IMPROVEMENT OF FILAMENT-PROTECTION CIRCUITRY IN A FINNIGAN MODEL 251 MASS SPECTROMETER

by Joe D. Wildman

U.S. GEOLOGICAL SURVEY

Open-file Report 86-484

UNITED STATES DEPARTMENT OF THE INTERIOR

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ABSTRACT

As delivered from Finnigan MAT,[1] the emission current of the Leybold-Heraeus model IM210 ionization vacuum gauge on a model 251 isotope ratio mass spectrometer can turn on as soon as the "PUMP ON" switch is depressed, before a good vacuum in the mass spectrometer is attained. The filament in the source of the mass spectrometer may turn on at the same time, thereby shortening its life or burning it out if the vacuum is poor. This design flaw can be corrected by a simple modification of the electronic circuitry.

INTRODUCTION

We have observed a problem in the Finnigan MAT 251 mass spectrometer in two situations. The first situation occurs during start up of the mass spectrometer and manifests itself in allowing the emission current on the Leybold-Heraeus IONIVAC model IM210 to turn on before a good vacuum in the mass spectrometer has been obtained. Because the mass spectrometer "SOURCE ON" switch is enabled by the IONIVAC "EMISSION ON" current, the filament in the source of the spectrometer could be turned on manually as soon as the vacuum reaches 10^{-2} millibar. Actually, depending

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[1]Use of trade names and trademarks in this publication is for descriptive purposes only and does not constitute endorsement by the U.S. Geological Survey.

on the speed with which the IONIVAC over-pressure circuit reacts, the IONIVAC emission and the source filament could be turned on momentarily at a much higher pressure. The second situation occurs during shutdown or loss of vacuum. During normal shutdown, the source filament will not turn off automatically when the turbo-molecular pump falls below 80 percent of maximum speed, but will remain on until the over-pressure circuit on the Leybold-Heraeus IM210 shuts down. In the event of a vacuum failure, the source filament will not be turned off until the Leybold-Heraeus over-pressure circuit reacts, possibly damaging the source filament.

The author wishes to thank Dr. I. L. Barnes of the National Bureau of Standards and Dr. P. Morales of the University of Mexico for constructive comments on this manuscript.

CIRCUIT DESCRIPTION

According to the Finnigan operating manuals (1983), the IONIVAC emission will be switched on automatically when the turbo-molecular pump reaches 80 percent of maximum rotational speed. This is accomplished by energizing Relay K12 in the BLS MAIN CONTROL UNIT which, through its contacts 11 and 12, connects terminals B to C on the REMOTE CONTROL terminals of the IONIVAC. The IONIVAC operating manual states that B must be connected to C to turn the emission on; B must be connected to A to turn the emission off. No connection to A is made in the Finnigan MAT 251. It was confirmed by telephone conversation with Leybold-Heraeus that disconnecting B from C will not necessarily shut off the emission. B must be connected to A to always shut off the emission. In the same manner, if B is left open, as is the case in the Finnigan 251 before the turbo-molecular pump reaches 80 percent of maximum speed, electrical noise will frequently turn on the emission. In fact, in our own unit the emission current will usually come on as soon as the "PUMPS ON" switch is pressed, minutes before the turbo-molecular pump has reached 80 percent of maximum speed.

CIRCUIT MODIFICATION

This problem is easily rectified. Although it is not shown on the BLS schematic diagram, terminal 10 of relay K12 is a normally closed contact and will be closed whenever the turbo-molecular pump is below 80 percent of maximum speed. To make the modification, first install a small pinjack or other connector on the rear of the BLS and connect it to terminal 10 of K12. The bottom view of of the pins of relay K12 is:

```
 13    14
3  6  9  12
2  5  8  11
1  4  7  10
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Next, connect this jack to terminal A of the IONIVAC. A will now be connected to B whenever the turbo-molecular pump is below 80 percent of maximum speed and B will be connected to C whenever the pump speed is greater than 80 percent. This completes the modification.

Mr. Ben Johnson of Finnigan MAT confirmed orally that, although they have not received any complaints of this problem, the described modification is an appropriate fix.

REFERENCE CITED

Finnigan MAT 251 operating manuals, part number 24 100, service number 8331 dated 11/83.