PRESSURE DROP ACROSS SINGLE HOLE PLATES

By

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PREFACE

The object of this work was to provide data for the prediction of the pressure drop across a perforated tray having a liquid seal. An investigation was also made to determine the effect of the ratio of plate thickness to the diameter of the perforation on the pressure drop measured across the dry plate.

The author wishes to thank Dr. Robert N. Maddox for his invaluable aid and guidance throughout the entire project. A word of thanks is also due Mr. Eugene E. McCroskey for his help in constructing and maintaining equipment.

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INTRODUCTION

Some of the most important unit operations are diffusional operations. One of the principal problems in any diffusional operation is that of obtaining intimate contact between the different phases of material. This contact is usually obtained by either of two general methods:

1. Use of columns containing trays which allow the phases to be alternately mixed and separated.
2. Use of a tower packed with any of the various types of packing available. The packing serves the purpose of providing a surface for contact between the phases.

The type of contactor with which this work is concerned is a column containing trays.

Bubble-cap trays are the most generally used by industry today. Fabrication costs are high for this type of tray, and for this reason, new tray designs are being sought.

Another type of tray is the perforated or sieve tray. These have the advantage of being cheaper to manufacture but have not been used to the extent of bubble-cap trays due to the tendency to dump or drain the liquid on the tray should the vapor flow be interrupted. The perforations of the sieve tray may be punched rather than drilled, thus reducing the cost of manufacture to as low as one-third the cost for bubble-cap trays.[8]

This work was undertaken to investigate the effect of the ratio of plate thickness to the diameter of the perforation in the plate upon the pressure drop measured across the dry plate. Perhaps, the most important portion of the work done was that relating to the prediction of the pressure drop across a tray having a liquid seal.

All runs were made with plates containing one hole. This was done on the premise that what could be predicted for a single hole could also be expanded to include multiple holes.

The wet tray pressure drops were to be determined with a fixed amount of liquid to avoid making the liquid level on the plate a function of the liquid flow rate across the plate.

One of the most notable articles published on perforated plates is that of Mayfield, et al.[9] This work found a slope of 2 of the curve resulting from a plot on log-log coordinates of pressure drop across the dry plate versus the mass velocity of the gas flowing through the column. The dry tray pressure drop was correlated with the wet tray pressure drop through an aeration factor. The aeration factor used was defined as the ratio of the observed pressure drop through the liquid on the tray to the calculated clear liquid depth on the tray; the calculated clear liquid depth being the sum of the outlet weir elevation and the weir head calculated by the Francis weir formula. In calculating aeration factors, the observed pressure drop through the liquid was obtained as the difference between the total observed pressure drop through the wet tray and the observed dry tray pressure drop at the same air rate. Some aeration factors above unity were observed. Mayfield concluded that, for all practical purposes, the orifice coefficients were independent of plate thickness, drilling pattern, and hole size.

Arnold, et al.,[1] found the pressure drop due to the dry plate was proportional to the 1.8 power of the gas velocity and correlated by a modified orifice coefficient equation. The wet tray pressure drop was correlated by an empirical correction factor applied to the sum of the dry tray pressure drop and the depth of the liquid seal. This factor decreased as the depth of the liquid seal increased.

APPARATUS

Column[8]

The column used was made up of four inch inside diameter glass pipe. This pipe was available in sections six inches long and flanged at each end making it possible to construct a column of any desired length. Four sections of this pipe were used for the column making an overall length of 24 inches. Each joint was equipped with a gasket to prevent leakage. The plate under investigation was inserted at the middle of the column providing a twelve-inch section above the plate for separating any entrained liquid from the vapor.

The end plates for the column were made of 0.03" galvanized sheet. These plates were fitted with copper tubing for connecting air, manometer, and water lines. A photograph of the assembled column appears in Figure 1.

Trays

The two trays used in this investigation were constructed of 0.0645" thick and 0.018" thick stainless steel sheet. The hole sizes used for the thick plate were 0.035", 0.063", and 0.125" in diameter, thus giving approximate ratios of hole diameter to plate thickness of 1/2, 1, and 2. The hole diameters used for the thinner plate were 0.035", 0.0555", and 0.073", thus giving approximate ratios of 2, 3, and 4 in comparison to the thickness of the plate.

Auxiliaries:

i. A Meriam 30" manometer filled with distilled water was used to measure the pressure drop across the tray. This manometer was connected to the column by 1/4" copper tubing with flared connections. The pressure taps were inserted through holes in the end plates of the column and soldered in place to prevent leakage. The manometer scale was calibrated in inches with the smallest division being 0.1 inch.

ii. A Precision Scientific Co. wet test meter was used to meter the air through the column. This meter was graduated to 0.001 cubic foot with one revolution of the indicator being equivalent to the passage of 0.1 cubic foot of air through the column. This meter was checked against a Bureau of Mines standard 0.1 cubic foot gas bottle and was found to indicate 0.096 cubic foot for each 0.1 cubic foot passed through the meter.

iii. Water for the liquid seal was drawn from the laboratory mains. The amount necessary for seals was determined by actual measurement in a section of tubing identical to that of the tower. The amounts of water determined for 1", 2", and 3" seals were 215 ml., 421 ml., and 627 ml. respectively. The amount of water determined for the 1" seal contained additional water to compensate for the flanged portion of the tube above the plates.

iv. Air supplied to the column was drawn from the laboratory supply tank. This tank was supplied by a single stage compressor. The pressure in the tank depended on the rate of withdrawal, the upper and lower limits being approximately

120 psig and 60 psig respectively. The air rate of flow was controlled by a reducing regulator.

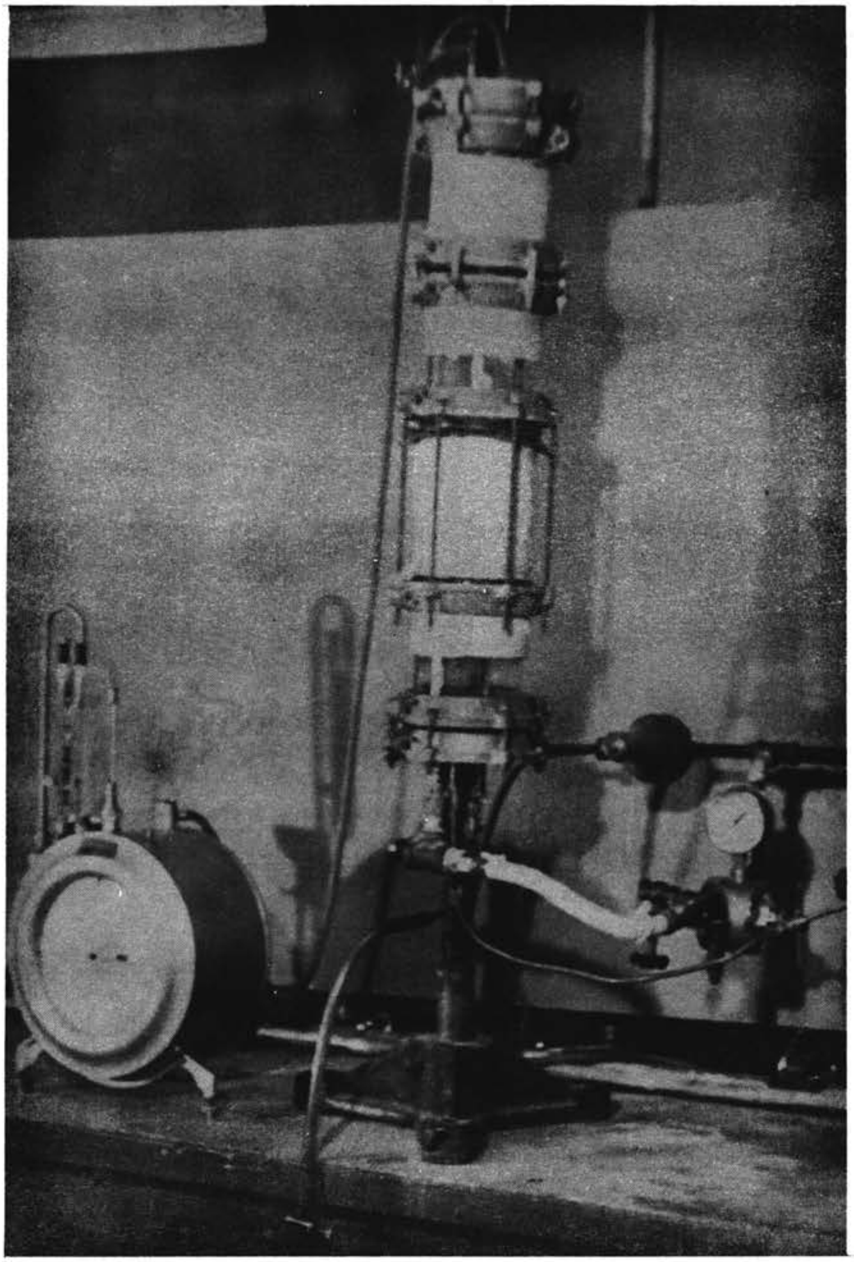


Figure I

Photograph of Column

PROCEDURE

Dry Tray Runs

The column was assembled with the plate to be investigated in place. The air was adjusted to the maximum air flow desired. The tower was allowed to operate until the air flow rate was constant. After a steady flow rate was reached, readings of the temperatures of entering and leaving air, pressure drop across the plate, air flow rate, and barometric pressure were recorded.

After one set of readings was taken, the air flow was adjusted by means of a needle valve and the tower permitted to stabilize before the readings were taken again under new conditions.

Wet Tray Runs

The column was assembled with the proper plate. The air was turned on and adjusted to the approximate air rate desired. A predetermined amount of water was added to the column through an opening in the tower top. This gave the desired liquid seal on the plate. Water was added after the air flow rate was adjusted in order to prevent weeping. Weeping may be defined as leakage of the liquid through the perforation due to insufficient air flow to hold up the liquid. The opening for the addition of water was tightly corked when not actually adding water. The column was allowed to reach equilibrium and the same readings were taken as for the dry run. The air rate was varied and the procedure repeated.

Predetermined amounts of liquid necessary for one, two, and three inches were added to each plate. Absorption oil of 0.842 specific gravity and water were selected for investigation.

RESULTS

On the following pages, the experimental data recorded from each run are presented in graphical form. These data are also in tabular form in the Appendix. The first data presented are for dry plate pressure drops, second, the pressure drops across plates having a fixed height of liquid, and finally the wet tray pressure drop correlation factor computed for each plate.

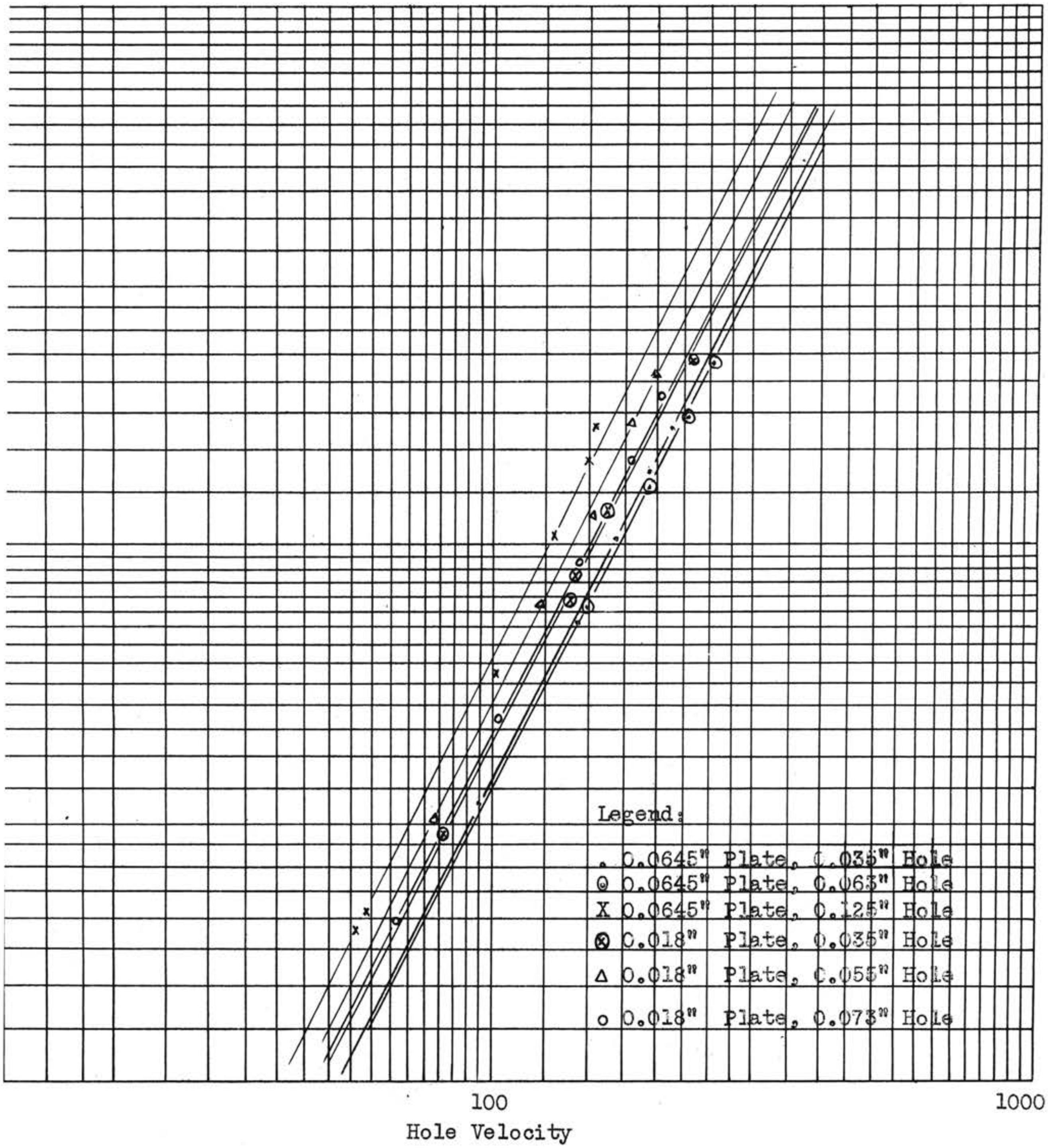


FIGURE 2

DRY TRAY PRESSURE DROPS

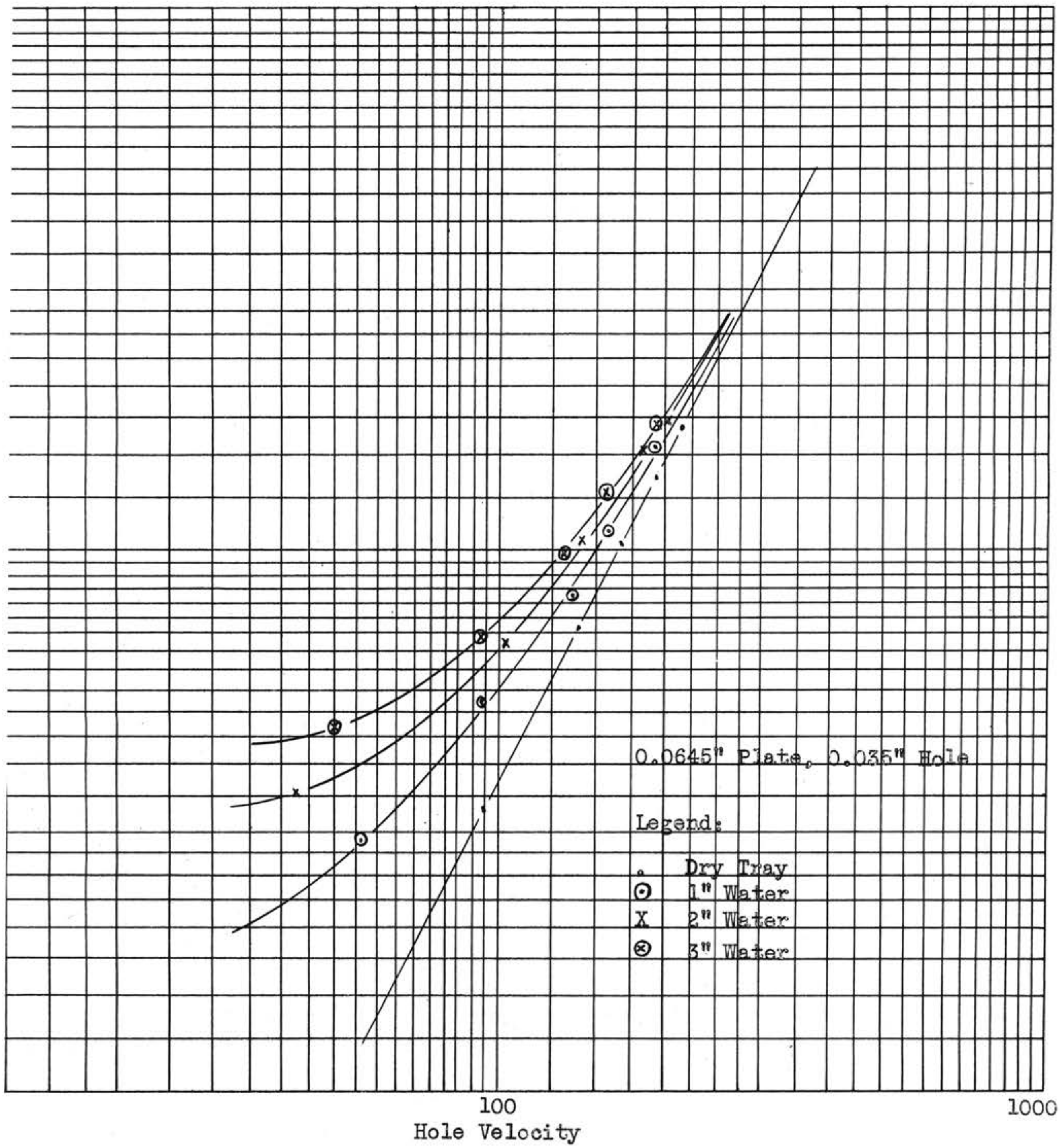


FIGURE 3

WET TRAY PRESSURE DROP

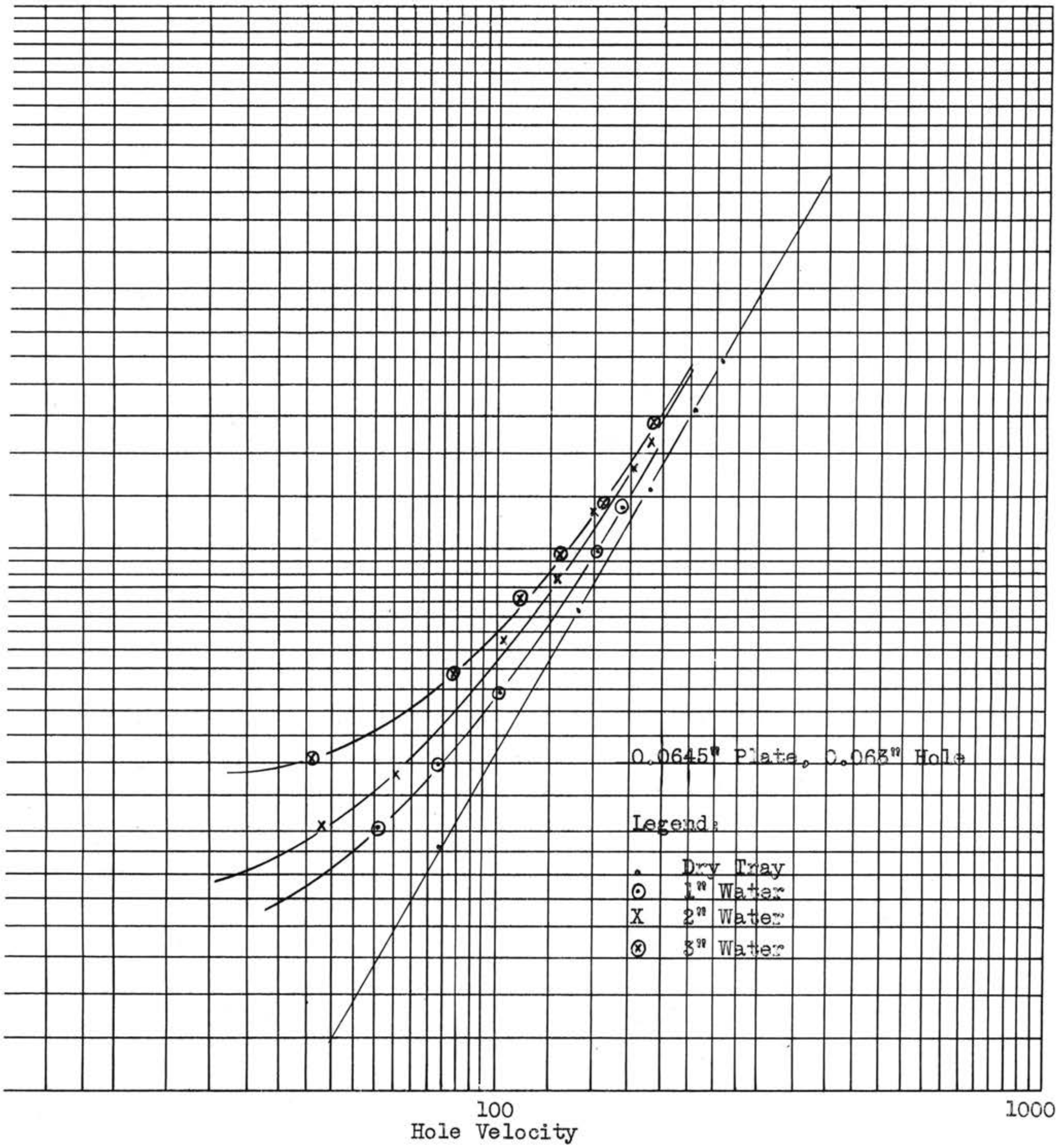


FIGURE 4

WET TRAY PRESSURE DROP

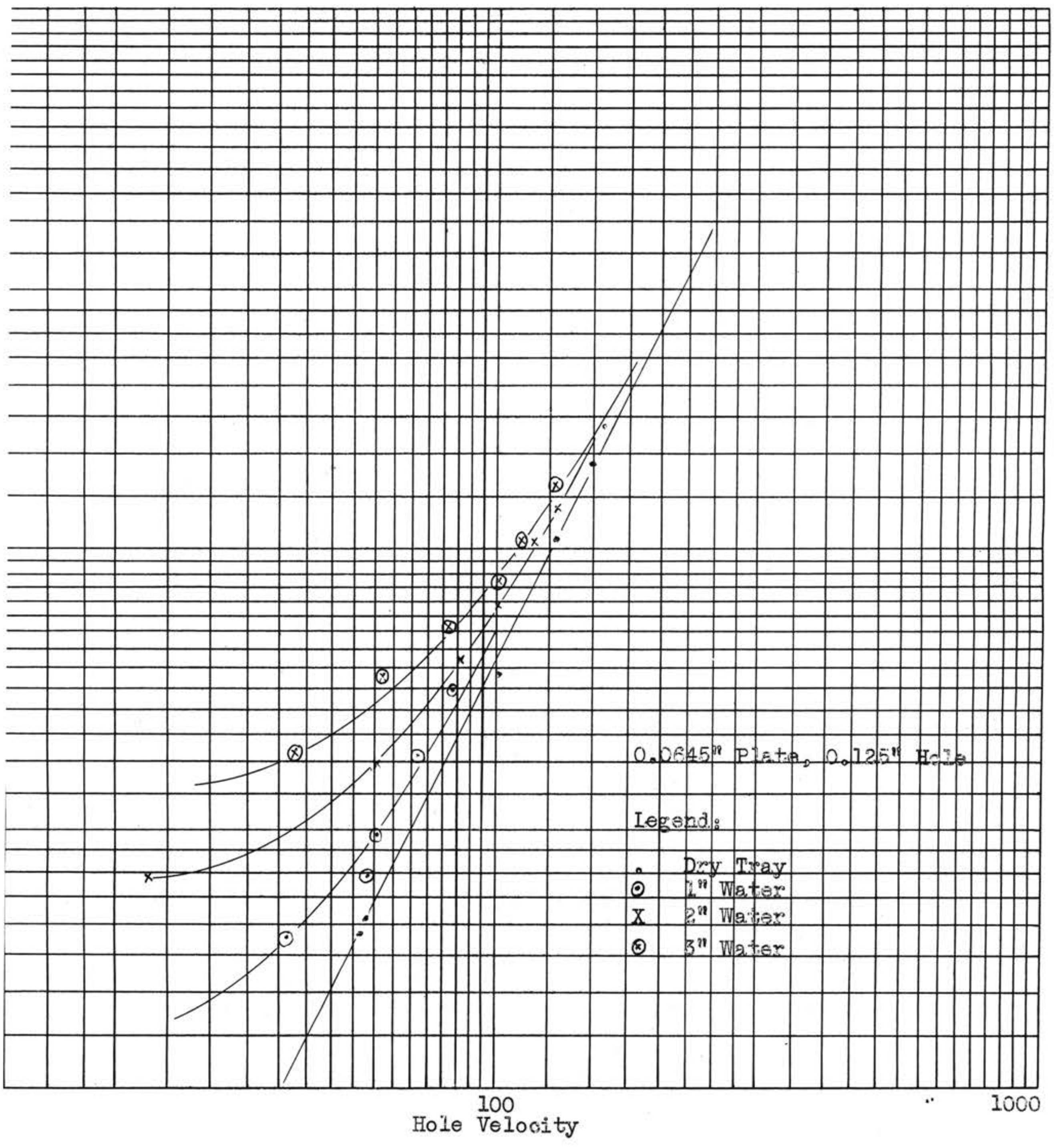


FIGURE 5

WET TRAY PRESSURE DROP

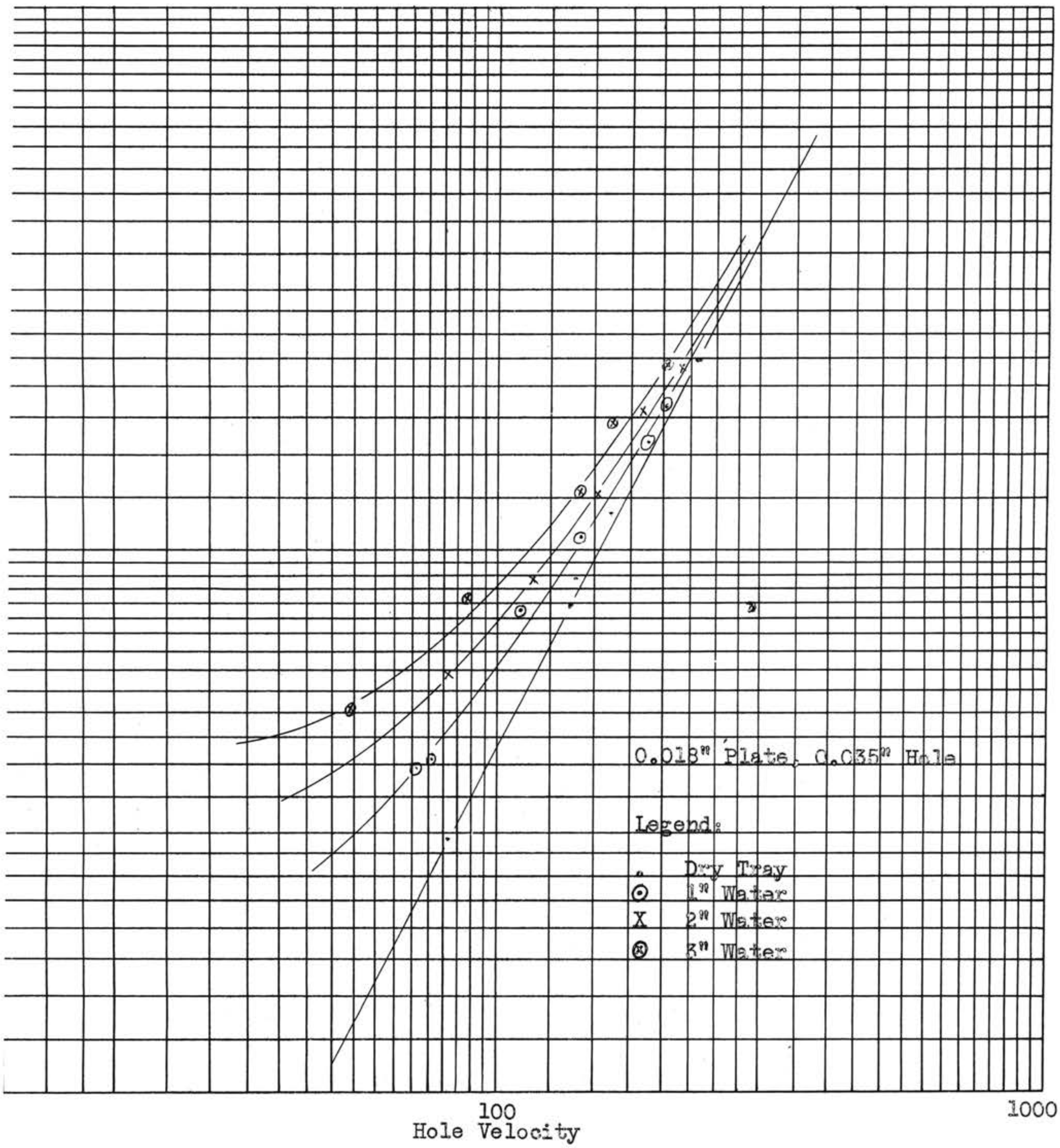


FIGURE 6

WET TRAY PRESSURE DROP

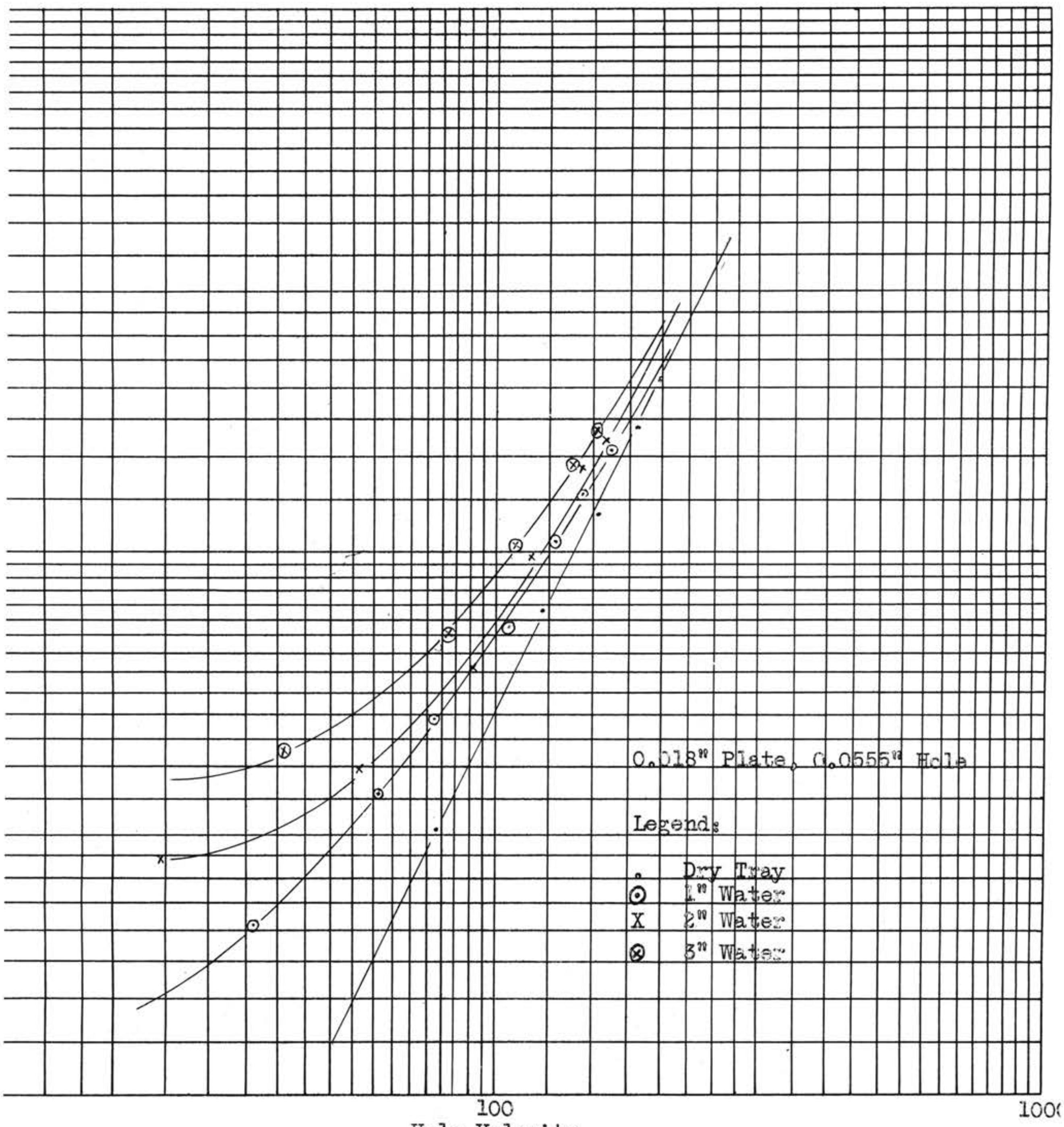


FIGURE 7

WET TRAY PRESSURE DROP

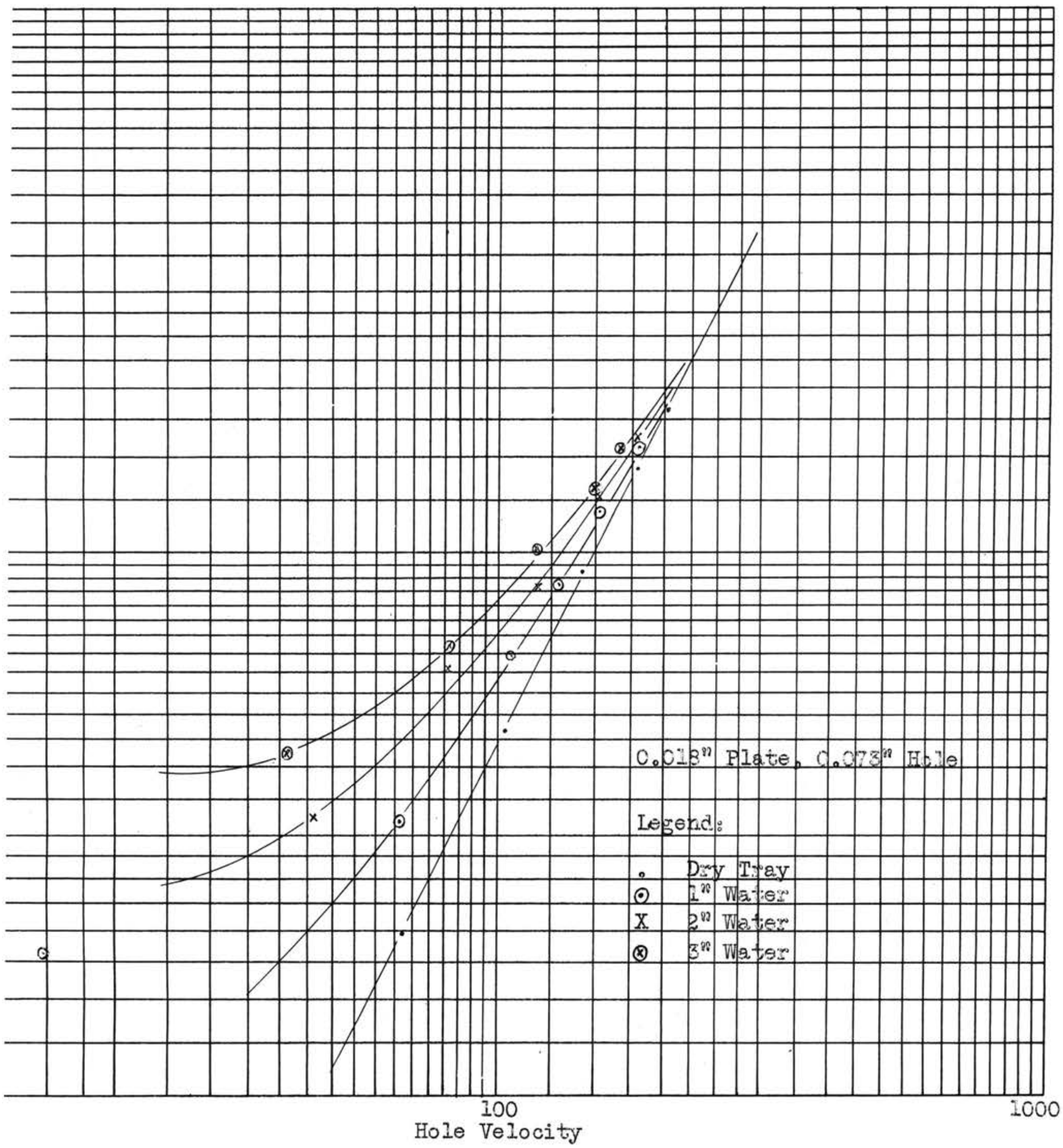


FIGURE 8

WET TRAY PRESSURE DROP

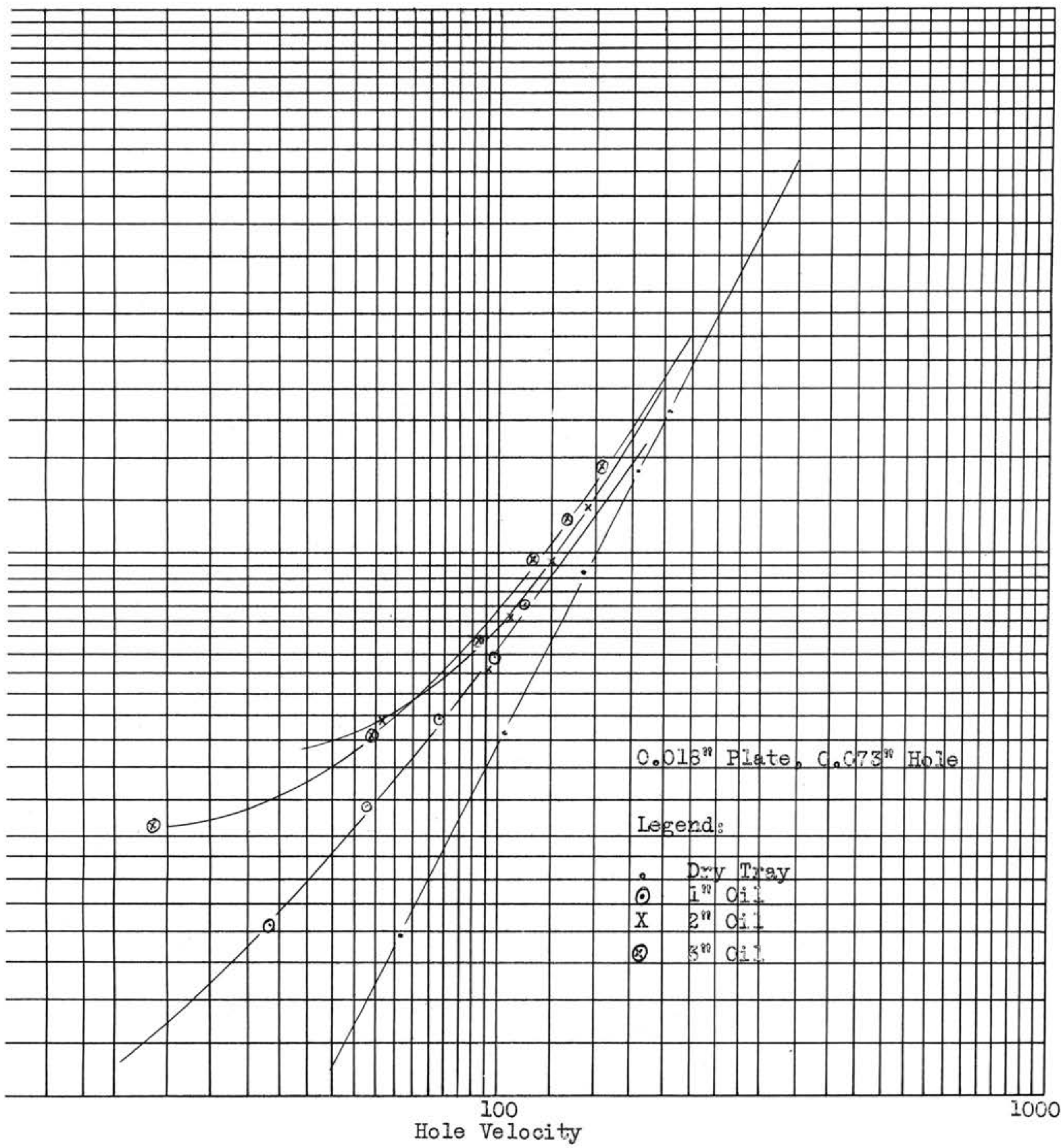
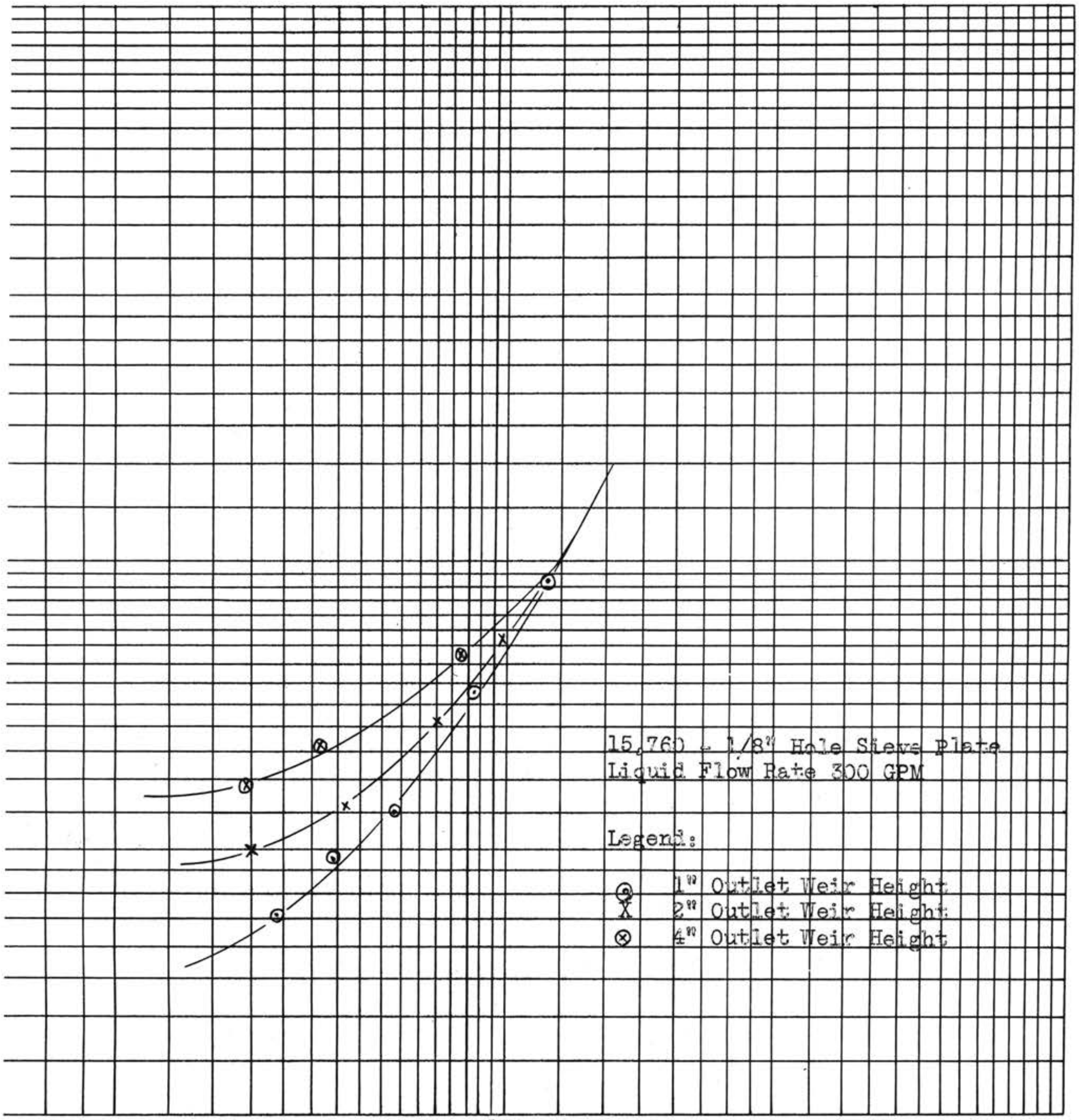


FIGURE 9

ABSORPTION OIL PRESSURE DROP



Hole Velocity

FIGURE 10

Mayfield, et. al.[9]

WET TRAY PRESSURE DROP

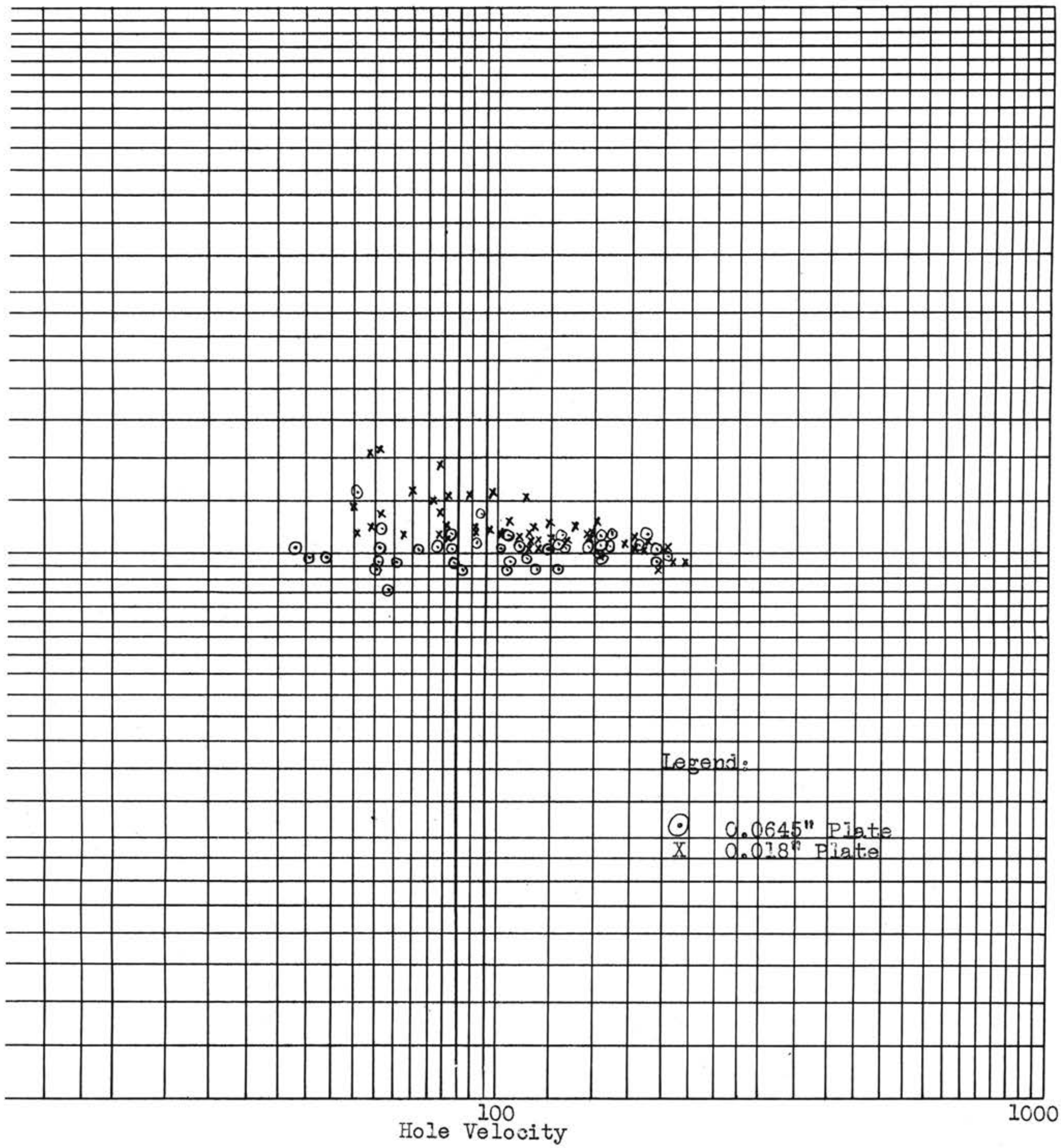


FIGURE 11

WET TRAY CORRELATION FACTOR, R

DISCUSSION OF RESULTS

Dry Tray Runs

The data representing the dry tray pressure drops are shown in Figures 2 through 8. These curves have an average slope of 2.01, which is to be expected when we examine the orifice coefficient equation. This equation sometimes appears in the form

$$V_o = C_o \sqrt{2gh}$$ [10]

The above equation is modified for our purposes to the form

$$V_o = K \sqrt{\Delta P}$$ [8]

where K is a constant and varies for each hole diameter. These values are tabulated in Tables I and II in Appendix B. These results appear to be inconclusive as to the effect of the ratio of hole diameter to plate thickness. It would appear, however, that the larger the hole diameter, the smaller the value for K. This was also found by Maddox[8] in his investigation.

In several of the early runs, an attempt was made to correlate the dry tray pressure drops by the method of "least squares" to determine the slope of the best curve drawn through points determined by experimental data. This method was found to be unreliable when comparing slopes for experimental points. It was found that a curve drawn by visual inspection was adequate within the range of experimental error. Sample calculations of this type may be found in Appendix C.

Wet Tray Runs

The data observed for trays having a liquid seal of 1", 2", and 3" are shown in graphical form by Figures 3 through 9. This data appears in tabular form in Tables III through IX in the Appendix B. These curves follow the general trend that was observed in Mayfield's[9] work. A sample curve of Mayfield's is shown in Figure 10.

Evaluation of these curves show that the pressure drop across the tray increases with an increase in the depth of the liquid seal on the tray.

The pressure drop across the wet tray can be correlated if the total pressure drop across the wet tray is assumed to be the sum of the pressure drop across the dry tray and the static liquid seal multiplied by some empirical correlation factor. This in equation form is

$$\Delta P_W = R\ (\Delta P_D + L.S.)$$

where ΔP_W = wet tray pressure drop

ΔP_D = dry tray pressure drop

R = empirical correction factor

L.S. = static liquid seal

The results of this correlation appear in Figure 11. They also appear in tabular form in Tables III through IX in the Appendix B.

It may be clearly seen from Figure 11 that the value of R approaches unity in all cases. The ratio of hole size to plate thickness appears to have very little influence upon the wet tray pressure drop. The values exceeding unity can probably be best explained by the added pressure necessary for the formation of bubbles in the liquid. The values greater than one are found for the lower rates of gas flow. The values of R that are less than unity probably result from the tendency of the gas flow to form a column in the liquid and thus reduce the pressure necessary to form a bubble. Since the extrapolation of dry plate pressure drop curves for low flow rates would fall below the experimental data range, it was felt that values computed for R would be unreliable. Therefore, they were omitted from the calculations.

It must be brought out that the heights of the clear liquid seals are known because predetermined amounts of water and oil were added; however, if a plate containing a weir were used, these depths would have to be determined on the plate after the gas flows were stopped due to the retention of gas in the liquid during flow conditions.

Absorption Oil Runs

Absorption oil was added to the 0.018" plate in the same manner as the water. It was found that the entrainment was excessive when a velocity great enough to prevent weeping was used with one inch of oil. Therefore, the results are doubtful for this depth of oil. When 2" and 3" of oil were used, this difficulty did not appear and the results are much more accurate. The difference in the values of "R" found for the oil run and the water run with the same plate and hole size appears to be negligible. If this is the case, the pressure drop for liquids of other viscosities and densities can be predicted in the same manner as that applied to water seals, making only a correction for the specific gravity of the liquid.

CONCLUSIONS AND RECOMMENDATIONS

The purpose of this investigation was to develop a means by which the pressure drop across a perforated tray having a liquid seal could be predicted. This was accomplished by assuming that the total pressure drop across the wet tray was the sum of the dry pressure drop, plus the depth of the liquid seal, multiplied by a wet tray pressure drop correlation factor. This in equation form is:

$$\Delta P_W = R\ (\Delta P_D + L.S.)$$

where:

ΔP_W = wet tray pressure drop, inches water

ΔP_D = dry tray pressure drop, inches water

L.S. = liquid seal, inches water

R = wet tray pressure drop correlation factor

This correlation factor approaches unity in all cases, as may be seen in Figure 11. It is proposed that this method of correlation can be applied to all liquids for predicting pressure drops.

An examination of the curves for wet tray pressure drops show that the pressure drops approach the dry tray pressure drop at higher hole velocities. This can be explained by the jetting effect through the hole at higher velocities. This jetting creates what is in effect a continuous column of air through the liquid. This is also the explanation for the lower values found for R. If this is true, then at some flow rate the effect of the liquid seal would become negligible and the pressure drop across the tray would be equal to the dry tray pressure drop.

No definite conclusions were drawn concerning the effect of the ratio of hole diameter to plate thickness on the pressure drop across the tray. However, it appears to have little, if any, influence on the dry tray pressure drop. This is exhibited to some extent in the values found for K.

Recommendations for future work are:

1. A series of experiments to evaluate the effect of viscosity on wet tray pressure drops.
2. Investigation of the effect of the ratio of hole diameter to plate thickness on dry tray pressure drops, when the plate involved has a much greater thickness than the plates used in the author's study.

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APPENDIX

APPENDIX A

THERMOMETER CALIBRATION

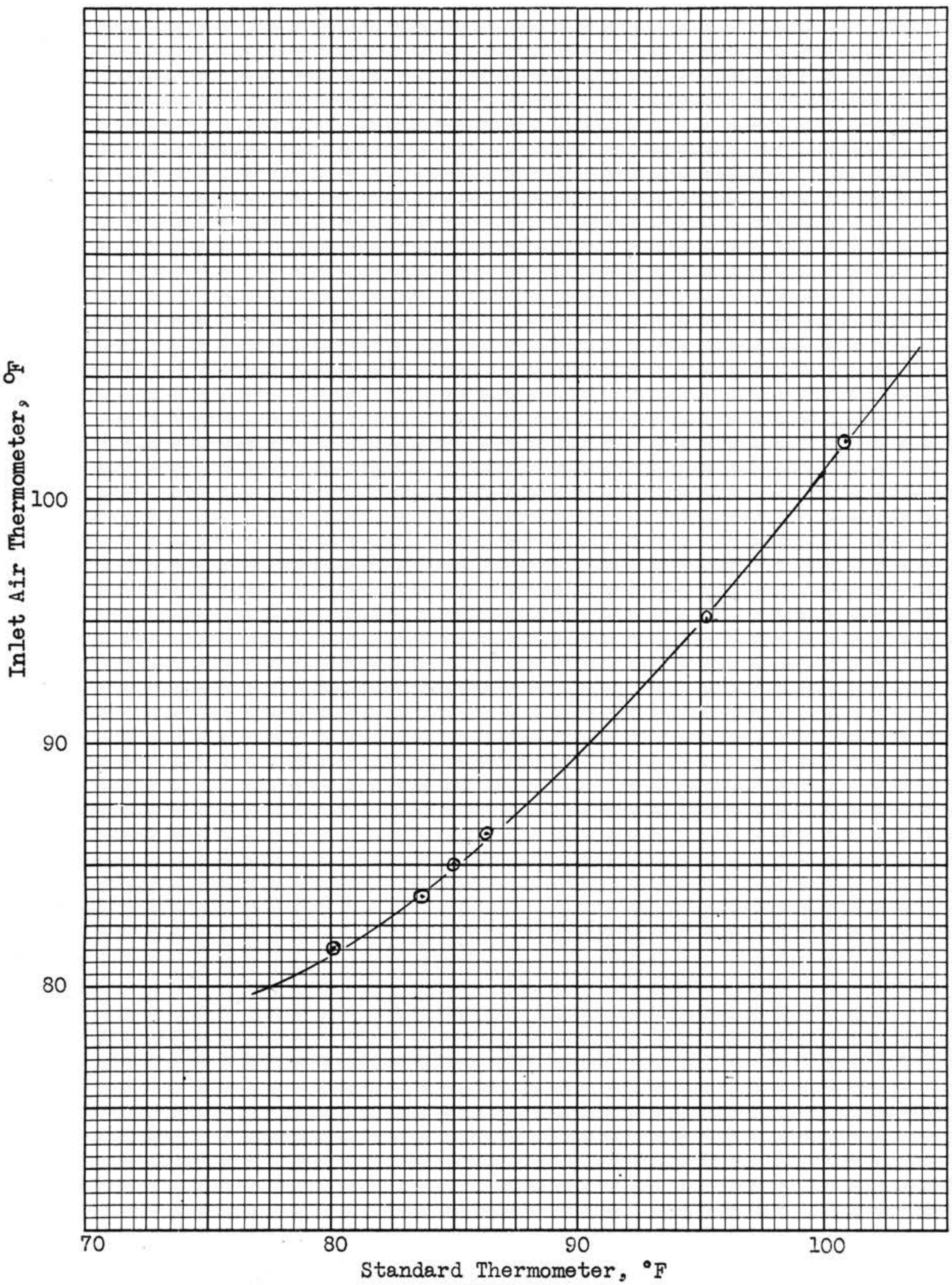

FIGURE 12

CALIBRATION CURVE, INLET AIR THERMOMETER

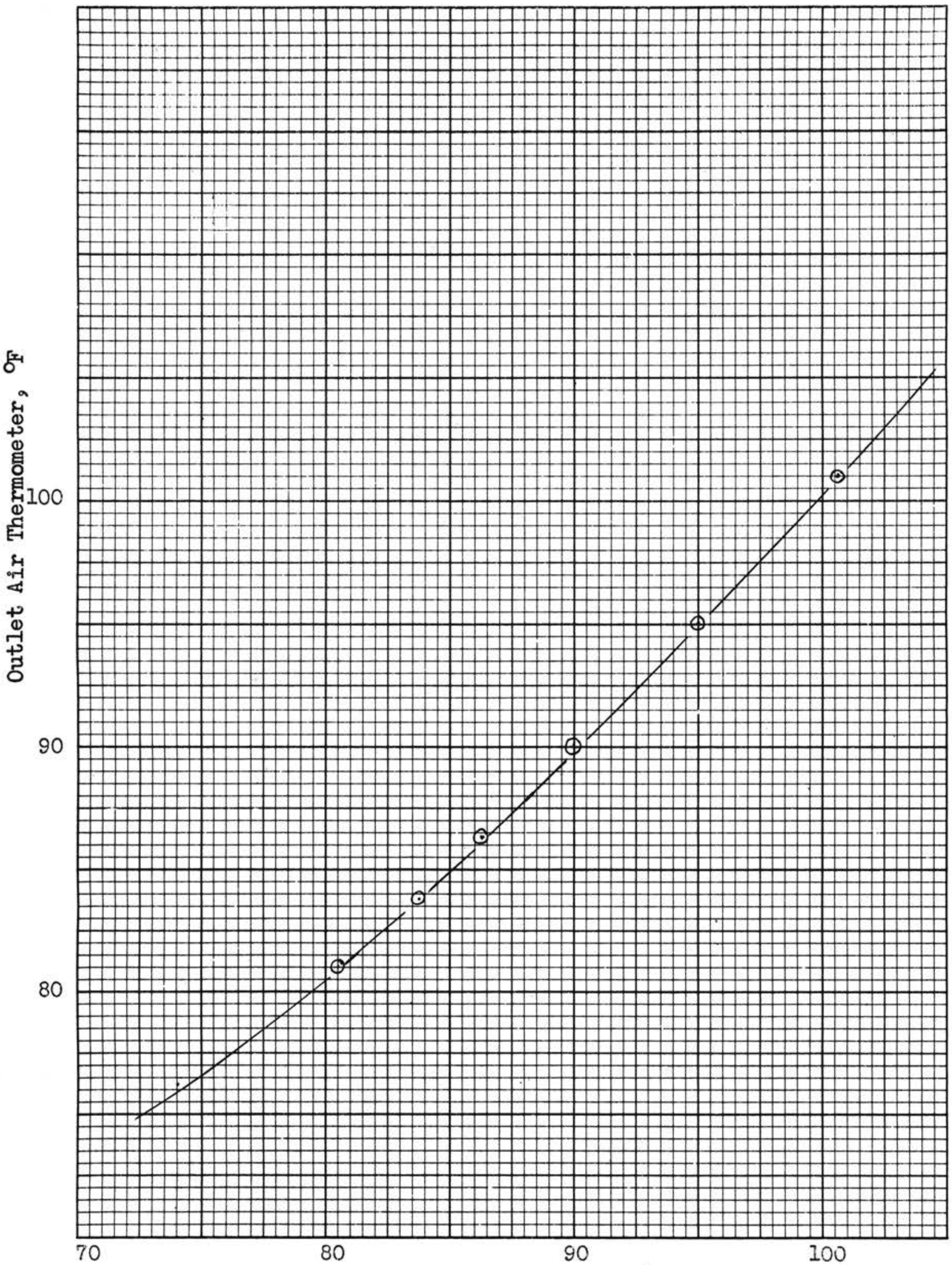

FIGURE 13
CALIBRATION CURVE, OUTLET AIR THERMOMETER

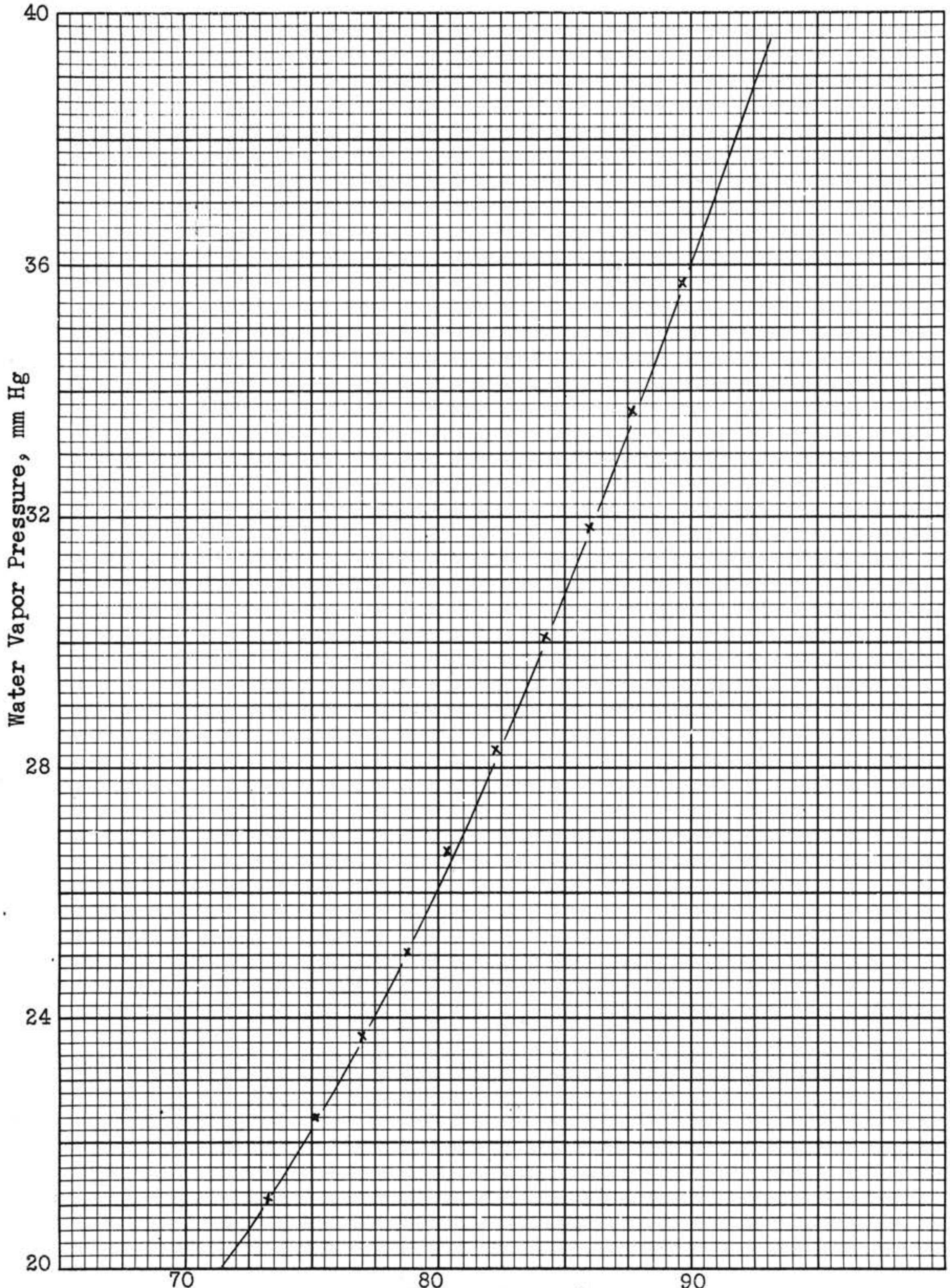

FIGURE 14
VAPOR PRESSURE OF WATER[10]

APPENDIX B

PRESSURE DROP DATA

TABLE I

DRY TRAY PRESSURE DROP

0.0645" Plate

Hole Size Inches	Time, sec, for 0.1 ft^3	Pressure Drop Inches Water	Hole Velocity ft/sec	K
0.035	63.4	17.12	219.0	52.9
	73.0	13.68	192.5	52.1
	82.5	10.36	169.0	51.3
	101.0	7.15	138.0	52.2
	149.0	3.30	95.0	
0.063	17.29	22.11	252.0	53.6
	19.20	17.95	226.0	53.4
	23.1	13.0	188.0	52.4
	30.4	7.52	143.5	52.4
	54.6	2.81	79.6	47.4
0.125	6.81	17.69	161.0	38.4
	7.30	13.69	150.0	37.0
	8.35	10.23	131.5	41.1
	11.12	5.86	109.5	45.2
	18.40	2.02	59.4	41.8
	19.00	1.89	57.6	42.1

TABLE II

DRY TRAY PRESSURE DROP

0.018" Plate

Hole Size Inches	Time, sec, for 0.1 ft^3	Pressure Drop Inches Water	Hole Velocity ft/sec	K
0.035	61.5	22.64	230.0	48.3
	71.0	18.82	199.5	46.0
	84.5	13.74	167.5	45.3
	93.0	8.72	152.0	51.4
	101.8	7.90	139.0	49.5
	176.6	2.84	80.1	48.0
0.0555	28.4	21.46	199.5	43.1
	31.9	17.03	177.0	42.9
	36.7	12.53	153.0	43.3
	47.0	7.78	120.0	43.2
	71.1	3.06	79.5	45.4
0.073	15.82	18.34	206.0	48.3
	18.50	13.56	177.0	48.2
	22.45	9.08	145.1	48.3
	30.80	4.71	106.0	48.9
	48.0	1.92	68.2	49.1

TABLE III

WET TRAY PRESSURE DROP

0.0645" Plate 0.035" Hole

Liquid Seal	Time, sec, for 0.1 ft^3	Pressure Drop Inches Water	Hole Velocity ft/sec	R
1" Water	74.9	16.08	188.7	1.15
	86.5	12.27	163.3	1.13
	109.5	8.29	129.0	1.15
	150.0	5.28	94.3	1.23
	251.0	2.86	56.3	1.32
2" Water	67.1	17.93	211.0	.992
	78.7	15.08	179.5	1.10
	99.0	10.49	143.0	1.09
	137.1	6.77	103.0	1.13
	326.0	3.52	43.4	
3" Water	72.0	17.35	196.8	1.01
	90.2	13.32	156.8	1.11
	109.5	9.92	129.1	1.08
	151.9	6.87	93.1	1.11
	283.0	4.70	50.0	

TABLE IV

WET TRAY PRESSURE DROP

0.0645" Plate 0.063" Hole

Liquid Seal	Time, sec, for 0.1 ft^3	Pressure Drop Inches Water	Hole Velocity ft/sec	R
1" Water	25.9	12.32	168.0	1.07
	28.8	9.89	151.0	1.02
	43.2	5.40	100.6	1.02
	55.6	3.98	78.3	1.06
	71.0	3.02	61.4	1.08
2" Water	24.0	15.73	181.5	1.12
	24.6	13.49	176.0	1.01
	29.0	10.77	149.9	1.01
	33.0	8.85	131.8	1.01
	42.0	6.28	103.8	0.958
	66.5	3.84	65.7	0.960
	90.2	3.12	48.4	0.987
3" Water	22.8	16.04	191.5	0.955
	27.4	12.43	158.8	0.987
	33.0	9.88	131.8	1.01
	38.6	8.08	112.8	0.974
	51.8	5.89	84.7	0.957
	94.1	4.03	46.1	0.988

TABLE V

WET TRAY PRESSURE DROP

0.0645" Plate 0.125" Hole

Liquid Seal	Time, sec, for 0.1 ft^3	Pressure Drop Inches Water	Hole Velocity ft/sec	R
1" Water	13.25	5.47	83.2	1.10
	15.75	4.10	72.4	1.02
	18.8	2.87	60.5	0.948
	20.5	2.48	58.3	0.85
2" Water	8.25	11.94	132.6	0.94
	9.21	10.10	119.0	0.944
	10.65	7.89	102.7	0.938
	12.49	6.08	87.6	0.938
	18.08	3.96	60.6	0.965
3" Water	8.45	13.35	129.7	1.02
	10.10	10.80	109.0	1.07
	11.50	8.71	102.1	0.952
	13.42	7.06	81.6	1.03
	25.3	4.13	43.3	1.03

TABLE VI

WET TRAY PRESSURE DROP

0.018" Plate 0.035" Hole

Liquid Seal	Time, sec, for 0.1 ft^3	Pressure Drop Inches Water	Hole Velocity ft/sec	R
1" Water	67.2	18.97	211.0	0.968
	74.9	15.48	189.5	0.948
	100.0	10.81	141.8	1.15
	107.5	8.88	131.7	1.10
	111.3	8.47	127.2	1.11
	116.0	7.78	122.2	1.10
	187.0	4.11	75.8	1.25
	202.0	3.96	70.1	1.32
2" Water	64.4	21.79	220.5	0.964
	78.6	16.73	180.0	1.06
	91.2	12.69	155.5	1.05
	120.0	8.92	118.3	1.14
	173.9	5.89	81.3	1.26
3" Water	69.1	22.58	205.0	1.07
	80.6	17.44	176.0	1.08
	100.0	12.83	141.8	1.13
	158.3	8.07	89.5	1.29
	259.0	5.18	54.7	1.24

TABLE VII

WET TRAY PRESSURE DROP

0.018" Plate 0.0555" Hole

Liquid Seal	Time, sec, for 0.1 ft^3	Pressure Drop Inches Water	Hole Velocity ft/sec	R
1" Water	34.2	16.19	164.0	1.04
	40.3	12.74	140.0	1.11
	44.0	10.59	128.0	1.08
	54.5	7.30	103.7	1.10
	71.4	4.94	78.9	1.22
	91.8	3.62	61.5	1.29
	149.0	2.14	37.8	
2" Water	34.6	16.41	163.0	1.01
	39.0	13.38	144.0	1.03
	48.1	9.64	117.0	1.06
	62.2	6.70	90.7	1.10
	100.5	3.95	56.1	1.13
	207.0	2.74	27.2	
3" Water	35.3	17.37	159.5	1.04
	41.3	13.62	139.5	1.02
	50.8	10.23	111.0	1.10
	67.5	7.10	82.6	1.11
	136.1	4.31	41.3	

TABLE VIII

WET TRAY PRESSURE DROP

0.018" Plate   0.073" Hole

Liquid Seal	Time, sec, for 0.1 ft^3	Pressure Drop Inches Water	Hole Velocity ft/sec	R
1" Water	18.25	15.38	179.0	1.05
	20.7	12.13	157.8	1.04
	25.1	8.73	130.0	1.05
	30.0	6.45	108.8	1.08
	48.3	3.21	67.6	1.11
	224.0	1.80	14.5	
2" Water	17.95	16.55	182.0	1.02
	20.80	12.63	157.0	1.01
	26.60	8.51	123.0	1.02
	40.3	5.02	81.1	1.07
	71.3	3.30	45.8	
3" Water	19.2	16.56	170.0	1.08
	21.7	13.52	150.5	1.06
	26.5	10.13	123.2	1.08
	40.0	6.33	81.7	1.10
	79.6	4.22	41.1	
	603.0	3.60	5.44	

TABLE IX

ABSORPTION OIL PRESSURE DROP

0.018" Plate 0.073" Hole

Liquid Seal	Time, sec, for 0.1 ft^3	Pressure Drop Inches Water	Hole Velocity ft/sec	R
1" Oil	29.0	8.00	113.9	1.23
	33.5	6.4	98.3	1.25
	42.0	4.91	78.5	1.38
	56.5	3.37	58.3	1.41
	84.5	2.07	39.0	
2" Oil	22.6	12.05	146.1	1.09
	26.3	9.63	125.0	1.11
	30.6	7.62	107.5	1.10
	36.9	6.12	95.5	1.05
	53.4	4.95	61.7	1.40
3" Oil	21.7	14.39	151.8	1.12
	24.4	11.96	135.1	1.11
	27.8	9.80	118.6	1.09
	36.8	6.80	92.2	1.04
	55.9	4.55	59.0	1.03
	138.8	3.15	24.4	

APPENDIX C

SAMPLE CALCULATIONS AND NOMENCLATURE

SAMPLE CALCULATIONS

Dry Tray Run

Data: Pressure drop data for 0.0645" plate with 0.035" hole, time for 0.1 ft^3 actual = 63.4 sec., air temp. - 93° F, barometric pressure - 734.4 mm. Hg. ΔP = 17.12" H_2O

Area of column
inside diameter = 4 inches

$$\frac{\pi \times 4^2}{4 \times 144} = 0.0874 \text{ ft}^2$$

Volume of wet air

$$\frac{0.1}{63.4} = 0.00157 \text{ ft}^3/\text{sec}$$

Volume of dry air
vapor pressure of H_2O at 93° F = 40 mm Hg.

$$0.00157 \times \frac{734.4 - 40}{734.4} = 0.00148 \text{ ft}^3/\text{sec}$$

Area of hole

$$\frac{\pi \times (.035)^2}{4 \times 144} = 6.68 \times 10^{-6} \text{ft}^2$$

Hole Velocity

$$\frac{0.00148 \text{ ft}^3/\text{sec}}{6.68 \times 10^{-6} \text{ ft}^2} = 222 \text{ ft/sec}$$

Calculation of K

$$V_o = K\sqrt{\Delta P}$$

$$K = \frac{V_o}{\sqrt{\Delta P}}$$

$$K = \frac{222}{\sqrt{17.2}} = 53.7$$

Wet Tray Runs

Data: 0.0645" plate with 0.035" hole
2" H_2O liquid seal
hole velocity 244 ft/sec
ΔP wet = 17.93" H_2O

ΔP Dry at 244 ft/sec = 16.40" H_2O

Calculation of R

$$R = \frac{\Delta P_W}{\Delta P_D + L.S.}$$

$$R = \frac{17.93}{16.40 + 2.0} = .976$$

Method of Least Squares [12]

Data: 0.018" plate, 0.035" hole, dry

hole velocity	ΔP_D
85.5	7.31
79.2	6.40
73.8	5.36
66.1	4.37
60.9	3.58

General Equation Form:

$$y = K X^n$$

Let the hole velocity = x and ΔP_D = y
then X = log 10 x and Y = log 10 y

X	Y	X^2	XY
1.9320	0.8639	3.7326	1.6691
1.8987	0.8062	3.6051	1.5307
1.8681	0.7292	3.4898	1.3622
1.8202	0.6405	3.3131	1.1658
1.7846	0.5539	3.1848	0.9885
9.3036	3.5937	17.3254	6.7163

$\Sigma X = 9.3036$
$\Sigma Y = 3.5937$
$\Sigma X^2 = 17.3254$
$\Sigma XY = 6.7163$

Writing simultaneous equations

$$5A + \Sigma XB = \Sigma Y$$

$$XA + \Sigma X^2B = \Sigma XY$$

Solving for B, the slope of the curve through the experimental points

$$(1) \quad 5A + 9.3036B = 3.5937$$

$$(2) \quad 9.3036A + 17.3254B = 6.7163$$

rewriting (1) = $9.3036A + 17.3159B = 6.6886$

subtracting (1) from (2)

$$(2) \quad 9.3036A + 17.3254B = 6.7163$$

$$(1) \quad \underline{9.3036A + 17.3159B = 6.6886}$$

$$0.0095B = 0.0277$$

$$B = 2.92$$

Therefore, the slope of the best curve through the experimental points has a slope of 2.92.

NOMENCLATURE

C_o = orifice coefficient

DA = dry air

g = acceleration of gravity

Δh = head loss across orifice

K = a constant

ΔP = pressure drop, inches water

ΔP_D = pressure drop across dry tray

ΔP_W = pressure drop across wet tray

R = wet tray pressure drop correlation factor

V_o = velocity through hole

WA = wet air

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