VALVE SIZING BY COMPUTATION

FORMULA KEY

A = Area of Pipe in $(inches)^2$
C_V = Valve Coefficient
EDR = Equivalent Direct Radiation (Sq. Ft.)
F = Pipe Area Factor (see Pipe Factors Table)
ft = Feet
G = Specific Gravity
ΔP = Pressure Drop, $P_1 - P_2$ psi
P_1 = Inlet Pressure, psia (psi + 14.7)
P_2 = Reduced Pressure, psia (psi + 14.7)
P_C = Pressure at Thermodynamic Critical Point, psia (water = 3206 psia)
P_V = Vapor Pressure, psia

$\Delta P_S = P_1 - P_V$ when $P_2 > P_V$

$\Delta P_S = P_1 - (.96 - .28\sqrt{P_V/P_C})\ P_V$ when $P_2 \leq P_V$

q = Liquid Flow Rate, U.S. gpm
Q = Flow Rate, SCFH
T = Absolute T (T + 460)°R
T_{SH} = Steam Superheat (°F) = Total Steam Temp. – Saturated Steam Temp.
$\bar{v}$ = Specific Volume $F_T^3/\#$
V = Velocity, FPM
W = Steam Flow, #/Hr.
W_S = Flow, #/Hr. Superheated Steam

To avoid interpolation or solve problems beyond the scope of the table, valve sizes may be determined by calculation as follows:

C_V

	SUBCRITICAL	CRITICAL
SATURATED STEAM:	$P_2 > .58\ P_1$ $C_V = \frac{W}{2.1\sqrt{\Delta P\ (P_1 + P_2)}}$	$P_2 \leq .58\ P_1$ $C_V = \frac{W}{1.71\ P_1}$
SUPERHEATED STEAM:	$P_2 > .55\ P_1$ $C_V = \frac{W\ (1 + .0007T_{SH})}{2.1\sqrt{\Delta P\ (P_1 + P_2)}}$	$P_2 \leq .55\ P_1$ $C_V = \frac{W\ (1 + .0007T_{SH})}{1.75\ P_1}$
GAS:	$P_2 > .5\ P_1$ $C_V = \frac{Q}{963}\sqrt{\frac{GT}{\Delta P\ (P_1 + P_2)}}$	$P_2 \leq .5\ P_1$ $C_V = \frac{Q\sqrt{GT}}{834\ P_1}$
LIQUID:	$P_2 > P_1 - .85\ \Delta P_S$ $C_V = q\sqrt{\frac{G}{\Delta P}}$	$P_2 \leq P_1 - .85\ \Delta P_S$ $C_V = .93q\sqrt{\frac{G}{\Delta P_S}}$

LOADS

WATER	$W = \frac{GPM}{2}$ X Temp. Rise (°F)
FUEL OIL	$W = \frac{GPM}{4}$ X Temp. Rise (°F)
AIR	$W = \frac{CFM}{900}$ X Temp. Rise (°F)
RADIATION	$W = \frac{f^2 EDR}{4}$
ABSORPTION	W = 16-20 #/Hr./Ton-Hr.
STM. ATOM	W = 0.1 #/Hr./#Oil

VELOCITY

STEAM $V = 2.4\frac{W\bar{v}}{A}$

FLOW

STEAM $W = \frac{.0433 \times V \times F}{\bar{v}}$

AIR & GASES $Q = \frac{.0259 \times V \times F \times P_1}{T}$

LIQUIDS $q = .0054 \times V \times F$

PIPE FACTORS FOR STANDARD (SCHEDULE 40) PIPE

SIZE	FACTOR	SIZE	FACTOR
1/8	.55	3 1/2	95
1/4	1.0	4	122
3/8	1.8	5	192
1/2	2.9	6	278
3/4	5.1	8	481
1	8.3	10	758
1 1/4	14	12	1076
1 1/2	20	14	1301
2	32	16	1699
2 1/2	46	18	2151
3	71	20	2673