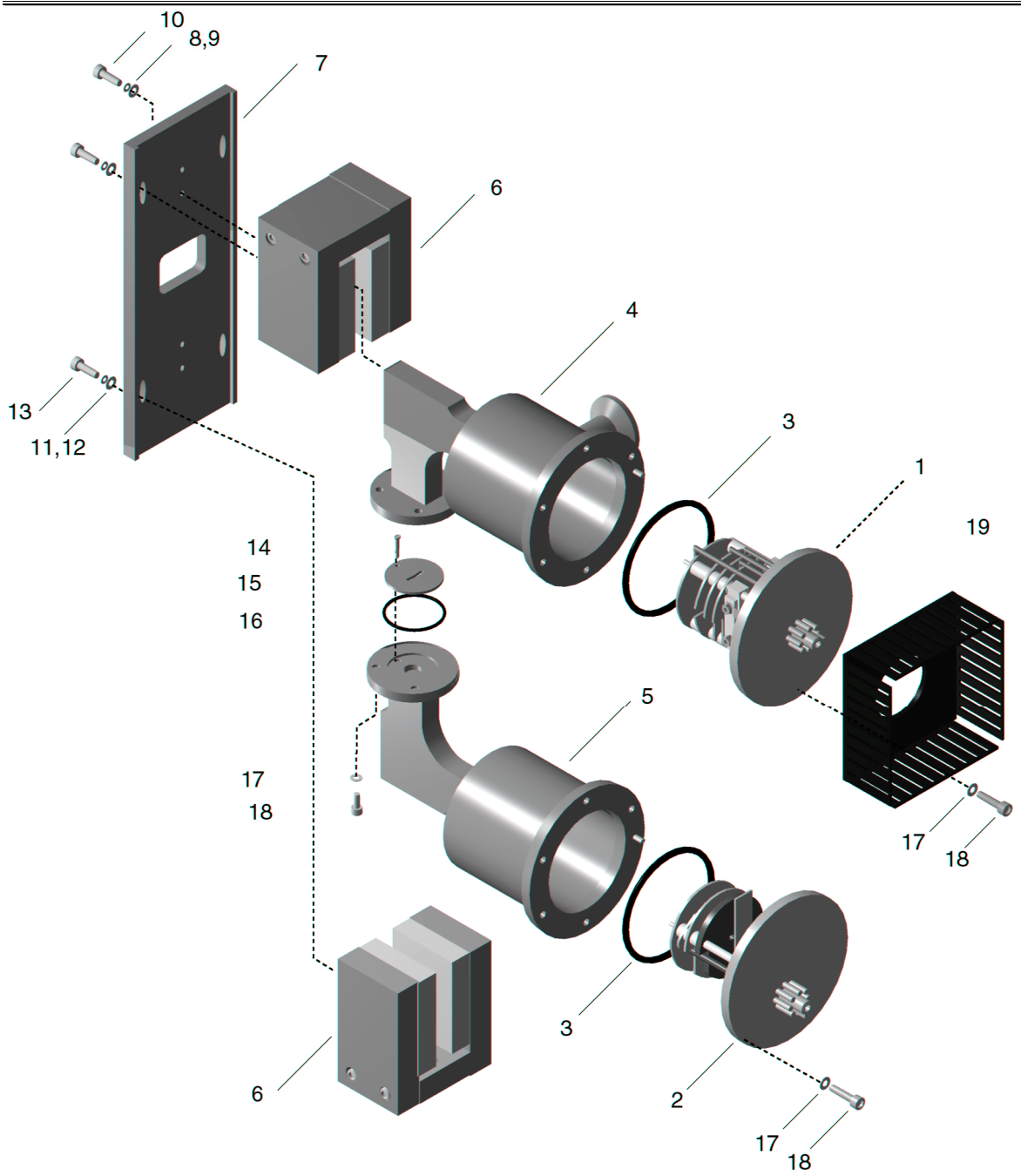

Figure AR-1 MS-50 Argon Mass Spectrometer Assembly

Item #	Veeco Part #	Description
1	0139-014-00	Argon Source Assembly
2	0139-051-00	Argon Collector Assembly
3	0011-037-00	O-Ring, 2 ½" I.D. x 1/16" W
4	0139-011-00	Source Body
5	0135-053-00	Collector Body
6	0139-012-00	Magnet Assembly, Argon
7		Magnet Alignment Plate
8	Commercial	Washer, Flat, #10
9	Commercial	Washer, Split Lock, #10
10	Commercial	Screw, Socket Head, #10-32 x ½
11	Commercial	Washer, Flat, #8
12	Commercial	Washer, Split Lock, #8
13	Commercial	Screw, Socket Head, #8-32 x ½
14	0130-168-00	Screw, Vented, #2-56 x 3/16
15	0139-112-00	Slit Plate, Center, Argon
16	0011-024-00	O-Ring, 1 1/8" I.D. x 1/16" W
17	Commercial	Washer, Split Lock, #6
18	Commercial	Screw, Socket Head, #6-32 x ½"
19	0137-232-00	Heatsink

3. Note the orientation of the magnet assembly to the mass spectrometer housing. Making a mark across a junction point between the magnet assembly and the spectrometer housing before disassembly may facilitate later re-assembly and alignment.

4. Remove the four screws securing the magnet assembly to the mass spectrometer housing. DO NOT REMOVE THE MAGNETS FROM THE MAGNET ALIGNMENT PLATE. Place the entire magnet assembly carefully on a non-metallic, non-magnetic surface.

5. Disassemble the two half sections of the mass spectrometer housing and remove the center slit plate and o-ring.

6. Remove the heat sink and the source assembly from the mass spectrometer housing. Remove the collector assembly from the mass spectrometer housing and place in a static bag or on a static-safe surface.

7. Clean the Source and Collector housings. The interior of each section should be bead blasted to remove any stains (do **not** use aluminum oxide powder!). Blow out the bead blast residue with dry, oil-free air. The sections should then be cleaned ultrasonically in an environmentally-safe cleaner (isopropyl recommended) and dried with a hot air gun.

8. Wearing lint-free gloves, coat the center o-ring with a thin film of high vacuum grease, then re-assemble the two sections of the mass spectrometer housing.

9. Clean the source as follows:

   - Remove the source o-ring and wipe away any excess grease from the groove with a lint-free cloth.
   - Remove the filaments (see Section 4.3.7 of the *MS-50 Operations and Maintenance Manual*). Clean the oval raceway using a fine emery cloth held with needle-nose pliers or a tweezer. Do not use excessive force: any bending or shifting of the filament area may cause an electrical short. Rinse the source in an environmentally-safe equivalent of freon. Install new filaments as per Section 4.3.8 of the *MS-50 Operations and Maintenance Manual*.

10. Clean the collector as follows:

    Remember to follow proper static precautions to protect sensitive circuitry when handling the collector!

    - Remove the o-ring and wipe away any excess grease from collector groove using a lint-free cloth.
    - Clean the collector using an environmentally-safe cleaner (isopropyl recommended).
    - Dry the collector assembly thoroughly by using a heat gun or by baking the entire assembly in a vacuum oven.

11. Wearing lint-free gloves, coat the source and collector o-rings with a thin film of vacuum grease. Re-install the o-rings into the source and collector grooves.
12. Re-assemble the collector and source assemblies into the mass spectrometer housing. Re-attach the heat sink to the source flange.

13. Re-mount the magnet assembly to the mass spectrometer housing, being careful to maintain the previous alignment (use the marks on the housing and magnet assembly, if made before disassembly.)

14. Using lint-free gloves, coat the o-ring on the KF ring which was removed from between the mass spectrometer and the high vacuum assembly.

15. Re-install the KF ring and the mass spectrometer in the system. Tighten the KF clamp.

16. Re-secure the mass spectrometer assembly to the MS-50 Argon frame.

17. Power up the MS-50 Argon and allow to pump. A full automatic tune must be performed on both filaments to insure proper performance and argon sensitivity.

6.0 Parts

This addendum section identifies those parts in the MS-50 Argon which differ from the standard MS-50 Leak Detector. Please refer to the *MS-50 Operations and Maintenance Manual*, Appendix A, for any parts not mentioned in this section.

6.1 Recommended Spare Parts for the MS-50 Argon

Mass Spectrometer	**0139-010-01**
Source Assembly	0139-014-00
Collector Assembly	0139-051-00
Source Rebuild Kit	Call Customer Service
Sniffer Probe Assembly	**0135-045-03**
Calibrator, Argon	**0139-392-00**

6.2Bill Of Material for MS-50 Argon Overall Assembly - Attached