ASME Code and Rupture Discs

ASME Code Concerning Rupture Disc Devices

ASME Section VIII, Division 1, 1998 Edition (ASME Code) provides rules for the use of rupture disc devices for overpressure protection. Within the scope of the ASME Code, rupture disc devices are characterized as non-reclosing pressure relief devices that may be used to satisfy relief requirements for overpressure protection of a pressure vessel.

ASME Code Rupture Disc Terminology

"A ***rupture disc device*** is a non-reclosing pressure relief device actuated by inlet static pressure and designed to function by the bursting of a pressure containing disc."

"A ***rupture disc*** is the pressure containing and pressure sensitive element of a rupture disc device."

"A ***rupture disc holder*** is the structure which encloses and clamps the rupture disc in position."

"The ***manufacturing design range*** is a range of pressure within which the marked burst pressure must fall to be acceptable for a particular requirement as agreed upon between the rupture disc manufacturer and the user or his agent."

"The ***specified disc temperature*** supplied to the rupture disc manufacturer shall be the temperature of the disc when the disc is expected to burst."

"A ***lot*** of rupture discs is those discs manufactured of a material at the same time, of the same size, thickness, type, heat, and manufacturing process including heat treatment."

"The ***minimum net flow*** area is the calculated net area after a complete burst of the disc with appropriate allowance for any structural members which may reduce the net flow area through the rupture disc device. The net flow area for sizing purposes shall not exceed the nominal pipe size area of the rupture disc device."

"The ***certified flow resistance factor K_R*** is a dimensionless factor used to calculate the velocity head loss that results from the presence of a rupture disc device in a pressure relief system."

Rupture Disc Performance Requirements

The ASME Code provides requirements for rupture disc performance. The ***rupture tolerance*** at the specified disc temperature shall not exceed ± 2 psi for marked pressures up to and including 40 psi and ± 5% for marked burst pressures above 40 psi.

The rupture disc must be marked at a pressure within the ***manufacturing range***. The manufacturing ranges available are defined in the product literature for each rupture disc model.

Rupture discs are typically manufactured to order where each order represents a lot. The ASME Code defines 3 methods of ***acceptance testing*** for rupture discs. The most common method requires that at least two discs from the lot be burst tested at the specified disc temperature. The results of these tests must fall within the rupture tolerance.

Rupture Disc Sizing Methodologies

The ASME Code defines three methodologies for sizing rupture disc devices.

The ***coefficient of discharge method*** (K_D) uses the calculated flow capacity of the device and then derates that capacity by a K_D of 0.62. This method is applicable only under the following conditions:

- The disc discharges to atmosphere
- The disc must be installed within 8 pipe diameters of the vessel nozzle
- The length of discharge piping must not exceed 5 pipe diameters
- The inlet and outlet piping is at least the same nominal size as the rupture disc device.

The ***resistance to flow method*** (K_R) has been adopted by the ASME Code for sizing relief systems when coefficient of discharge method does not apply. The rupture disc is treated as a flow resistive element within the relief system. The resistance of the rupture disc is denoted by the certified resistance factor K_R. The code requires the calculated relieving capacity of the system be multiplied by 0.90 to allow for uncertainties inherent in this method.

The ***combination capacity method*** is used when a rupture disc is installed on the inlet side of a pressure relief valve. Use a rupture disc of the same nominal size or larger than the valve's inlet and derate the valve capacity by 0.90 or a higher certified value for that disc/valve combination.

Manufacturer Certification

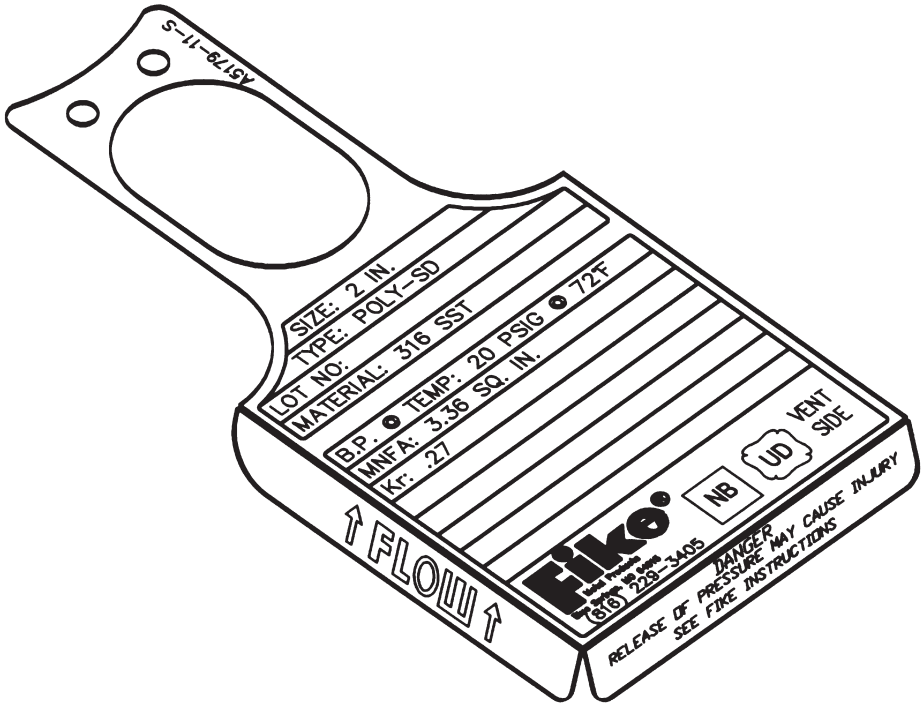
The ASME Code has provisions for the application of the UD Code symbol to rupture disc devices. The authorization to use the UD stamp is based on an audit by an ASME representative of various manufacturing, testing, and quality assurance systems. In addition, periodic validation tests are performed to insure close agreement between production discs and certification disc.

Rupture Disc Device Certification

In order to apply the UD symbol to a rupture disc, the rupture disc device family must be certified through testing by an authorized ASME designee. The testing involves bursting 3 discs from 3 different sizes within a product family. Each of these discs must burst within the ASME defined burst tolerance. Each of these discs is then mounted on an ASME certified flow test rig and flow tested to determine a K_R value. The certified flow resistance factor is published in the National Board of Boiler and Pressure Vessel Inspectors "Red Book".

Rupture Disc Marking Requirements

The ASME Code defines the minimum requirements for marking of rupture disc devices. Rupture discs certified to the current edition of the ASME code are marked as shown. Markings include minimum net flow area, certified flow resistance factor K_R, ASME UD code symbol and NB symbol.



ASME Application Requirements

The ASME Code defines certain sizing and pressure rating criteria for various applications of rupture discs. In the case of ***primary relief or sole relieving device*** (shown in fig. 1), it must be sized to prevent the pressure in the vessel from rising more than 10% or 3 psi, whichever is greater, above the maximum allowable working pressure (MAWP) of the vessel. In addition, the rupture disc marked burst pressure shall not exceed the MAWP.

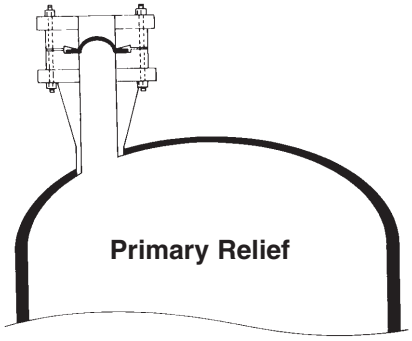


Figure 1 — Primary

The ASME Code allows rupture disc devices to be used in ***multiple*** as a ***secondary device*** to other rupture disc devices or pressure relief valves (shown in fig. 2). In this case, the secondary device is sized to prevent the pressure in the vessel from rising more than 16% or 4 psi, whichever is greater, above the MAWP. The burst pressure of the secondary device may be marked at a pressure not exceeding 105% of the MAWP.

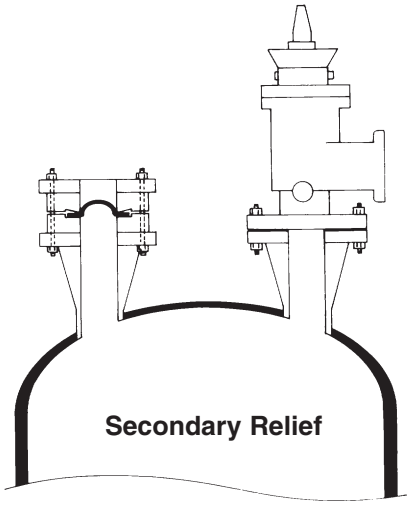


Figure 2 — Secondary

Another application allowed by the ASME Code is the use of a ***rupture disc in combination with a pressure relief valve*** (shown in figures 3 & 4). In this application, the rupture disc device seals the pressure relief valve from the vessel contents or downstream vapors. The disc/valve combination may be used as a primary or secondary relief device. The ASME Code provides guidelines for the use of disc/valve combinations.

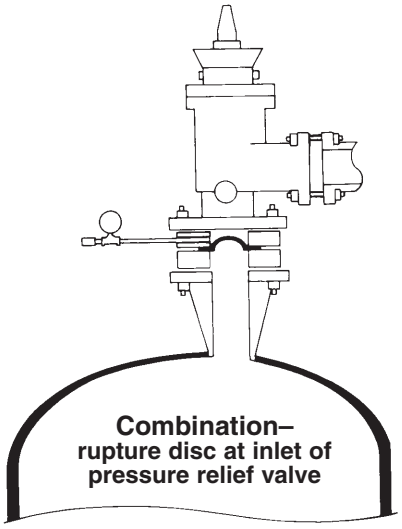


Figure 3 — Combination

A rupture disc may be installed between a pressure relief valve and the vessel provided:

- The combination provides ample capacity to meet the overpressure requirements.
- The rupture disc does not interfere with proper functions of the valve (i.e. rupture disc must be a non-fragmenting design).
- The marked capacity of the valve is de-rated by a combination capacity factor of 0.90 or a factor certified for the specific disc/valve combination.
- The space between the rupture disc and valve is provided with a pressure gage, try cock, free vent, or suitable telltale indicator. This arrangement must be capable of detecting a leak and/or preventing a buildup of pressure in the space because any pressure buildup will affect the relieving pressure on the process side of the disc.

A rupture disc may also be installed on the outlet of a pressure relief valve provided:

- The space between the valve and rupture disc is vented or the valve is designed so any accumulated pressure on the outlet of the valve will not affect the opening pressure of the valve.
- The marked burst pressure of the disc plus any downstream backpressure does not exceed the set pressure of the valve.
- The rupture disc provides sufficient capacity to permit flow through the valve without exceeding the allowable overpressure.
- The bonnet of the relief is vented.

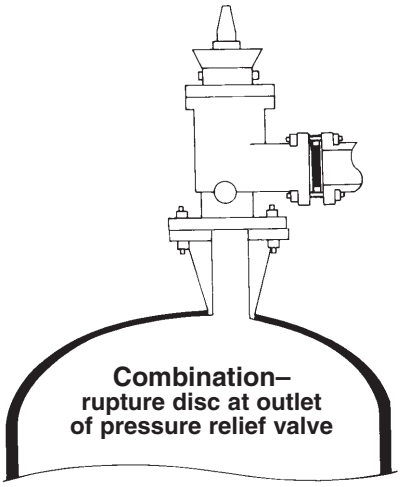


Figure 4 — Combination

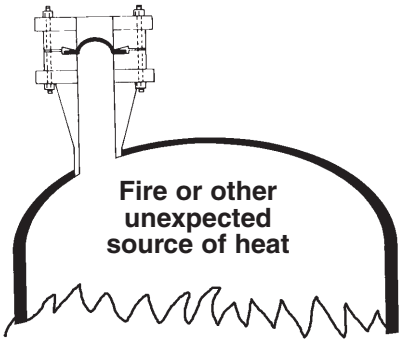


Figure 5 — External Fire

Where an a***dditinal hazard can be created by exposure of a pressure vessel to fire or other unexpected sources of external heat***, supplemental pressure relief devices shall be installed to protect against excessive pressure. A rupture disc in this application shall be capable of preventing the pressure from rising more than 21% above the MAWP and have a marked burst pressure not exceeding 110% of the MAWP. If the same rupture disc device is also used to meet non-fire pressure relief requirements, then the marked burst pressure shall not exceed the MAWP.

A rupture disc device intended ***primarily for protection against exposure of a pressure vessel to fire or other unexpected sources of heat*** may be used as follows, provided the vessel has no permanent supply connection and is used for storage of non-refrigerated liquefied compressed gases at ambient temperatures. The rupture disc shall be capable of preventing the pressure from rising more than 20% above the MAWP. The marked burst pressure shall not exceed the MAWP.

Fike CORPORATION

704 South 10th Street • Blue Springs, Missouri 64015-4263 U.S.A.
(816) 229-3405 • Telefax (816) 228-9277
Home Page: http//www.fike.com • e-mail: fmpsales@fike.com

September, 2002
Revised Issue

FORM NO. TB8100-8 902