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The HRT vent valve was connected to the 80 kw steam generator for this test as shown in Fig. 1. Use of this steam generator permitted a constant pressure supply of saturated steam for these tests.

In these tests, 2000 psig saturated steam was allowed to pass through the vent valve at various openings for a measured length of time. Steam discharged from the valve passed through a one inch pipe to a dump tank and condensing coils which are described in a report by Haubenreich.* Condensate collected in the dump tank was weighed and the mass flow rate was determined from this measurement and the length of the time of the test. Results of these tests are shown in Table 1 and Fig. 2. It should be noted that the 1/2 inch position of the valve is at its fullest opening.

TABLE I
RESULTS OF THE HRT VENT VALVE TESTS

Valve Position in.	% Valve Stroke	Condensate Collected lbs.	Time Min.	Flow Rate lb/min.	Upstream Pressure psig	Downstream Pressure psig
1/2	100	37.75	10.32	3.65	2015	15
3/8	75	29.5	10.00	2.95	2025	15
1/4	50	23.5	10.00	2.35	2020	15
1/8	25	9.0	5.00	1.80	2025	15

These results show that the vent valve does control the rate of flow of high pressure saturated steam.

Flow rates at other inlet pressures were calculated and are shown in Fig. 2. These were calculated assuming sonic velocity and perfect gas

* Haubenreich, P. N., "The Flow of a Flashing Mixture of Water and Steam at High Pressures", ORNL CF 55-5-200, May 16, 1955.

relationship through the valve. The maximum rate of flow is then given by the following relation.*

$$W_{\max} = C_v A_2 \sqrt{\frac{gcp_1}{v_1} \gamma \left(\frac{2}{\gamma+1} \right)^{\frac{\gamma+1}{\gamma-1}}} \quad (1)$$

For a particular material at a definite valve opening, Equation (1) becomes

$$W_{\max} \sqrt{\frac{v_1}{p_1}} = \text{a constant} \quad (2)$$

Equation (2) was used to calculate the flows at other inlet pressures.

Maximum flow rates through the vent valve for various pressures are found by cross plotting the information shown in Fig. 2. This information is shown in Fig. 3.

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/mg

* Perry, J. H., Chemical Engineer's Handbook, 34d Ed., page 403, McGraw-Hill Book Co., New York, (1950).

FIG. 1 HRT VENT VALVE TEST APPARATUS

EUGENE DIETZGEN CO.
MADE IN U. S. A.

NO. 340, 120 DIETZGEN GRAPH PAPER
20 X 20 PER INCH

FIG. 2. RESULTS OF HRT VENT VALVE TESTS.
(MARCH 28, 1956)

FIG. 3 VOLUME FLOW RATE VS.
INLET PRESSURE