

DETERMINATION OF CERTIFIED RELIEVING CAPACITIES

Determine the certified relieving capacity for the pressure ranges listed in NB-18 using the appropriate formulas and correction factors listed below.

Determination of Certified Relieving Capacity (W)

Method	Area Configuration	Formula	Resulting Capacity Units for W
Four-Device (Slope)		$W=SP$	SCFM (Air), lbm/hr (saturated steam), btu/hr (hot water)
Four-Device (Flow Factor)		$W=F\sqrt{(P-P_d)}$	GPM (US)
Coefficient of Discharge (Air @ 60° F and 14.7 psia)			SCFM (Air)
	Nozzle Full Lift	$W=18.331APK$	
	Curtain Area	$W=18.331\pi DLPK$	
	45 deg. Seat	$W=18.331\pi DLPK(0.707)$	
Coefficient of Discharge (Water @ 70° F)			GPM (US)
	Nozzle Full Lift	$W=38AK\sqrt{(P-P_d)}$	
	Curtain Area	$W=38\pi DLK\sqrt{(P-P_d)}$	
	45 deg. Seat	$W=38\pi DLK(0.707)\sqrt{(P-P_d)}$	
Coefficient of Discharge (Saturated Steam)			lbm/hr (saturated steam)
	Nozzle Full Lift	$W=51.5APK$	
	Curtain Area	$W=51.5\pi DLPK$	
	45 deg. Seat	$W=51.5\pi DLPK(0.707)$	

Special considerations for steam capacity calculations

- For steam pressures over 1500 psi and up to 3200 psi the value W shall be multiplied by the Napier correction factor F_N (if the correction factor is greater than 1.0):

$$F_N = (0.1906P - 1000)/(0.2292P - 1061)$$

- For superheated conditions the final capacity shall be calculated by multiplying the capacity determined from the formulas above by the appropriate Ksh factor found in ASME Section I table PG-68.7
- For pressures over 3200 psig the final capacity shall be calculated by multiplying the capacity determined from the formulas above by the appropriate Ksc factor found in ASME Section I table PG-67.5. The Napier correction factor (F_N) is not used.

Definition of Terms

W = Certified Relieving Capacity as determined by appropriate formula from table above

A = actual discharge area through valve at developed lift (sq. in.)

D = seat diameter (in.)

K = certified coefficient of discharge

L = lift (in.)

S = slope (SCFM/psia, lbm/hr/psia, or btu/hr/psia)

F = flow factor $GPM/\sqrt{(P-P_d)}$

P = absolute relieving pressure (psia) determined from table below

P_d = pressure at discharge of valve (psia)

P_{set} = marked set pressure (psig)

Determination of P for calculation of W

Service Fluid	ASME Code Designator	P
Air, Water, Steam	UV, NV (other than main steam valves)	$P = (P_{set} + 3 \text{ psi or } 10\%, \text{ whichever is greater}) + 14.7 \text{ psia}$
Air	UV (marked 20% OP)	$P = (P_{set} + 20\%) + 14.7 \text{ psia}$
Steam	V, NV (Class 1, 2, or 3 main steam valves)	$P = (P_{set} + 2 \text{ psi or } 3\%, \text{ whichever is greater}) + 14.7 \text{ psia}$
Steam	HV	$P = 34.7 \text{ psia (for 15 psi steam boilers)}$
Hot Water	HV	$P = (P_{set} + 10\%, \text{ whichever is greater}) + 14.7 \text{ psia}$

Capacity Conversions

- Multiply steam capacity in lbm/hr by 1,000 to obtain capacity in btu/hr
- For UV designated valves, use Section XIII Appendix IV to convert capacity in terms of a fluid other than the media for which the valve is officially rated.
- For NV designated valves, use Section III Appendix XVIII to convert capacity in terms of a fluid other than the media for which the valve is officially rated.

Non-reclosing devices

Device designs certified by the Flow Resistance method are not marked with a relieving capacity value. The certified flow resistance (K_{rg}, K_{rl}, K_{rgl}) is included on the nameplate and shall be used when determining total flow resistance of the pressure relief system and the flowing capacity it will relieve through the use of accepted engineering practices. The flow resistance subscripts "g," "l," or "gl" indicate that the device has been certified for fluids that are compressible (K_{rg}), incompressible (K_{rl}), or both (K_{rgl}). Unless otherwise noted, the pressure drop across a certified non-reclosing device shall be calculated using dimensions for standard pipe (STD). For pressure relief systems discharging directly to atmosphere which include a non-reclosing device installed within 8 pipe diameters of the vessel nozzle and having a discharge pipe no longer than 5 pipe diameters, system capacity can be determined from the equations found above using the listed minimum net flow area (MNFA) marked on the nameplate and an assumed coefficient of discharge equal to 0.62.