or is obtained from Fig. NE-7734.2(a)-1.

\[ A = \text{flow area, in}^2 \text{ (mm}^2) \]

\[ k = \text{ratio of specific heats, } C_v/C_p \]

\[ M = \text{molecular weight} \]

\[ P = \text{inlet pressure, psi (kPa)} \]

\[ P_o = \text{discharge pressure, psi (kPa)} \]

\[ Q = \text{ft}^3/\text{hr at } 14.7 \text{ psi and } 60^\circ \text{F (m}^3/\text{hr at 101 kPa and } 15^\circ \text{C)} \]

\[ r = \text{pressure ratio, } P_o/P \]

\[ T = \text{temperature, deg } K \]

\[ W = \text{lb/hr (kg/hr)} \]

The average of the coefficients of discharge \( K_D \) of the tests required shall be multiplied by 0.90 and their product shall be the coefficient \( K \) of that design. The coefficient of the design shall not be greater than 0.876 (the product of 0.9 \times 0.975).

(b) If any of the experimentally determined coefficients fall outside of a range of \( \pm 5\% \) of the average coefficient, the unacceptable valves shall be replaced by two valves of the same size and set pressure. Following the test of these valves, a new average coefficient shall be determined, excluding the replaced valve test results. If any individual coefficient is now outside of the \( \pm 5\% \) range, then the test shall be considered unsatisfactory and shall be cause for the ASME designated organization to refuse certification of the particular valve design.

**NE-7734.3 Calculation of Relieving Capacity**

(a) The certified relieving capacity of all sizes and pressures of a given design, for which the value of \( K \) has been established, shall be calculated by the appropriate formula given above multiplied by the coefficient \( K \). Values obtained from pressurized tests may be converted to equivalent vacuum from the above equation.

(b) The coefficient shall not be applied to valves whose beta ratio (the ratio of valve throat and inlet diameter) lies outside the range of 0.15 to 0.75, unless tests have demonstrated that individual coefficients of discharge, \( K_D \), for valves of the extreme ends of a larger range is within \( \pm 5\% \) of the average coefficient, \( K \). For designs where lift is used to determine the flow area, all valves shall have the same nominal lift-to-seat diameter ratio \( (L/D) \).

**NE-7735 Laboratory Acceptance of Relieving Capacity Tests**

Tests shall be conducted at a place where the testing facilities, methods, procedures, and person supervising the tests (Authorized Observer) meet the applicable requirements of ASME PTC 25-2001. The tests shall be made under the supervision of, and certified by, an Authorized Observer. The testing facilities, methods, procedures, and qualifications of the Authorized Observer shall be subject to the acceptance of the ASME Boiler and Pressure Vessel Committee on recommendation from a representative from an ASME designated organization. Acceptance of the testing facility is subject to review within each 5 year period. Capacity test data shall be submitted to the ASME designated organization for review and acceptance.

**NE-7800 MARKING, STAMPING WITH CERTIFICATION MARK, AND DATA REPORTS**

**NE-7810 PRESSURE AND VACUUM RELIEF VALVES**

**NE-7811 Marking and Stamping With Certification Mark**

Each pressure relief valve shall be plainly marked by the Certificate Holder with the required data below in such a way that the marking will not be obliterated in service. The data shall be in characters not less than \( \frac{3}{32} \text{ in. (2.5 mm)} \) high. The marking shall be placed on the valve or on a nameplate securely fastened to the valve. The Certification Mark with NV Designator shall be stamped on the valve or nameplate, but the other required data may be stamped, etched, impressed, or cast. The marking shall include the following:

(a) name, or an acceptable abbreviation, of the Certificate Holder

(b) Certificate Holder's design or type number

(c) size \([\text{NPS (DN)}, \text{the nominal pipe size}] \) of the valve inlet

(d) set pressure \( \text{psi (kPa)} \)

(e) certified capacity and overpressure in percent or psi in accordance with NE-7700 Pressure Relief Valves:

- \( \text{lb/hr (kg/hr)} \) of saturated steam for valves certified on steam, or
- \( \text{scfm (standard cubic feet per minute) at } 60^\circ \text{F (20°C) and 14.7 psi (101 kPa)} \) of air for valves certified on air or gas, or
- \( \text{gal/min (L/min) of water at } 70^\circ \text{F (20°C)} \) for valves certified on water

Vacuum Relief Valves:

- \( \text{scfh (standard cubic feet per hour) at } 60^\circ \text{F (20°C) and 14.7 psi (101 kPa)} \)

(f) applicable official Certification Mark, as shown in Table NCA-8100-1

In addition to the above, each pressure relief valve shall have a separate nameplate attached to the component that includes the marking requirements of NCA-8220 and NE-3593.3.
deflections in determining fatigue life. Where accelerated fatigue testing is employed, the deflection and number of cycles required shall be in accordance with Appendix II. Cumulative fatigue requirements can be satisfied in accordance with NE-3366.2(g) without additional testing by assuming that the slope of the fatigue curve is 4.3 (on a log-log plot) and that the curve passes through the test point.

(3) An individual design may be shown to comply by a design analysis in accordance with NE-3200. The stresses at every point in the bellows shall be determined by either elastic shell theory or by a plastic analysis, where applicable. Where an elastic analysis is employed, stress intensity tables 2A, 2B, and 4 in Section II, Part D, Subpart 1 and fatigue curves of Appendix I may be used to evaluate the design. The stability requirements of (c) above may be demonstrated by either (3)(a) or (3)(b) below:

(a) elastic stability calculations, provided that the ratio of the internal pressure at which the bellows is predicted to become unstable to the equivalent cold operating pressure exceeds 10; or

(b) the pressure test of NE-6230, provided that the test is conducted at 2.25 times the equivalent cold design pressure, and single rotation and universal joints are held at their design rotation angle or offset movement during the test and the requirements of NE-3366.2(b) are not exceeded by such a test. [The pressure test required by NE-6230 shall satisfy the instability test requirements for bellows larger than 50 in. (1 300 mm) in diameter.]

(f) The bellows manufacturer’s design report shall state which of the above procedures was utilized to verify the design.

(g) If there are two or more types of stress cycles which produce significant stresses, their cumulative effect shall be evaluated as stipulated in NE-3221.5(e)(5).

(h) Where necessary to carry the pressure, the cylindrical ends of the bellows may be reinforced by suitable collars; the design method used to assure that the stresses generated will not cause premature failure of the bellows material or weldment shall include the attachment weld between the bellows and end connections.

(i) If reinforcing rings are used, they shall have the same radius as the root of the convolution.

(j) The Design Specifications shall state the maximum allowable force that can be imposed on the connecting parts or shall request the bellows manufacturer to determine the force necessary to deflect the bellows a given distance, preferably the maximum movement to be absorbed.

NE-3367 Closures on Small Penetrations

Closures on penetrations of NPS 2 (DN 50) or less may be made by the use of closure fittings such as blind flanges, welded plugs, or caps manufactured in accordance with standards listed in Table NCA-7100-1.

NE-3700 ELECTRICAL AND MECHANICAL PENETRATION ASSEMBLIES

NE-3720 DESIGN RULES

(a) The design of the pressure retaining portion of the electrical and mechanical penetration assemblies shall be the same as for vessels (NE-3300).

(b) For closing seams in electrical and mechanical penetrations meeting the requirements of NE-4730(c), the closure head shall meet the requirements of NE-3325 using a factor $C = 0.30$. The fillet weld shall be designed using an allowable stress of $0.5S_{mc}$. 

(h) Where necessary to carry the pressure, the cylindrical ends of the bellows may be reinforced by suitable collars; the design method used to assure that the stresses generated will not cause premature failure of the bellows material or weldment shall include the attachment weld between the bellows and end connections.

(i) If reinforcing rings are used, they shall have the same radius as the root of the convolution.

(j) The Design Specifications shall state the maximum allowable force that can be imposed on the connecting parts or shall request the bellows manufacturer to determine the force necessary to deflect the bellows a given distance, preferably the maximum movement to be absorbed.

NE-3367 Closures on Small Penetrations

Closures on penetrations of NPS 2 (DN 50) or less may be made by the use of closure fittings such as blind flanges, welded plugs, or caps manufactured in accordance with standards listed in Table NCA-7100-1.