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Subject: CF 57-6-50 (Unclassified)

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Very truly yours,

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/jr

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OAK RIDGE, TENNESSEE**ORNL**
CENTRAL FILES NUMBER

57-6-50

DATE: June 13, 1957

COPY NO. 32

SUBJECT: Capillary Flowmeter Performance in the HRT Mockup

TO: I. Spiewak

FROM: P. H. Harley

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INTRODUCTION

A capillary flowmeter⁽¹⁾ was installed on the HRT mockup leak detector in March, 1957. The flowmeter consisted of six feet of capillary tubing with an I.D. of 0.012-in. and was supported by 1/4 in. autoclave tubing. The pressure drop across the capillary was measured by a 100 in. electric Foxboro D/P cell and transmitted to a Foxboro dynalog pressure recorder. The recorder zero was set at 50 per cent and the flow could be measured in either direction from 0 to 5 cc per hour.

The flowmeter, which was connected to four pair of flanges, has been used for 1500 hours. During this time no flange leaks occurred in the system. A leak was produced by loosening a tubing fitting so that the leak detector could be tested under leak-locating conditions.

DISCUSSION

The capillary flowmeter, Figure 1, was in operation for 1500 hours in the HRT mockup. To test the system, a leak was created by loosening a tubing fitting until the desired leak rate (1-4 cc/hr) was obtained. With the system at equilibrium, the leak could be located within a few minutes by the following technique, when a leak is indicated:

1. Capillary bypass valve is opened to determine the zero point.
Flange isolation valves are all open.
2. Flange isolation valve 1 is closed.
3. Capillary bypass valve is closed and D/P cell permitted to equilibrate. If the cell equilibrates at the same reading as originally shown on the chart (indicating the same leak rate), flange No. 1 is tight. Isolation valve No. 1 is reopened.
4. Sequence 1-3 is repeated until the leaking flange or flanges are located.

Sequence 1-3 takes about 2 minutes. Any desired number of isolation valves can be closed simultaneously if rapid leak location is desired.

Because the flowmeter was so sensitive to changes in loop temperature, the flowmeter was of little value when the loop was not at thermal equilibrium. With the loop at equilibrium, the flowmeter would fluctuate ± 0.1 cc/hr, Figure 2. By checking the instrument zero (opening the bypass), leak rates as low as 0.2 cc/hour could be located with the flowmeter.

In the mockup, a change in the loop temperature of about 10°C per hour would indicate an apparent leak rate of 1.5 cc/hr.

CONCLUSIONS

The following conclusions have been made from operating the capillary flowmeter in the HRT mockup:

1. Leaks as low as 0.2 cc/hr could be located.
2. Leaks could be located rapidly. A 1 cc per hour leak in the mockup was located in six minutes.

The time to locate the same leak by change in pressure is estimated to be about 1.5 hours.

3. The flowmeter is less sensitive to changes in room temperature than the former changing-pressure leak detection system used on the mockup.
4. The flowmeter was very sensitive to changes in the loop temperature. This means that judgment must be used in deciding whether an apparent leak is merely a loop temperature fluctuation.

REFERENCE

- (1) E. C. Hise, "Capillary Flowmeter," ORNL-CF-57-2-144, February 20, 1957.

P. H. Harley
P. H. Harley

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Fig 1 HRT Mock up Leak Detector System

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Fig. 2 LEAK FLOW CHART

Zero - 50%
Total Range $\pm$ 5 c.c./hour