

That is, readings should be taken across the horizontal and vertical axis of the pipe as shown on diagram D. The location of these points from the center is shown together with the accompanying table No. 1, which gives the distance from the center of the pipe to point of reading, expressed in per cent. of the pipe diameter.

To get exact results a small pipe should be divided into more zones than a pipe of larger diameter, as the ratio of frictional surface to cross sectional area is greater, hence the more static pressure in proportion to the impact pressure, which correspondingly reduces the velocity pressure.

The corresponding velocities for each of these readings should be determined and an average taken of all of these velocities in order to compute the air quantity. *Inasmuch as the velocity varies as the square root of the pressure, accurate results cannot be obtained by averaging the pressure readings and taking the corresponding velocity as the average.*

TABLE 1. PIPE TRAVERSE FOR PITOT TUBE READINGS

Distance from Center of Pipe to Point of Reading in Percent. of Pipe Diameter									
No. of Equal Areas in Traverse	No. of Readings	1st R.	2nd R.	3rd R.	4th R.	5th R.	6th R.	7th R.	8th R.
3	12	20.4	35.3	45.5					
4	16	17.7	30.5	39.4	46.6				
5	20	15.5	27.2	35.3	41.7	47.4			
6	24	14.5	25.0	32.3	38.2	43.3	47.9		
7	28	13.4	23.1	29.9	35.3	40.1	44.3	48.2	
8	32	12.5	21.6	28.0	33.2	37.6	41.5	45.1	48.4

The velocity may be determined from the velocity pressure by use of the formula.

$$v = 1096.5 \sqrt{\frac{P}{W}}$$

v = velocity in ft. per min.

P = pressure in in. of water.

W = weight of air in lb. per cu. ft. under the existing conditions of temperature, barometer and humidity.

With dry air at 70 deg. and 29.92 in. barometer,

$W = 0.0749$ whence the formula becomes

$$v = 4005 \sqrt{P}$$

With saturated air at 70 deg. and 29.92 in. barometer,

$W = 0.0735$ and

$$v = 4046 \sqrt{P}$$

For dry air at any temperature and pressure.

$$W = \frac{0.0028862B}{1 + 0.0021758T}$$

For moist air:

$$W = \frac{0.0028862B - 0.001088e}{1 + 0.0021758T}$$

where B = height of barometer in inches of mercury.

T = temperature in deg. Fahr.

e = vapor pressure.

(Source—W. H. Carrier.)

Where approximate results only are desired:

For circular pipe, multiply the velocity pressure taken at the center of the pipe by 0.81 or the velocity by 0.91.

For rectangular pipe, no definite factor can be given, which is even approximately correct, that will cover the varying proportions of width to height of the cross sectional area of rectangular ducts.

The Committee recommends the Pitot tube as a simple and convenient instrument for the measurement of air or gases, which, when used with the proper care and accuracy of reading, gives results with an error of less than 1½ per cent. with velocity pressure ranging from 0.1 in. upwards.

DIRECTIONS FOR FIELD TESTS WITH THE PITOT TUBE

For the information of those who are not familiar with the use of the Pitot Tube, the following explanation is appended by the Guide Publication Committee.

In determining the velocity and pressures of air in ducts by the use of a pitot tube, a hole must be punched in the duct preferably at least 10 diameters of the duct

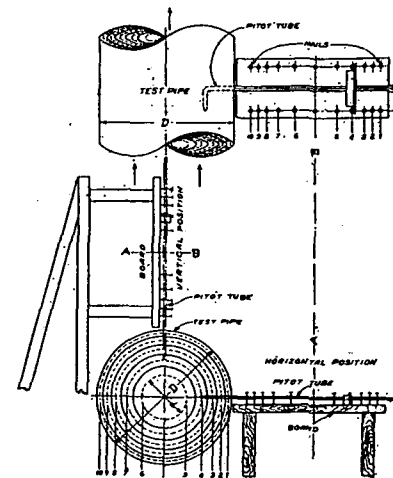


FIG. 2

from the fan inlet or outlet or from an elbow or change in cross section of the duct. For ordinary determinations, this hole should be made at the center of the top or bottom of the duct and made just large enough to admit the Pitot Tube. Where great accuracy is desired or where it is necessary to make readings close to the fan outlet or to elbows, both horizontal and vertical readings should be made.

In order to make readings at the points in the duct indicated in Table 1, in the above report, it will be found convenient to clamp the Pitot Tube in a block as indicated in Fig. 2 and construct a board with nails or pegs inserted so as to hold the tube at the desired points.

For measuring pressures exceeding 1 in., the ordinary manometer is sufficiently accurate. However, in ventilation systems, where the velocity pressure is usually below 1 in. the inclined manometer containing gasoline, usually colored for convenience in reading, will be found most convenient and accurate. Inclined manometers can be obtained with either a fixed inclination or constructed so that various inclina-