

CASES OF ASME BOILER AND PRESSURE VESSEL CODE

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Case 2091-3

Buckling Pin Pressure Relief Devices

Section VIII, Division 1

Inquiry: Under what conditions may a buckling pin¹ pressure relief devices (herein referred to as buckling pin devices) be used to satisfy the requirements of para. UG-125?

Reply: It is the opinion of the Committee that buckling pin pressure relief devices may be used to satisfy the requirements of para. UG-125 provided the following requirements are met:

(a) *General.* The set pressure tolerance shall not exceed ± 2 psi for marked set pressures up to and including 40 psi and $\pm 5\%$ for marked set pressures above 40 psi.

(b) *Relieving Capacity.* The relieving capacity of the pressure relief system that uses a buckling pin device to meet the requirements of UG-125 shall be determined by one of the methods presented below.

(1) The relieving capacity of the pressure relief system that uses a buckling pin device stamped with the "UV" symbol as the sole relief device shall be determined by evaluating the certified capacity marked on the device and the characteristics of the system fluid and system components both upstream and downstream of the pressure relief device.

(2) The relieving capacity of the pressure relief system that uses a buckling pin device stamped with a "UD" symbol as the sole relief device shall be determined by a value calculated under the requirements of UG-127(a)(2)(a) using a coefficient of discharge or UG-127(a)(2)(b) using flow resistance.

(3) The relieving capacity of the pressure relief system that uses a UD stamped buckling pin device installed between the vessel and a UV stamped pressure relief valve shall be determined by evaluating the marked combination capacity as determined in accordance with para. (c)(2)(b) below and the effects of other system components (see UG135).

(c) *Application and Installation.* Each buckling pin device used to satisfy the requirements of UG-125 and this Case shall be stamped with a Code Symbol (see Figs. UG-129.1 or UG129.2), certified in accordance with UG-131(a) requirements for pressure relief valves for UV symbol stamped devices and for rupture disks for "UD" symbol stamped devices, and shall have been fabricated by a Manufacturer holding a valid Certificate of Authorization (UG-117). Buckling pin devices may be used as described below:

(1) A buckling pin device may be used as the sole pressure relieving device on a vessel.

(2) A UD stamped buckling pin device may be installed between a pressure relief valve and the vessel provided.

(a) the combination of the pressure relief valve and the buckling pin device is ample in capacity to meet the requirements of UG-125.

(b) the marked combination capacity of a pressure relief valve when installed with a buckling pin device between the inlet of the valve and the vessel shall be the rated capacity of the valve multiplied by a factor of 0.90 provided the resistance factor K_{RG} , K_{RGL} , and K_{RL} of the device is less than 6.0 or by a combination capacity factor established in accordance with UG-132 by applying the requirements for rupture disk devices.

(c) the space between a buckling pin device and a pressure relief valve shall be provided with a pressure gage, a try cock, free vent, or suitable telltale indication.

(d) the nominal pipe size of the buckling pin device shall not be less than the normal pipe size of the pressure relief valve unless the capacity and functioning of the specific combination of buckling pin device and pressure relief valve have been established by test in accordance with UG-132. In no case shall the device interfere with the proper functioning of the pressure relief valve.

(e) the set pressure of the buckling pin device is equal to or greater than 90% of the set pressure of the pressure relief valve.

(3) A buckling pin pilot operated pressure relief device² may be used to satisfy the requirements of UG-125, provided the requirements of UG-125 through

¹ A buckling pin device is a nonreclosing pressure relief device actuated by inlet static pressure and designed to function by the buckling of a pin axially loaded in compression.

UG-136 for pilot operated pressure relief valves are met and the nonreclosing pilot meets the requirements of this Case.

(4) Buckling pin devices shall be installed in accordance with UG-135. The requirements of UG-135(b)(1) for pressure relief valves shall apply to "UV" stamped buckling pin devices only.

(d) *Marking.* Buckling pin devices shall be plainly marked by the Manufacturer with the required data in such a way that the marking will not be obliterated in service. The marking may be placed on the device or on a plate or plates permanently attached to the device:

(1) the name, or an acceptable abbreviation of the Manufacturer

(2) Manufacturer's design or type number

(3) NPS _____ (the nominal pipe size of the device inlet)

(4) set pressure _____ psi

(5) buckling pin temperature

(6) flow direction

(7) buckling pin to buckling pin device identifier

(8) for devices to be "UV" stamped, certified capacity (as applicable):

(a) lb/hr of saturated steam at an overpressure 10% or 3 psi, whichever is greater for devices certified on steam complying with UG-131(b): or

(b) gal/min of water at 70° F at an overpressure of 10% or 3 psi, whichever is greater for devices certified on water: or

(c) SCFM standard cubic feet per minute at 60° F and 14.7 psia or lb/min of air at an overpressure of 10% or 3 psi, whichever is greater for devices certified on air. Devices that are capacity certified in accordance with UG-131©(2) shall be marked "at 20% overpressure."

(d) In addition to one of the fluids specified above, the Manufacturer may indicate the capacity in other fluids (see Appendix 11).

(e) ASME symbol as shown in Fig. UG-129.7

(9) for devices to be UD stamped

(a) minimum net flow area _____ sq. in.

(b) certified flow resistance K_{RG} _____

K_{RL} _____, K_{RGL} _____, as appropriate

(c) ASME symbol as shown in Fig. UG-129.2

2 A buckling pin pilot operated pressure relief device is a buckling pin self actuated pressure relief device actuated by inlet pressure in which the main valve is combined with and is controlled by a self-actuated buckling pin.

(10) Year built, or alternatively, a coding may be marked on the device such that the Manufacturer can identify the year the device was tested.

(11) This Case number.

(12) The buckling pin shall be marked according to one of the following methods:

(a) For buckling pin devices using a replaceable buckling pin to control set pressure, the buckling pin shall be marked with its lot number, and the information required by para. (d)(1), (d)(4), (d)(5), (d)(7), (d)(8)(e), or (d)(9)(c) as applicable (see note below), or

(b) For buckling pin devices that are single use and permanently assembled, the marking requirements of paras. (d)(9)(a), (d)(9)(b), and (d)(12)(a) shall be applied to the device, or

(c) For buckling pin devices that have a replaceable buckling pin within the sealed body per para. (e)(1), the buckling pin shall be marked with its lot number

NOTE: When the buckling pin size or configuration does not permit the use of an attached metal tag a metal tag may be attached using a nonmetallic connector with an adhesive that complies with Appendix 18 of Section VIII, Division I.

(e) *Minimum Mechanical, Material, and Construction Requirements.* Buckling pin devices shall meet the requirements of UG-136(A)(1), (a)(4), (a)(5), (a)(6), (b)(1), (B)(3), and (B)(4) and the following:

(1) Means shall be provided in the design for sealing all critical parts to ensure that these parts are original and unmodified. Seals shall be installed in a manner to prevent changing or modifying parts without breaking the seal. If the buckling pin is replaceable, this component is not required to be sealed if it is marked in accordance with para. (d)(12)(a). Seals shall be installed by the Manufacturer. For buckling pin devices larger than NPS ½ (DN15), the seal shall serve as a means of identifying the device Manufacturer.

(2) Adjacent sliding and sealing surfaces shall both be of a corrosion resistant material suitable for use with the fluid to be contained.

(3) Material used for buckling pins shall be controlled by the Manufacturer of the device by a specification ensuring the control of material properties.

(4) Buckling pins shall be manufactured by the device Manufacturer.

(5) If the design of the buckling pin device is such that liquid can collect on the discharge side, except as permitted in subpara. (e)(6) below, the device shall be equipped with a drain at the lowest point where liquid can collect (for installation, see UG-135).

(6) Devices that cannot be equipped with a drain as required in para. (e)(5) above because of a design or application may be used provided:

(a) the devices are used only on gas service where there is neither liquid discharged from the device nor liquid formed by condensation on the discharge side of the device.

(b) the devices are provided with a cover or discharge piping per UG-135(g) to prevent liquid or other contaminant from entering the discharge side if the device.

(c) the device is marked FOR GAS SERVICE ONLY in addition to the other required marking.

(f) *Inspection of Manufacturing of Buckling Pin Devices.* Buckling pin devices shall meet the requirements of UG-136(c)(3) for UV stamped devices and UG-137(c)(3) for UD stamped devices.

(g) *Production Testing of Buckling Pin Devices.* Each device to which the Code Symbol Stamp is to be applied shall be subjected to the following tests by the Manufacturer. The Manufacturer shall have a documented program for the application, calibration and maintenance of gages and instruments used during these tests.

(1) All pressure parts of UD stamped devices and primary pressure parts of UV stamped devices exceeding NPS 1 inlet size or 300 psi design pressure where the materials used are either cast or welded shall be tested at a pressure of at least 1.5 times the design pressure of the parts. These tests shall be conducted after all machining operations on the parts have been completed. There shall be no visible signs of leakage.

(2) The secondary pressure zone of each UV stamped device exceeding NPS 1 inlet size, when such devices are designed for discharge to a closed system, shall be tested with air or other gas at a pressure of at least 30 psi. There shall be no visible signs of leakage.

(3) Set pressure qualification of a buckling pin device shall be accomplished by completing set pressure testing in the device. At least two buckling pins from the same lot shall be tested in the device. For single use permanently assembled buckling pin devices having the same specification and configuration, to be supplied as a single lot, at least two completed devices shall be tested. The tests shall be conducted at the buckling pin temperature or according to para. (g)(4)(d). The tests shall be within the tolerance defined by para. (a).

(4) For all buckling pin lot qualification testing:

(a) Sample buckling pins selected from each lot shall be made from the same material and of the same form and size as those used in service.

(b) Test results shall be applicable only to buckling pins used in buckling pin devices supplied by the device Manufacturer.

(c) At least two buckling pins or two single use permanently assembled buckling pin devices from the same lot shall be tested using a method in para. (g)(4)(e) at the buckling pin temperature in accordance with para. (g)(4)(d).

(d) Test shall be conducted at the buckling pin temperature (as agreed between device Manufacturer and user) or at ambient temperature provided that one of the following methods is used:

(1) For qualification of a buckling pin lot where the buckling pin temperature is within the range -40°F to $+140^{\circ}\text{F}$, ambient temperature buckling pin testing or the method of para. (g)(4)(d)(2) may be followed.

(2) For qualification of a buckling pin lot at a single temperature beyond the range of para. (g)(4)(d)(1), at least two buckling pin tests shall be conducted at the specified buckling pin temperature.

(e) Buckling pin testing shall be complete according to para. (g)(3) or, except for single use permanently assembled buckling pin devices, using one or more of methods of para. (g)(e)(1) or (g)(e)(2) below:

(1) Lot qualification testing shall be done in a test buckling pin device of the same form and pressure area dimensions as that in which the buckling pins will be used. At least two set pressure tests shall be completed at the buckling pin temperature in accordance with para. (g)(4)(d). The test shall be within the tolerance defined in para. (a).

(2) The set pressure of a lot of buckling pins for a buckling pin device may be verified by a characterization test that determines the activation loading (force) under device opening conditions. The following characterization test conditions shall apply:

(a) The buckling pin retaining arrangement shall be the same for all characterization tests applied to a buckling pin device.

(b) Using buckling pins from the same lot as tested under para. (g)(3) or (g)(4)(e)(1) at least two components shall be tested to determine the activation force that correlates to the buckling pin device tested set pressure. The average of these tests defines the base force that shall be used to permit further buckling pin qualification using characterization rather than buck-

ling pin device set pressure testing. The following shall be used to define a Corrected Base Force that corresponds to the nominal set pressure of the buckling pin device:

Corrected Base Force = (Nominal Set Pressure) x (Average Base Force) / Average Tested Set Pressure per para (g)(3) or (G)(4)(e)(1)

(c) The qualification of additional buckling pin quantities or lots may use this Corrected Base Force in place of buckling pin device set pressure testing provided the buckling pins function at activation forces that are within $\pm 3\%$ of the Corrected Base Force

for set pressures above 40 psi. For set pressures below 40 psi, the tested components shall function at activation forces within a plus-minus tolerance of the Corrected Bas Force determined as follows:

(40) x 3% = \pm % tolerance for actual test forces (nominal set pressure (psi))

(h) *Welding and Other Requirements.* All welding, brazing, heat treatment, and nondestructive examination used in the construction of bodies, bonnets, yokes, and holders shall be performed in accordance with the applicable requirements of Section VIII, Division I.