NC-7734. When tests are performed in accordance with NC-7734, the capacity shall be determined at no more than 2 psi (13.8 kPa) above the actual set pressure.

NC-7731.4 Blowdown.
(a) Valves set at or above 15 psig (100 kPa gage), having an adjustable blowdown construction, shall be adjusted prior to capacity certification testing so that the blowdown does not exceed 5% of the set pressure.
(b) Valves set below 15 psig (100 kPa gage), having adjustable blowdown construction, shall be adjusted prior to capacity certification testing so that blowdown does not exceed 3 psi (20 kPa) and shall not be less than 0.5 psi (4 kPa).

NC-7731.5 Drawings. Prior to capacity certification tests, the Certificate Holder shall submit drawings showing the valve construction to the Authorized Observer. The Authorized Observer shall submit the drawings and all test results to the ASME Designated Organization for review and acceptance.

NC-7731.6 Design Changes. When changes are made in the design of a pressure relief valve which affect the flow path, lift, or performance characteristics, new tests shall be performed in accordance with this subsection.

NC-7731.7 Restricted Lift Valves.
(a) The design of the lift restraining device shall be subject to review by an ASME Designated Organization.
(b) For main steam service under Subsection NC, all valves shall be capacity tested at each pressure and lift at a flow rating pressure not exceeding 103% of the valve set pressure as required in the applicable NC paragraphs.
(c) For air or gas service and for steam service other than in (a) above, all valves shall be capacity tested at each pressure and lift at a flow rating pressure not exceeding 110% of the set pressure as required in the applicable Code paragraph.
(d) For each valve tested, it shall be verified that actual measured capacity at restricted lift will equal or exceed the ASME rated capacity at full rated lift multiplied by the ratio of measured restricted lift to full rated lift.

NC-7732 Flow Model Test Method — Pilot or Power Operated Valves
NC-7732.1 Flow Capacity. When test facility limitations make it impossible to perform capacity tests of the full-scale pressure relief valves, flow models of three different sizes may be utilized as a basis for capacity certification. Such flow models shall be sized consistent with the capabilities of the accepted test laboratory where the tests will be conducted and shall accurately model those features, such as orifice size, valve lift, and internal flow configuration, which affect flow capacity. The test models need not be functional pressure relief valves, provided that other tests are conducted to demonstrate proper function of the valve design as prescribed in NC-7732.2. The relieving capacity of valve designs certified by use of flow models shall be established by the coefficient of discharge method similar to that outlined in NC-7734. The certified relieving capacity of all sizes and pressures of a given design for which the value of $K$ has been established, based on flow model tests in accordance with the method of NC-7734, shall not exceed the value calculated by the appropriate equation in NC-7734.2 multiplied by the coefficient $K$.

NC-7732.2 Demonstration of Function. The function of three valves of the design to be certified shall be demonstrated by tests. Such tests may be performed in conjunction with the capacity certification tests outlined above or as separate tests using production valves. The purpose of these tests is to demonstrate to the satisfaction of a representative from an ASME Designated Organization that the valve will open at set pressure within the required opening pressure tolerance, will achieve full lift, and will reclose within required blowdown. If required by test facility limitations, these tests may be conducted at reduced flow capabilities. Measurement of valve blowdown may not be possible.

NC-7733 Slope Method
(a) For pressure relief valves of a specific design, four valves of each combination inlet size and orifice size shall be tested. These four valves shall be set at pressures that will cover the appropriate range of pressures for which the valves are to be used or within the range of the authorized test facility.
(b) The instantaneous slope of each test point shall be calculated and averaged, where slope is defined as follows.
(1) For valves with set pressures of 15 psig (100 kPa gage) and greater, slope is defined as the measured capacity divided by the absolute inlet pressure.
(2) For valves with set pressures of 3 psig (20 kPa gage) up to but not including 15 psig (100 kPa), the slope is defined as the measured capacity divided by the quantity,

$$F = \left( \frac{k - 1}{k - 1} \right)^{2/k} \cdot \frac{1 - \left( \frac{k - 1}{k} \right)}{1 - r}$$

where

- $k = \frac{C_v}{C_p}$
- $P = \text{inlet pressure, psi (kPa)}$
- $P_o = \text{discharge pressure, psi (kPa)}$
- $r = \text{pressure ratio, } P_o/P$

(c) If any of the experimentally determined slopes fall outside of a range of ±5% of the average slope, the unacceptable valves shall be replaced by two valves of the same size and set pressure. Following the test of these
(c) Capacity certification tests for air or gas service with set pressures of 3 psig (20 kPa gage) up to but not including 15 psig (100 kPa gage) shall be conducted in accordance with the requirements of NC-7731 through NC-7734. When tests are performed in accordance with NC-7734, the capacity shall be determined at no more than 2 psi (13.8 kPa) above the actual set pressure.

NC-7731.4 Blowdown
(a) Valves set at or above 15 psig (100 kPa gage), having an adjustable blowdown construction, shall be adjusted prior to capacity certification testing so that the blowdown does not exceed 5% of the set pressure.
(b) Valves set below 15 psig (100 kPa gage), having adjustable blowdown construction, shall be adjusted prior to capacity certification testing so that blowdown does not exceed 3 psi (20 kPa) and shall not be less than 0.5 psi (4 kPa).

NC-7731.5 Drawings. Prior to capacity certification tests, the Certificate Holder shall submit drawings showing the valve construction to the Authorized Observer. The Authorized Observer shall submit the drawings and all test results to the ASME designated organization for review and acceptance.

NC-7731.6 Design Changes. When changes are made in the design of a pressure relief valve which affect the flow path, lift, or performance characteristics, new tests shall be performed in accordance with this Subarticle.

NC-7731.7 Restricted Lift Valves
(a) The design of the lift restraining device shall be subject to review by an ASME designated organization.
(b) For main steam service under Subsection NC, all valves shall be capacity tested at each pressure and lift at a flow rating pressure not exceeding 103% of the valve set pressure as required in the applicable NC paragraphs.
(c) For air or gas service and for steam service other than in (a) above, all valves shall be capacity tested at each pressure and lift at a flow rating pressure not exceeding 110% of the set pressure as required in the applicable Code paragraph.
(d) For each valve tested, it shall be verified that actual measured capacity at restricted lift will equal or exceed the ASME rated capacity at full rated lift multiplied by the ratio of measured restricted lift to full rated lift.

NC-7732 Flow Model Test Method — Pilot or Power Operated Valves
NC-7732.1 Flow Capacity. When test facility limitations make it impossible to perform capacity tests of the full-scale pressure relief valves, flow models of three different sizes may be utilized as a basis for capacity certification. Such flow models shall be sized consistent with the capabilities of the accepted test laboratory where the tests will be conducted and shall accurately model those features, such as orifice size, valve lift, and internal flow configuration, which affect flow capacity. The test models need not be functional pressure relief valves, provided that other tests are conducted to demonstrate proper function of the valve design as prescribed in NC-7732.2. The relieving capacity of valve designs certified by use of flow models shall be established by the coefficient of discharge method similar to that outlined in NC-7734. The certified relieving capacity of all sizes and pressures of a given design for which the value of K has been established, based on flow model tests in accordance with the method of NC-7734, shall not exceed the value calculated by the appropriate formula in NC-7734.2 multiplied by the coefficient K.

NC-7732.2 Demonstration of Function. The function of three valves of the design to be certified shall be demonstrated by tests. Such tests may be performed in conjunction with the capacity certification tests outlined above or as separate tests using production valves. The purpose of these tests is to demonstrate to the satisfaction of a representative from an ASME designated organization that the valve will open at set pressure within the required opening pressure tolerance, will achieve full lift, and will reclose within required blowdown. If required by test facility limitations, these tests may be conducted at reduced flow capabilities. Measurement of valve blowdown may not be possible.

NC-7733 Slope Method
(a) For pressure relief valves of a specific design, four valves of each combination inlet size and orifice size shall be tested. These four valves shall be set at pressures that will cover the appropriate range of pressures for which the valves are to be used or within the range of the authorized test facility.

(b) The instantaneous slope of each test point shall be calculated and averaged, where slope is defined as follows.
1. For valves with set pressures of 15 psig (100 kPa gage) and greater, slope is defined as the measured capacity divided by the absolute inlet pressure.
2. For valves with set pressures of 3 psig (20 kPa gage) up to but not including 15 psig (100 kPa gage), slope is defined as the measured capacity divided by the quantity:

\[ F = \sqrt{\frac{k}{k-1}} \left( \frac{1}{r} \right)^{\frac{k}{k-1}} \left( \frac{1}{1-r} \right) \]

where
- \( k = \) ratio of specific heats, \( C_v / C_p \)
- \( P = \) inlet pressure, psi (kPa)
NC-7734. When tests are performed in accordance with NC-7734, the capacity shall be determined at no more than 2 psi (13.8 kPa) above the actual set pressure.

NC-7731.4 Blowdown.
(a) Valves set at or above 15 psig (100 kPa gage), having an adjustable blowdown construction, shall be adjusted prior to capacity certification testing so that the blowdown does not exceed 5% of the set pressure.
(b) Valves set below 15 psig (100 kPa gage), having adjustable blowdown construction, shall be adjusted prior to capacity certification testing so that blowdown does not exceed 3 psi (20 kPa) and shall not be less than 0.5 psi (4 kPa).

NC-7731.5 Drawings. Prior to capacity certification tests, the Certificate Holder shall submit drawings showing the valve construction to the Authorized Observer. The Authorized Observer shall submit the drawings and all test results to the ASME designated organization for review and acceptance.

NC-7731.6 Design Changes. When changes are made in the design of a pressure relief valve which affect the flow path, lift, or performance characteristics, new tests shall be performed in accordance with this Subarticle.

NC-7731.7 Restricted Lift Valves.
(a) The design of the lift restraining device shall be subject to review by an ASME designated organization.
(b) For main steam service under Subsection NC, all valves shall be capacity tested at each pressure and lift at a flow rating pressure not exceeding 103% of the valve set pressure as required in the applicable NC paragraphs.
(c) For air or gas service and for steam service other than in (a) above, all valves shall be capacity tested at each pressure and lift at a flow rating pressure not exceeding 110% of the set pressure as required in the applicable Code paragraph.
(d) For each valve tested, it shall be verified that actual measured capacity at restricted lift will equal or exceed the ASME rated capacity at full rated lift multiplied by the ratio of measured restricted lift to full rated lift.

NC-7732 Flow Model Test Method — Pilot or Power Operated Valves

NC-7732.1 Flow Capacity. When test facility limitations make it impossible to perform capacity tests of the full-scale pressure relief valves, flow models of three different sizes may be utilized as a basis for capacity certification. Such flow models shall be sized consistent with the capabilities of the accepted test laboratory where the tests will be conducted and shall accurately model those features, such as orifice size, valve lift, and internal flow configuration, which affect flow capacity. The test models need not be functional pressure relief valves, provided that other tests are conducted to demonstrate proper function of the valve design as prescribed in NC-7732.2. The relieving capacity of valve designs certified by use of flow models shall be established by the coefficient of discharge method similar to that outlined in NC-7734. The certified relieving capacity of all sizes and pressures of a given design for which the value of $K$ has been established, based on flow model tests in accordance with the method of NC-7734, shall not exceed the value calculated by the appropriate formula in NC-7734.2 multiplied by the coefficient $K$.

NC-7732.2 Demonstration of Function. The function of three valves of the design to be certified shall be demonstrated by tests. Such tests may be performed in conjunction with the capacity certification tests outlined above or as separate tests using production valves. The purpose of these tests is to demonstrate to the satisfaction of a representative from an ASME designated organization that the valve will open at set pressure within the required opening pressure tolerance, will achieve full lift, and will reclose within required blowdown. If required by test facility limitations, these tests may be conducted at reduced flow capabilities. Measurement of valve blowdown may not be possible.

NC-7733 Slope Method

(a) For pressure relief valves of a specific design, four valves of each combination inlet size and orifice size shall be tested. These four valves shall be set at pressures that will cover the appropriate range of pressures for which the valves are to be used or within the range of the authorized test facility.
(b) The instantaneous slope of each test point shall be calculated and averaged, where slope is defined as follows.
(1) For valves with set pressures of 15 psig (100 kPa gage) and greater, slope is defined as the measured capacity divided by the absolute inlet pressure.
(2) For valves with set pressures of 3 psig (20 kPa gage) up to but not including 15 psig (100 kPa gage), slope is defined as the measured capacity divided by the quantity

$$
[F(P - P_o)]^{1/2}
$$

where

$$
F = \left( \frac{k}{k - 1} \right)^{2/k} \frac{1 - \left( \frac{k - 1}{k} \right)^{2/k}}{1 - r}
$$

$k$ = ratio of specific heats, $C_v/C_p$
$P$ = inlet pressure, psi (kPa)
$P_o$ = discharge pressure, psi (kPa)
$r$ = pressure ratio, $P_o/P$

(c) If any of the experimentally determined slopes fall outside of a range of ±5% of the average slope, 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 slope shall be determined, excluding
(b) Valves set below 15 psig (100 kPa gage), having adjustable blowdown construction, shall be adjusted prior to capacity certification testing so that blowdown does not exceed 3 psi (20 kPa) and shall not be less than 0.5 psi (4 kPa).

NC-7731.5 Drawings. Prior to capacity certification tests, the Certificate Holder shall submit drawings showing the valve construction to the Authorized Observer. The Authorized Observer shall submit the drawings and all test results to the ASME designated organization for review and acceptance.

NC-7731.6 Design Changes. When changes are made in the design of a pressure relief valve which affect the flow path, lift, or performance characteristics, new tests shall be performed in accordance with this Subarticle.

NC-7731.7 Restricted Lift Valves.
(a) The design of the lift restraining device shall be subject to review by an ASME designated organization.
(b) For main steam service under Subsection NC, all valves shall be capacity tested at each pressure and lift at a flow rating pressure not exceeding 103% of the valve set pressure as required in the applicable NC paragraphs.
(c) For air or gas service and for steam service other than in (a) above, all valves shall be capacity tested at each pressure and lift at a flow rating pressure not exceeding 110% of the set pressure as required in the applicable Code paragraphs.
(d) For each valve tested, it shall be verified that actual measured capacity at restricted lift will equal or exceed the ASME rated capacity at full rated lift multiplied by the ratio of measured restricted lift to full rated lift.

NC-7732 Flow Model Test Method — Pilot or Power Operated Valves

NC-7732.1 Flow Capacity. When test facility limitations make it impossible to perform capacity tests of the full-scale pressure relief valves, flow models of three different sizes may be utilized as a basis for capacity certification. Such flow models shall be sized consistent with the capabilities of the accepted test laboratory where the tests will be conducted and shall accurately model those features, such as orifice size, valve lift, and internal flow configuration, which affect flow capacity. The test models need not be functional pressure relief valves, provided that other tests are conducted to demonstrate proper function of the valve design as prescribed in NC-7732.2. The relieving capacity of valve designs certified by use of flow models shall be established by the coefficient of discharge method similar to that outlined in NC-7734. The certified relieving capacity of all sizes and pressures of a given design for which the value of K has been established, based on flow model tests in accordance with the method of NC-7734, shall not exceed the value calculated by the appropriate equation in NC-7734.2 multiplied by the coefficient K.

NC-7732.2 Demonstration of Function. The function of three valves of the design to be certified shall be demonstrated by tests. Such tests may be performed in conjunction with the capacity certification tests outlined above or as separate tests using production valves. The purpose of these tests is to demonstrate to the satisfaction of a representative from an ASME designated organization that the valve will open at set pressure within the required opening pressure tolerance, will achieve full lift, and will reclose within required blowdown. If required by test facility limitations, these tests may be conducted at reduced flow capabilities. Measurement of valve blowdown may not be possible.

NC-7733 Slope Method

(a) For pressure relief valves of a specific design, four valves of each combination inlet size and orifice size shall be tested. These four valves shall be set at pressures that will cover the appropriate range of pressures for which the valves are to be used or within the range of the authorized test facility.

(b) The instantaneous slope of each test point shall be calculated and averaged, where slope is defined as follows.

(1) For valves with set pressures of 15 psig (100 kPa gage) and greater, slope is defined as the measured capacity divided by the absolute inlet pressure.

(2) For valves with set pressures of 3 psig (20 kPa gage) up to but not including 15 psig (100 kPa gage), slope is defined as the measured capacity divided by the quantity

\[
\left[ \frac{P}{P_{o} - P_{3}} \right]^{1/2}
\]

where

\[
F = \frac{k}{\frac{k - 1}{k^{2/k}} \left[ \frac{1 - (r)^{k - 1}}{1 - r} \right]}
\]

- \( k \) = ratio of specific heats, \( C_{v}/C_{p} \)
- \( P \) = inlet pressure, psi (kPa)
- \( P_{o} \) = discharge pressure, psi (kPa)
- \( r \) = pressure ratio, \( P_{o}/P \)

(c) If any of the experimentally determined slopes fall outside of a range of ±5% of the average slope, 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 slope shall be determined, excluding the replaced valve test results. If any individual slope is now outside of the ±5% range, then the tests shall be considered unsatisfactory and shall be cause for the ASME designated organization to refuse certification of the particular valve design.
nc-7734. When tests are performed in accordance with nc-7734, the capacity shall be determined at no more than 2 psi (13.8 kPa) above the actual set pressure.

**nc-7731.4 Blowdown.**

(a) Valves set at or above 15 psig (100 kPa gage), having an adjustable blowdown construction, shall be adjusted prior to capacity certification testing so that the blowdown does not exceed 5% of the set pressure.

(b) Valves set below 15 psig (100 kPa gage), having adjustable blowdown construction, shall be adjusted prior to capacity certification testing so that blowdown does not exceed 3 psi (20 kPa) and shall not be less than 0.5 psi (4 kPa).

**nc-7731.5 Drawings.** Prior to capacity certification tests, the Certificate Holder shall submit drawings showing the valve construction to the Authorized Observer. The Authorized Observer shall submit the drawings and all test results to the ASME designated organization for review and acceptance.

**nc-7731.6 Design Changes.** When changes are made in the design of a pressure relief valve which affect the flow path, lift, or performance characteristics, new tests shall be performed in accordance with this subsection.

**nc-7731.7 Restricted Lift Valves.**

(a) The design of the lift restraining device shall be subject to review by an ASME designated organization.

(b) For main steam service under subsection NC, all valves shall be capacity tested at each pressure and lift at a flow rating pressure not exceeding 110% of the valve set pressure as required in the applicable NC paragraphs.

(c) For air or gas service and for steam service other than in (a) above, all valves shall be capacity tested at each pressure and lift at a flow rating pressure not exceeding 110% of the valve set pressure as required in the applicable Code paragraph.

(d) For each valve tested, it shall be verified that actual measured capacity at restricted lift will equal or exceed the ASME rated capacity at full rated lift multiplied by the ratio of measured restricted lift to full rated lift.

**nc-7732 Flow Model Test Method — Pilot or Power Operated Valves**

**nc-7732.1 Flow Capacity.** When test facility limitations make it impossible to perform capacity tests of the full-scale pressure relief valves, flow models of three different sizes may be utilized as a basis for capacity certification. Such flow models shall be sized consistent with the capabilities of the accepted test laboratory where the tests will be conducted and shall accurately model those features, such as orifice size, valve lift, and internal flow configuration, which affect flow capacity. The test models need not be functional pressure relief valves, provided that other tests are conducted to demonstrate proper function of the valve design as prescribed in NC-7732.2. The relieving capacity of valve designs certified by use of flow models shall be established by the coefficient of discharge method similar to that outlined in NC-7734. The certified relieving capacity of all sizes and pressures of a given design for which the value of K has been established, based on flow model tests in accordance with the method of NC-7734, shall not exceed the value calculated by the appropriate equation in NC-7734.2 multiplied by the coefficient K.

**nc-7732.2 Demonstration of Function.** The function of three valves of the design to be certified shall be demonstrated by tests. Such tests may be performed in conjunction with the capacity certification tests outlined above or as separate tests using production valves. The purpose of these tests is to demonstrate to the satisfaction of a representative from an ASME designated organization that the valve will open at set pressure within the required opening pressure tolerance, will achieve full lift, and will relieve within required blowdown. If required by test facility limitations, these tests may be conducted at reduced flow capabilities. Measurement of valve blowdown may not be possible.

**nc-7733 Slope Method**

(a) For pressure relief valves of a specific design, four valves of each combination inlet size and orifice size shall be tested. These four valves shall be set at pressures that will cover the appropriate range of pressures for which the valves are to be used or within the range of the authorized test facility.

(b) The instantaneous slope of each test point shall be calculated and averaged, where slope is defined as follows.

1. For valves with set pressures of 15 psig (100 kPa gage) and greater, slope is defined as the measured capacity divided by the absolute inlet pressure.

2. For valves with set pressures of 3 psig (20 kPa gage) up to but not including 15 psig (100 kPa gage), slope is defined as the measured capacity divided by the quantity:

\[
\left(\frac{P}{P_o}\right)^{1/2}
\]

where

\[
P = \left(\frac{k}{k - 1}\right)^{r/2} \left[\frac{1 - \left(\frac{k}{r}ight)^{k - 1}}{1 - r}\right]
\]

\[
k = \frac{C_v}{C_p}
\]

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

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

(c) If any of the experimentally determined slopes fall outside of a range of ±5% of the average slope, the unacceptable valves shall be replaced by two valves of the same size and set pressure. Following the test of these