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Agilent Technologies

TPS Bench and Mini-IMG Instruction Manual

FIELD SERVICE MANUAL

This document is for users of Varian's Turbo Pumping Systems with Mini-IMG gauges installed.

For systems with IM-500 gauges installed, see the *IM-100/IM-500 Gauge Tube Rebuild Kit* instructions (Varian P/N# 699908235).

Revision A
October 2009

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Contents

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Introduction

This manual covers two topics:

- Section 2 “TPS Bench Operation” on page 2-1, which describes a TPS bench startup procedure to ensure long life for the Mini-IMG and proper operation of the TPS bench.
- Section 3 “Mini-IMG Cleaning” on page 3-1, which discusses the cleaning procedure for the Mini-IMG.

Hazard and Safety Information

This manual uses the following standard safety protocols:

WARNING

The warning messages are for attracting the attention of the operator to a particular procedure or practice which, if not followed correctly, could lead to serious injury.

CAUTION

The caution messages are displayed before procedures, which if not followed, could cause damage to the equipment.

NOTE

The notes contain important information.

Vacuum Equipment and Cleanliness

Cleanliness is vital when servicing any vacuum equipment.

CAUTION

Do not use silicone oil or silicone grease.

Use powder-free butyl or polycarbonate gloves to prevent skin oils from getting on vacuum surfaces.

Do not clean any aluminum parts with Alconox®. Alconox is not compatible with aluminum and will cause damage.

NOTE

Normally, it is unnecessary to use vacuum grease. However, if it must be used, avoid silicone types, and use it sparingly. Apiezon® L grease is recommended (Varian Part Number 695400004).

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Section 2. TPS Bench Operation

2.1 Purpose

To describe a TPS bench startup procedure to ensure long life for the Mini-IMG gauge and proper operation of the TPS bench.

2.2 TPS Bench operation

The system (Figure 2-1) is comprised of the following:

- SH-110 pump backing a V81 turbo pump.
- V81AG rack controller.
- Mini-IMG high vacuum gauge connected to the turbo through a tee at the inlet.

The gauge is controlled by the AG controller and connected to it for reading the pressure. The system is controlled by two power switches:

- One switch powers on and initializes the system and also turns the 24 V supply to the gauge, even when the pumping switch is on. This system then tries to start the ionization and generate the plasma.
- The other switch (pumping) starts the pumps where *0* is off and *1* is on.

Figure 2-1 V81-AG Front

2.3 Gauge Operation

This cold cathode inverted magnetron gauge works by creating plasma around the anode from the random release of electrons from the cathode. These electrons strike the gas molecules and ionize them, generating a current for the cathode. This current is measured and correlated to the pressure, and displayed by the controller.

The gauge is rated for high vacuum, from ~ 10^{-3} to 10^{-10} T range for pressure. There is no direct downside of turning the gauge on at low vacuum, which is from atmosphere to 10^{-3}; however, the life of the gauge can be increased if the gauge is turned off when the system is not in use or by not leaving it on for long durations at low vacuum.

The gauge generates high voltage of 2 kV from a 24 V supply using the flyback transformer. This high voltage is completely contained within the gauge body and is of no risk as long as the gauge cover is not removed or tampered with while the gauge is still powered.

The current in the gauge takes some time (when P is around the 10^{-3} T range) to stabilize and provide consistent current for plasma generation. During this time there is a high current fluctuation due to excessive collision with the gas molecules. If the gauge is left on for long durations at atmospheric pressure, and the system contains highly contaminant gases, then the ionization process deposits significant contamination on the gauge collector. While contamination will occur at high vacuum, but because the number of collisions are fewer, this slows contamination. The amount of contamination depends on the gas being pumped (highly contaminating or not), duration of gauge operation, pressure inside the chamber, condition of the collector etc.

Figure 2-2 shows images of the gauge found on the system which has slight contamination on the collector.

Slight contamination in the plasma region (With heavy contamination the surface is completely discolored and burnt)

Contamination on both upper and lower sides of the plasma chamber

Figure 2-2 Contaminated Gauge

Figure 2-3 shows the contaminated collector next to a new collector: not much contamination, no need for replacement.

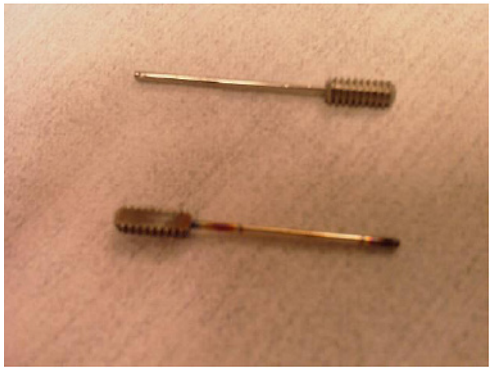

Figure 2-3 Contaminated Collector

Figure 2-4 shows the clean collector chamber. With heavy contamination, this region also discolors.

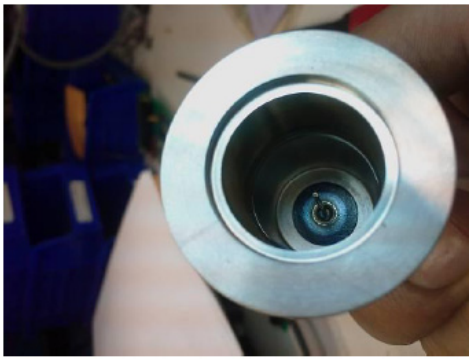

Figure 2-4 Clean Collector Chamber

2.4 Proper Operation

To avoid the contamination that occurs when the gauge is turned on without the pumping system, the best practice is to:

- ❑ Leave the pumping knob at *1* all the time, and
- ❑ Operate the system using the power switch only.

This ensures that the gauge turns off when the power is turned off and only turns on with the pumping system when the power is turned on.

Another option is to use both the pumping and power switch to turn on or off at the same time. In this situation, the gauge is only running for a few seconds while waiting for the pumping to start and avoids any contamination or risk of failure.

Another benefit of using the power switch is that all system power is immediately removed when the power switch is toggled. Additionally, the fan also turns off. If the pumping switch is only used with the power switch on, the controller, gauge and fan stay on all the time.

Section 3. Mini-IMG Cleaning

3.1 Purpose

This section explains the cleaning procedure for the Mini-IMG gauge.

3.2 Overview

Over time it is normal for all Inverted Magnetron Gauges (IMG) to suffer from internal deposits and erosion of the internal parts. How fast and to what extent this occurs depends on the chemicals the gauge is exposed to during operation and the vacuum pressure. When this happens, the gauge often exhibits reading stability problems or may not even start up.

This cleaning procedure tries to remove all possible contaminants from the gauge elements.

3.3 Procedure

Tools Required:

- ❑ Clean lint free cotton, nitrile gloves or finger cots
- ❑ Hex key or wrench - 1/16
- ❑ 3/16 hex nut driver
- ❑ Snap ring pliers for internal type - .047 tip size
- ❑ Scotch Brite
- ❑ Acetone

1. Mark the position of the inlet flange on the magnet so that you don't change the position when re-assembling (Figure 3-1). This can cause a slight change of the calibration/ sensitivity.

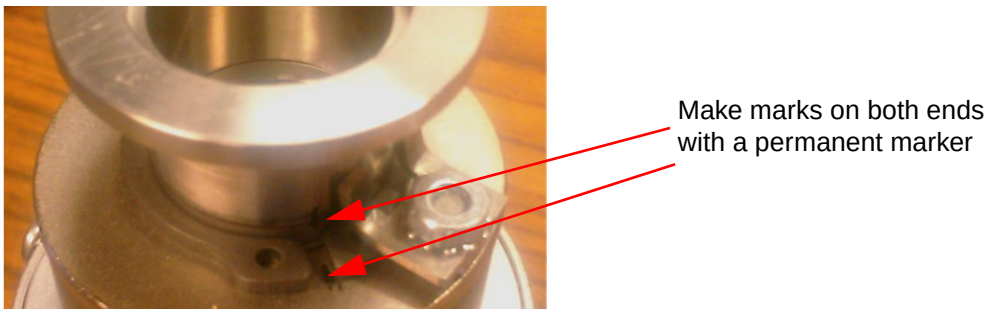

Figure 3-1 Mark the Magnet

2. Remove the electrical connector screws as shown in Figure 3-2.

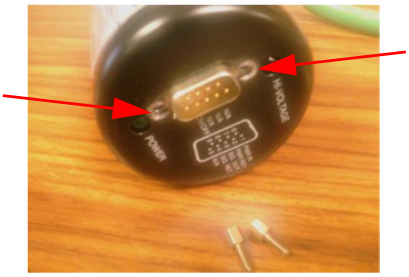

Figure 3-2 Electrical Connector Screws

3. Remove the side screws from the metal cover as shown in Figure 3-3 and remove the cover to reveal the electronics inside.

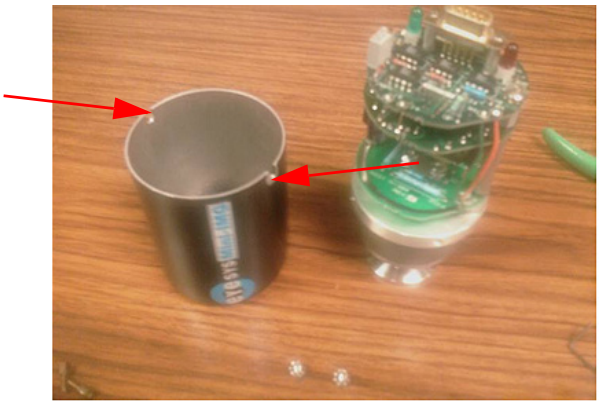

Figure 3-3 Electrical Connector Screws

4. Remove the screw which holds the magnet to the inlet flange as shown in Figure 3-4. Ensure that the marker positions do not change.

Figure 3-4 Magnet Retention Screw

5. Use the small Allen wrench to loosen the screws holding the gauge body to the electronics assembly (Figure 3-5). With these screws loosened, slide the gauge body out of the groove with the magnet still attached, then slide the magnet out of the flange.

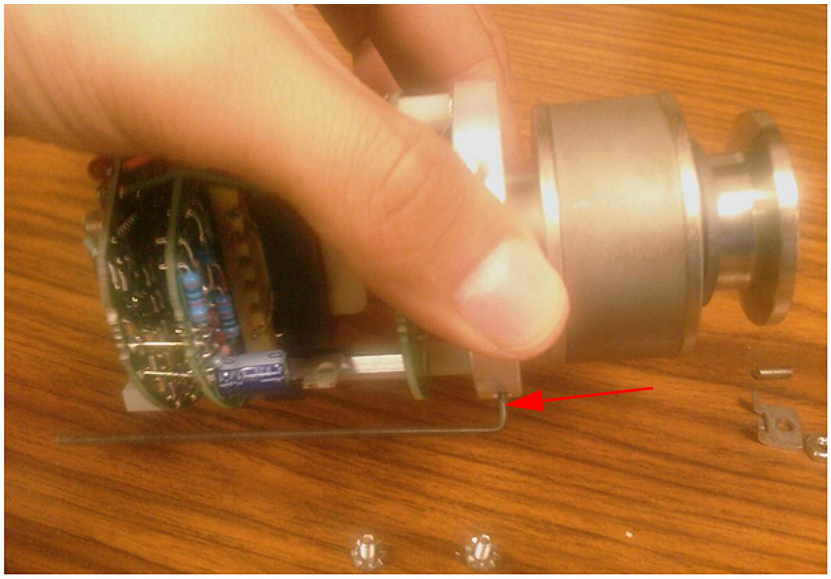

Figure 3-5 Gauge Body Retention Screws

6. Remove the snap ring inside the gauge inlet containing the pole pieces (Figure 3-6).

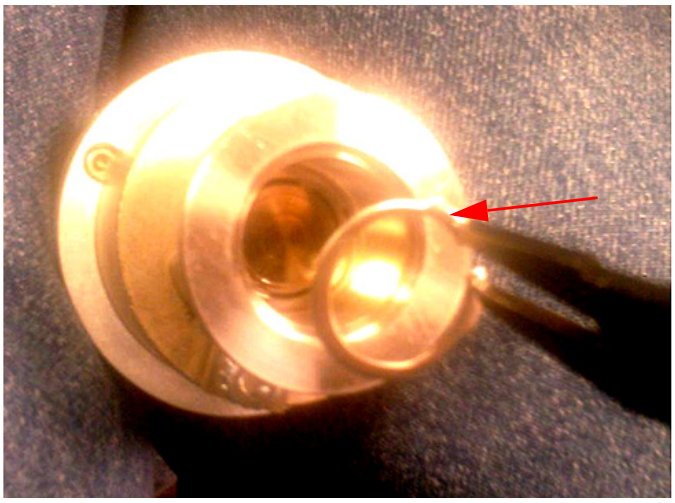

Figure 3-6 Snap Ring

7. Slide out the two pole pieces and the spacer (Figure 3-7). The inner pole piece has a single center hole and the outer pole piece has five holes. Ensure that the large side of tapered hole faces inward. The poles and spacer are around the long thin anode, which is screwed into the gauge body (cannot remove this, special tool needed).

   These pieces go on top of the anode inside the gauge body.

Figure 3-7 Pole Pieces and Spacer

8. Look for any contamination on the two pole pieces and also look inside the gauge body, around the anode for any contamination (Figure 3-8).

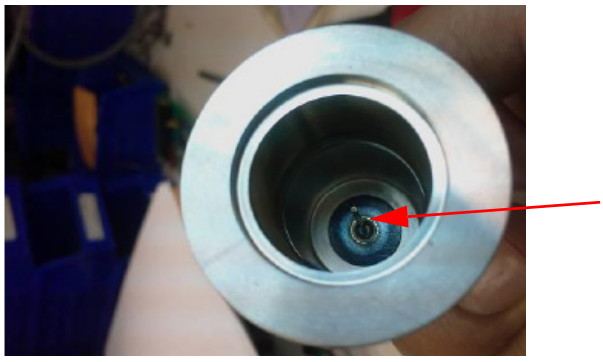

Figure 3-8 Gauge body with Anode Indicated

9. To clean contaminated surfaces:
   a. Soak some cleaning cloth with acetone.
   b. Clean the pole pieces with acetone or alcohol. You can use Scotch Brite or other similar abrasive material with Acetone to clean parts.
   c. Air-dry the parts.

NOTE

If the anode tube is also contaminated, it must be removed and replaced.

10. Re-assemble in the reverse order. Ensure that the marks created earlier on the magnet and the body align.

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