ARMSTRONG
THEORETICAL STEAM LOSS CALCULATIONS (IP UNITS)

The basic formulas used to estimate the live steam loss of defective traps are as follows:

MASONEILAN'S FORMULA

$$(2.1)(C_V)\sqrt{\Delta P(P_i + P_o)} = \text{Blow Through}$$

Where: C_V = Flow Coefficient

$\Delta P = P_i - P_o$

P_i = Inlet Pressure (psia)

P_o = Outlet Pressure (psia)

NAPIER'S FORMULA

$$(51.43)(P_i)(A_0)$$

Where: A_0 = Area of Orifice

These are general formulas used in determining steam loss through and orifice. Based on data compiled in the field as well as actual test data from our lab in Michigan, certain changes have been made to these formulas.

In addition to inlet pressure, back pressure, and orifice size, piping configurations, severity of failure, and condensate load influence the quantity of steam loss through a trap. Consequently, service and very light condensate loads as found in drip and tracer service and the much higher condensate loads associated with coil and process applications.

Back pressure, service time and modulating conditions are incorporated in the calculations. Naturally, some information such as how many months a trap operates per year is determined by data supplied by plant personnel.

ARMSTRONG
ADJUSTED STEAM LOSS CALCULATIONS (IP UNITS)

Given from trap survey log sheet:

P.I. = Inlet pressure (psig)
P.O. = Outlet pressure (psig)

Step 1: Convert pressures to psia:

P.I. + 14.7 = P_i, actual inlet pressure (psia)
P.O. + 14.7 = P_o, actual outlet pressure (psia)

Step 2: Determine P_o , outlet pressure(psia) to be used in calculations:

If $P_o \geq 0.5 P_i$, then use P_o
If P0 < 0.5 P_i, then use 0.5 P_i

Step 3: Determine ΔP using P_i and P_o found in step 2:

$\Delta P = P_i - P_o$

Step 4: Calculate steam flow or blow through (lb/hr):

$$W = (0.9)(C_V)\sqrt{\Delta P(P_i + P_o)}$$ for coil & process applications

$$W = (1.4)(C_V)\sqrt{\Delta P(P_i + P_o)}$$ for tracer & drip applications

Where:
W = Steam flow or blow through (lb/hr)
C_V = Flow coefficient (trap specific)
P_i = Inlet pressure (psia)
P_o = Outlet pressure (psia)
$\Delta P = P_i - P_o$

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STEAM LOSS CALCULATION EXAMPLES (IP UNITS)

A. Coil Application

Given: P.I = 100 psig
P.O. = 0 psig
C_V = 32.1

Step 1: $P_i = 100 + 14.7 = \underline{114.7}$
$P_o = 0 + 14.7 = \underline{14.7}$

Step 2: $\frac{14.7}{114.7} = 0.13 < 0.5$, therefore

$P_o = (0.5)(Pi) = (0.5)(114.7) = \underline{57.35}$

Step 3: $\Delta P = P_i - P_o = 114.7 - 57.35 = 57.35$

Step 4: $W = (0.9)(32.1)\sqrt{57.35(114.7 + 57.35)} = 2{,}869$ lb/hr

B. Drip Application

Given: P.I = 100 psig
P.O. = 60 psig
C_V = 32.1

Step 1: $P_i = 100 + 14.7 = \underline{114.7}$
$P_o = 60 + 14.7 = \underline{74.7}$

Step 2: $\frac{74.7}{114.7} = 0.65 \geq 0.5$, therefore

$P_o = \underline{57.35}$

Step 3: $\Delta P = P_i - P_o = 114.7 - 74.7 = 40$

Step 4: $W = (1.4)(32.1)\sqrt{40(114.7 + 74.7)} = 3{,}912$ lb/hr

STEAM LOSS CALCULATION EXAMPLES (IP UNITS)
(Continued)

C. Tracer Application

Given: P.I = 100 psig
P.O. = 45 psig
C_V = 32.1

Step 1: $P_i = 100 + 14.7 = \underline{114.7}$
$P_o = 45 + 14.7 = \underline{59.7}$

Step 2: $\frac{59.7}{114.7} = 0.52 \geq 0.5$, therefore

$P_o = \underline{59.7}$

Step 3: $\Delta P = P_i - P_o = 114.7 - 59.7 = 55$

Step 4: $W = (1.4)(32.1)\sqrt{55(114.7 + 59.7)} = 4{,}401$ lb/hr