Advanced Math & Problem Solving

Course Outline

I. Review of determining areas

II. Review of determining air velocity

III. Review of determining quantity of air

IV. Review of perimeters (square & circle)

V. Determining perimeter of trapezoids

VI. Determining rubbing surfaces

VII. Coefficient of friction

VIII. Inches of water gauge

IX. Total ventilating pressure

X. Unit ventilating pressure

XI. Total resistance of an airway

XII. Units of work

XIII. Horsepower

XIV. Depth of Shaft- Atmospheric air pressure

XV. Equivalent orifice

XVI. Water calculations

XVII. Barrier Pillar formula & calculations

Formula Terms & Equations

a = sectional area of airway measured in square feet ($ft.^2$)

- *Rectangle or square*…….height x width = area

- *Trapezoid* ……. $\frac{\text{top width + bottom width}}{2}$ x height = area

- *Circle*……..¶ x r^2 = area

  Note: ¶ = 3.1416

v = velocity of air current measured in feet per minute (fpm)

- Smoke tube…….$\frac{\text{distance}}{\text{decimal time}}$

- Anemometer……

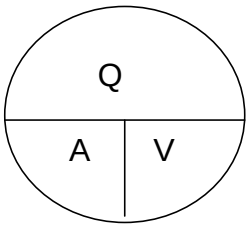
- Magnehelic…….V.P. = 4003 X $\sqrt{\text{i}}$
  (Velocity Pressure)
  note: see page 6

q = quantity of air, in cubic feet per minute (cfm)

- *Quantity of air (cfm).....* q = a x v

- *Velocity of air.....*……v = $\frac{q}{a}$ or

- *Area (when velocity and quantity are known).....* ……..a = $\frac{q}{v}$



Algebraic Circle

l = length of airway measured in linear feet

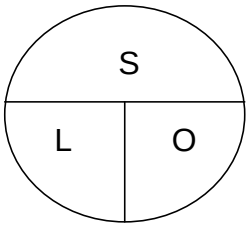
o = perimeter of airway measured in *linear feet*

- *Rectangle or Square*…… Top width +bottom width + side 1 + side 2
- Circle……¶ x diameter
- Trapezoid…… $Z = \sqrt{X^2 + Y^2}$
- (Pythagoras's Theorem) to find side Then: Top width +bottom width + side 1 + side 2

Note: see page 5

s = rubbing surface measured in square feet (ft^2)

- **Rubbing surface**..... s = lo



Algebraic Circle

k = coefficient of friction,
(The resistance of one square foot of rubbing surface to an air current with a velocity of one foot per minute) ***{.00000002}***

i = inches of water gauge; also given as w.g.

- **Water gauge**..... $i = \frac{p}{5.2}$

P = total ventilating pressure, in pounds (lbs.)

- **Total pressure**.....P = pa

p = unit ventilating pressure, in pounds per square feet ($lb./ft.^2$)

- **Unit pressure, lbs. per sq ft**..... $p = \frac{ksv^2}{a}$

R = total resistance of an airway, in pounds; equals P

- **Resistance, lbs**..... R = pa = P

u = units of work, in foot-pounds per minute

- **Units of power, ft lbs per min**.....……..u = ksv^3
  (The work performed each minute by a current of air with a velocity of a certain number of feet per minute.)

h = horsepower; also given as h.p. or H.P.
(One horsepower can move: 33,000 lbs. One foot vertically in one minute
: 330 lbs. 100 feet vertically in one minute
: 33 lbs. 1,000 feet vertically in one minute)

- **Horsepower**..... h = $\frac{u}{33{,}000}$.

1 horsepower = 746 watts/electricity

1 horsepower = .746 kilowatts/electricity

Hg = inches of mercury

- **Atmospheric air pressure**..... 1 (mercury) inch = 876 feet in air column
  (Depth of Shaft) (Barometric pressure)

Equivalent orifice.....E.O.= $\frac{.0004 \times Q^{New}}{\sqrt{i}}$
(Regulators)

Water (gallons)……1 cubic foot = 7.5 gallons

Water (weight)……1 cubic foot = 62.5 lbs.

Temperature conversion
Fahrenheit to Centigrade……C^o = 32 - F^o temp. x .555

Centigrade to Fahrenheit……F^o = C^o x 1.8 + 32

Barrier Pillar Formula…….
2 X (10’ + (2’ for every foot or part of a foot of seam height) + (5’ for every 100’ or part of 100’ of cover**)**

TRAPEZOID

PYTHAGORAS'S THEOREM

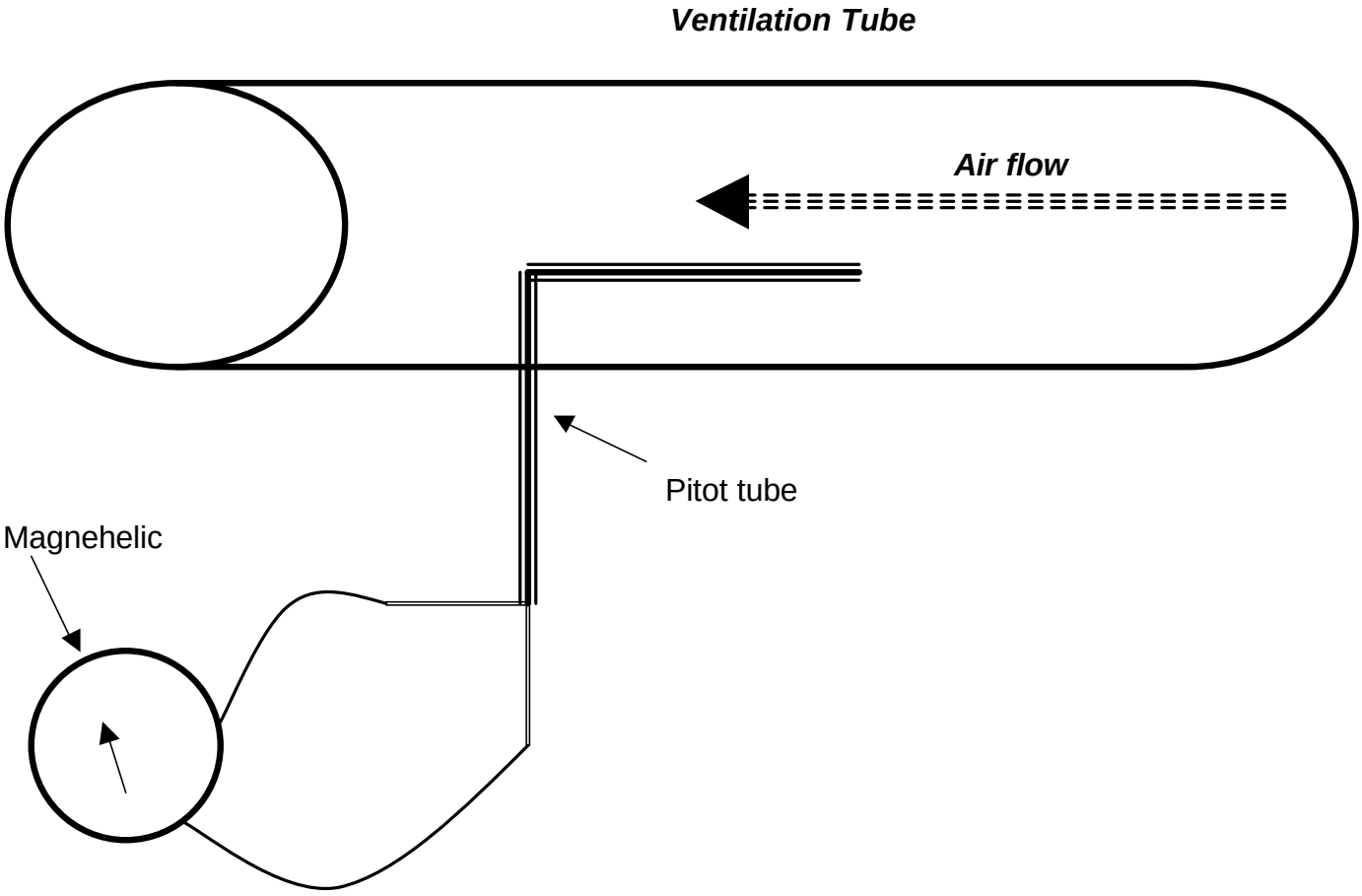
$$Z = \sqrt{X^2 + Y^2}$$

This formula is used to find the angle side of a right triangle. The height is given and the top and bottom portion of the trapezoid are given.
To find "X", use the following:

$$\frac{\text{BOTTOM - TOP}}{2} = X$$

Complete by finding the perimeter by adding the top + the bottom + the right side + the left side.

Taking an air reading using a Magnehelic and a Pitot tube: When high velocity air movement will damage the anemometer.



Take magnehelic reading (inches of water), and then use the formula;

4003 x $\sqrt{\text{i.}}$ = V.P. or ventilation pressure, which is in fpm

FORMULAS FOR METHANE EVALUATION

Q_G = Quantity of Methane Gas (cfm)

Q_R = Quantity of Return Air(cfm)

$\%_G$ = Percentage of Gas (methane detector reading)

Q_r = Quantity of Intake Air(cfm)

METHANOMETER CONVERSION (2 decimal places)

(detector) (decimal equivalent)
.5% of methane = .005
1.0% OF methane = .01

For quantity of methane in a 24 hour period:
Q_G x 60 (minutes) x 24 (hours) = $CF/CH_4/24$

The formula to find the quantity of gas when the percent of gas and the quantity of return air are known:

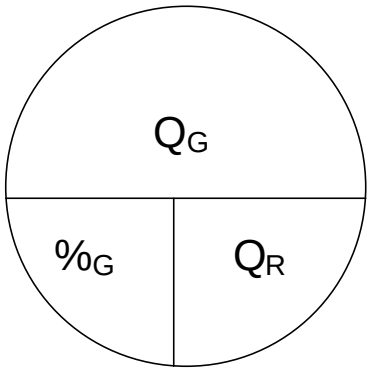
$$Q_G = Q_R \times \%_G$$

The formula to find the percent of gas when the quantity of gas and the quantity of return air are known:

$$\%_G = \frac{Q_G}{Q_R}$$

The formula to find the quantity of return air when the quantity of gas and the percent of gas are known:

$$QR = \frac{Q_G}{\%_G}$$



Algebraic Circle

The formula to find the quantity of return air when the quantity of gas and quantity of intake air are known:

$$Q_R = Q_G + Q_r$$

Dilution Formula

The formula to find the amount of ***air to add*** to reduce the percent of gas in an air current:

$$\text{Air to add} = \frac{Q_G}{\%_{G(\text{new gas reading})}} - Q_R$$

To find the ***total volume*** of air, do not subtract the return air volume.