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Correction of a vacuum design fault in leak detectors*

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ABSTRACT

This paper describes a vacuum design fault in the Veeco Model MS 170 Leak Detector and provides a simple and inexpensive solution to correct the fault.

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INTRODUCTION

The maintenance of high vacuum in a large vacuum system requires continuous and reliable leak-checking capabilities. We use four Veeco MS 170 Leak Detectors to provide this capability for the ISX-B tokamak facility, which includes a main vacuum vessel, three neutral beam injector vacuum systems, and about twenty smaller diagnostic vacuum chambers. Four leak detectors were needed because of continual malfunctions which required fairly long repair times (approximately 3 weeks). One particular type of malfunction manifested itself much more frequently. Diagnosis of this problem was made and corrective action taken. This problem, which has occurred on all of our MS 170 leak detectors, is thought to be generic to the MS 170, but may be limited to these four.

VACUUM DESIGN FAULT

A continuing problem has been experienced with the vacuum system of the MS 170 Leak Detector (LD) which manifests itself by intermittent exposures of the high vacuum system to high pressures; i.e., the air-cooled diffusion pump was exposed, at a minimum, to pressures greater than a few torr and, in the worst case, to atmospheric pressure. These exposures severely degrade and contaminate both the pumping system and the mass spectrometer tube including the ion source. After a few of these exposures, it was necessary to disassemble, clean, reassemble, and calibrate the leak detectors. This procedure was costly, both in money and lost time; therefore, all valves and vacuum

components were disassembled and studied for problem areas to define the underlying cause of repeated faults of this type.

The problem was the orientation of the vent valve. The function of the vent valve is to vent the system to air when the START-VENT switch is moved to the VENT position. It is a normally closed solenoid valve that is opened by application of 110 VAC to the solenoid. The valve is held closed by a spring pushing on the plunger which contains an elastomer seal on its seat end. As installed, the axis of the plunger is mounted horizontally. We found that the spring is of marginal strength and does not positively seat the plunger every time. In addition to nonuniform seating caused by sagging of the plunger, severe vibrations or shocks (e.g., rolling the LD across a rough floor) can cause unseating of the plunger.

MODIFICATION

Two solutions to the problem were obvious: 1) use a stronger spring and 2) reorient the valve. The first was rejected because a stronger spring would create more load and could cause the solenoid to overheat. The second solved the problem completely. The vent valve was reoriented in such a manner that the plunger axis is vertical and the spring motion down. This provided sufficient additional force to positively seat the vent valve in all cases.

SUMMARY

A vacuum fault was identified in the Veeco MS 170 Leak Detector, and a simple and inexpensive solution was found. Discussions with the Leak Detector Repair Shop of the Y-12 Vacuum Technology Laboratory revealed that other types of leak detectors, most notably the Leybold Herymes Model F, have similar faults that can probably be corrected with the same type of modification.¹

Reference

1. R. C. Glandon, Y-12 Development Center, Oak Ridge, TN 37830, May 1983.