


CNRS *Centre National de la Recherche Scientifique*
INFN *Istituto Nazionale di Fisica Nucleare*



OUTGASSING TEST OF “STORED” ANTISPRING ASSEMBLIES


Code:
VIR-TRE-PIS-3400-143
LIGO-T990066-00-D

Date: 16/01/1999

	<p>"Stored" antisprings</p>	<p>Doc: VIR-TRE-PIS-3400-143 code Issue: 1 Date: 16/01/1999 Page: 2</p>
---	-----------------------------	---

CHANGE RECORD

<i>Issue/Rev</i>	<i>Date</i>	<i>Section affected</i>	<i>Reason/ remarks</i>

<p>Authors: M. Bernardini H. B. Pan R. Poggiani</p>	<p>Date</p>	<p>Signature </p>
<p>Approved by:</p>		



 The logo for VIRGO, featuring a stylized circular symbol composed of several curved lines above the word "VIRGO" in a bold, sans-serif font.	"Stored" antisprings	Doc: VIR-TRE-PIS-3400-143 code Issue: 1 Date: 16/01/1999 Page: 3
---	----------------------	--

Table of contents

In this note we briefly report the outgassing measurements performed of some antispring assemblies which has been stored for several weeks after delivering from the factory. The measurement method is described in detail in the note VACPISA 025.

	“Stored” antisprings	Doc: VIR-TRE-PIS-3400-143 code Issue: 1 Date: 16/01/1999 Page: 4
---	----------------------	--

1 - System performances

The typical base pressure of the test chamber after a baking at 250 °C for several days is $\sim 10^{-10}$ mbar, with an outgassing rate of the order of $\sim 10^{-12}$ mbar l s⁻¹ cm⁻².

The main components of outgassing after baking are H₂, H₂O, N₂/CO, CO₂. The internal surface of the chamber is 3200 cm².

2 - Measurement of the outgassing flow of antisprings

The experimental samples were four antispring assemblies each one consisting of 6 Philips Ferroxdure 330 magnets glued with Vac-Seal to a metal support.

The test was motivated by the fact that the Superattenuator filter under vacuum test at the moment exhibited a strong water vapour outgassing. Possible candidates for such behavior are the antispring assemblies. We have performed another test with antispring assemblies as described in the note VIR-TRE-PIS-142. In that test the antispring assemblies were unpacked just before the test. On the other hand, the antisprings on the filter could have been installed only after several weeks storage. Thus it was necessary to check the effect of storage.

We monitored the evolution of outgassing (time is measured from beginning of the test through the whole paper):

t(h)	T(°C)	p ₁ (mbar)	p ₂ (mbar)	Q(mbar l/s)
28.4	15	3.2x10 ⁻⁶	5.8x10 ⁻⁷	5.2x10 ⁻⁵
97.1	15	1.4x10 ⁻⁶	2.4x10 ⁻⁷	2.3x10 ⁻⁵
147.4	14	9.9x10 ⁻⁷	1.8x10 ⁻⁷	1.6x10 ⁻⁵
169.1	12	9.2x10 ⁻⁷	1.7x10 ⁻⁷	1.5x10 ⁻⁵
194.5	14	8.1x10 ⁻⁷	1.5x10 ⁻⁷	1.3x10 ⁻⁵
267	15	7.0x10 ⁻⁷	1.3x10 ⁻⁷	1.1x10 ⁻⁵
314.5	21	8.8x10 ⁻⁷	1.6x10 ⁻⁷	1.4x10 ⁻⁵
335	11	5.2x10 ⁻⁷	9.1x10 ⁻⁸	8.6x10 ⁻⁶
361.5	19	6.8x10 ⁻⁷	1.2x10 ⁻⁷	1.1x10 ⁻⁵
430.6	12	4.9x10 ⁻⁷	8.7x10 ⁻⁸	8.1x10 ⁻⁶



We quote some relevant numbers for comparison with the other test:

After 4 days at room temperature: $Q = 2.3 \times 10^{-5}$ mbar l s⁻¹; water vapor ~67%

After 7 days at room temperature: $Q = 1.5 \times 10^{-5}$ mbar l s⁻¹; water vapor ~71%

Which should be compared to the results of the other test, normalized to 24 magnets:

After 4 days at room temperature: $Q = 2.9 \times 10^{-5}$ mbar l s⁻¹; water vapor ~53%

After 7 days at room temperature: $Q = 2.2 \times 10^{-5}$ mbar l s⁻¹; water vapor ~53%

After 4 days at room temperature and a preliminary vacuum baking: $Q = 0.8 \times 10^{-6}$ mbar l s⁻¹; water vapor ~35%

The water content is larger for this set of antisprings than for the “as delivered” antispring assemblies described in the note VIR-TRE-PIS-3400-142.

The mass spectrum measured after some days pumping at room temperature are shown in Fig. 1. The water content decreased from ~70% to ~60% in a couple of weeks of pumping.

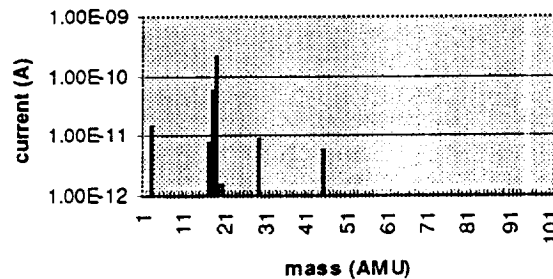


Fig. 1 Outgassing spectrum after some days pumping at room temperature

We heated the samples at 150 °C for 47 hours and monitored the outgassing:

t(h)	T(°C)	p ₁ (mbar)	p ₂ (mbar)	Q(mbar l/s)
431.3	55	3.2×10^{-6}	6.8×10^{-7}	5.2×10^{-5}
478.5	150	6.1×10^{-6}	7.0×10^{-7}	1.1×10^{-4}



The mass spectrum measured during baking is shown in Fig. 2.

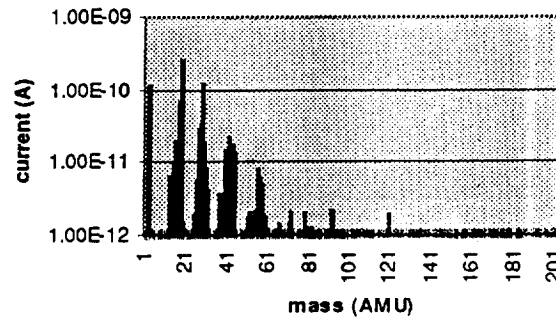


Fig. 2 Outgassing spectrum during baking at 150 °C

Organic fragments appeared but below the level observed for the antisprings described in the note VIR-TRE-PIS-3400-142.

We switched off the heating and we measured:

t(h)	T(°C)	p ₁ (mbar)	p ₂ (mbar)	Q(mbar l/s)
501.1	12	1.9x10 ⁻⁷	3.5x10 ⁻⁸	3.1x10 ⁻⁶
599.4	10	1.2x10 ⁻⁷	1.9x10 ⁻⁸	2.0x10 ⁻⁶
646.7	12	1.0x10 ⁻⁷	1.9x10 ⁻⁸	1.6x10 ⁻⁶

The mass spectrum the thermal cycle is shown in Fig. 3.

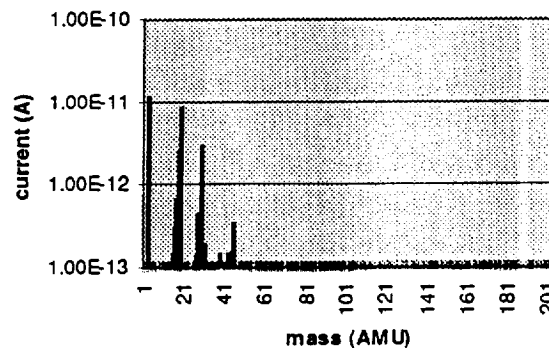


Fig. 3 Outgassing spectrum after the thermal cycle

The outgassing flow evolution is summarized in Fig. 4.

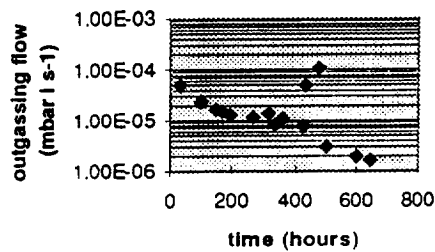


Fig. 4 Time evolution of the outgassing flow

3 - Discussion

The average outgassing flow measured for the four antispring assemblies (accounting for 24 magnets and ~24 cm² of Vac-Seal adhesive) after the thermal cycles described above was ~2x10⁻⁶ mbar l s⁻¹. Some relevant points are the following:

- the outgassing level of the “as delivered” and “stored” antispring assemblies is of the same order
- the “stored” antisprings exhibited a larger water absorption, as could be expected for a long storage inside not hermetically sealed envelopes
- the “stored” antisprings exhibited a smaller organic contamination during baking

The results seem to suggest that the “as delivered” and “stored” antispring assemblies could have been prepared in different ways.

For the above reasons, we strongly recommend another vacuum test on the antispring assemblies.