Continental Disc® Corporation

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Fundamentals of Rupture Disc Devices

A Continental Disc Corporation Presentation

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Established in 1965, Continental Disc Corporation is a leading manufacturer of rupture disc devices for a variety of process industries, including chemical, petrochemical, petroleum refining, pharmaceutical, beverage, food/dairy, aerospace, gases, electronics and other markets worldwide. Choose Continental Disc Corporation for all your engineered pressure safety products which protect equipment, lives & the environment!

History of Rupture Discs

- The first use of rupture discs occurred sometime in the mid-1930's. The oil field industry used a flat piece of metal, typically lead, between flanges in a pipeline to prevent piping and vessels from exploding
- In the 1940's, formed solid metal rupture discs which could be operated at 70% of their burst pressure were developed
- In the 1950's the composite type rupture disc was introduced, which could be operated at up to 80% of its burst pressure
  - Higher operating to burst pressure ratios allow process pressures to be closer to the maximum capabilities of the process equipment which can increase production output and throughput
- In the 1960's, reverse acting rupture discs were introduced which were capable of operating at up to 90% of their burst pressure

Since the 1970's, many developments have been made in the rupture disc industry which have allowed rupture discs to be utilized in many different fields never before imagined and at operating pressures up to 95% of their marked burst pressure

Rupture Discs Have Helped Industries Evolve…

- Rupture discs can be made of a wide variety of materials ranging from metal, graphite, polymers, plastics, composites, etc.
- The newest rupture disc technology allows processes to operate up to 95% of the rupture disc's burst pressure without leakage
- Certain types of rupture discs can cycle millions of times from their operating pressure to full vacuum without failures
  - This feature can dramatically increase the service life of the rupture disc
- Rupture discs achieve full flow capacity once they activate
  - There is no requirement of overpressure to achieve full flow for rupture discs like there is for valves which is typically 110% of the valves activation pressure
- A rupture disc and holder require little to no maintenance
  - If the rupture disc bursts, then it is replaced
  - A valve may need to be reworked after only one activation to fix seat damage which can cause leakage

Rupture Discs Have Helped Industries Evolve…

- Rupture discs can have ASME certified flow resistance factors (K_R) or ASME certified flow capacities (K_D)
  - K_R values assist users in calculating the flow capacity of there reliving system
  - K_D values allow for manufacturers to mark devices with a flow capacity
- The service life of a rupture disc has increased from about 1 year to 3-5 years *(depending on service conditions)*
- Rupture discs have been designed to be non-fragmenting
- Rupture discs are available in sizes from 1/8” in diameter up to 50”+ in diameter
- The burst pressure of a rupture disc can be from only several inches of water column (InWC) to 100,000+ psig
  - Rupture discs are able to provide reliable pressure relief for any process no matter what the size or pressure

Why do you need a rupture disc?

- Safety of equipment and personnel
  - Rupture discs are an essential part of a pressure relief system
- Failsafe, leak-tight, lightweight, accurate and dependable
- Pressure relief devices may be required by local codes and regulations and/or by insurance agencies
- Instantaneous pressure relief
  - Rupture discs burst within milliseconds of exposure to their burst pressure
- Exotic materials of construction
  - Rupture discs are ideal for isolating valves from corrosive chemicals so that the valve does not have to be made of an exotic material
- High relief capacity
  - Most designs of rupture discs allow for higher relief capacities compared to the same size of pressure relief valve
- Leak tightness
  - Rupture discs remain leak tight until they burst
  - Rupture discs are ideal for isolating valves to eliminate leakage

Basic Types of Rupture Discs // Tension Acting

Solid metal: 70% operating to burst pressure

Pros:

- Economical
- Capable of very high burst pressures

Cons:

- Fragmenting
- Can be very fragile
- Most require a vacuum support to resist partial to full vacuum
- Can be difficult to reach low burst pressures (especially in smaller sizes)
- Can fatigue due to cyclic condition

Basic Types of Rupture Discs // Tension Acting

Composite: 80% operating to burst pressure (formed), 50% operating to burst pressure (flat)

Pros:

- Economical
- Non-fragmenting design (for discs without metal seals)
- No holder required (flat only)
- Possible to achieve different burst pressures in two directions (flat only)
- Good cyclic capabilities (formed only)

Cons:

- Most require a vacuum support to resist partial to full vacuum
- Non-metallic components typically have max temperature capabilities of 400°F – 500°F

Basic Types of Rupture Discs // Tension Acting

Cross Scored Solid Metal: 80%-90% operating to burst pressure

Pros:

- Non-fragmenting design
- High burst pressures

Cons:

- Can be very fragile
- May require a vacuum support to resist partial to full vacuum
- Can be difficult to reach low burst pressures (especially in smaller sizes)
- Can fatigue due to cyclic conditions

Basic Types of Rupture Discs // Tension Acting

Graphite: 80%-90% operating to burst pressure

Pros:

- Excellent chemical resistance
- No holder required

Cons:

- Fragmenting
- Most require a vacuum support to resist partial to full vacuum
- Can fatigue due to cyclic conditions

Basic Types of Rupture Discs // Reverse Acting

Scored Reverse Acting (Sanitary Type): 90%-95% operating to burst pressure

Pros:

- Non-fragmenting design
- Highest operating to burst ratio
- Extremely high cyclic capabilities
- No holder required
- Long service life
- Proven to be excellent for sanitary applications
  - Clean in place (CIP) compatible

Cons:

- Cost
- Can be very fragile

Basic Types of Rupture Discs // Reverse Acting

Scored Reverse Acting (Insert Type): 90%-95% operating to burst pressure

Pros:

- Non-fragmenting design
- Highest operating to burst ratio
- Extremely high cyclic capabilities
- Long service life

Cons:

- Cost
- Can be very fragile

What Information is Required to Order a Rupture Disc?

- Media type: gas, liquid or gas/liquid
- Maximum Allowable Working Pressure (MAWP) of vessel/piping/equipment that the rupture disc will be protecting
- Is the process static, cycling or pulsating
- Maximum vacuum or backpressure
- Desired burst pressure for rupture disc
- Coincident temperature
- Fragmenting or non-fragmenting rupture disc required
- Manufacturing range
- Leakage requirement
- Size
- Material
- Special requirements
  - Testing, cleaning, packaging, marking, etc.

What do you do once you receive your rupture discs, holders & accessories?

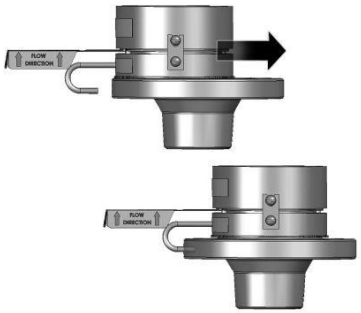
- **Read the installation instructions!!!**
- Be very careful when handling a rupture disc
- Do not touch the center portion of the rupture disc
  - Hold the rupture disc by the gasket or OD…
    Which ever way the installation instructions tell you to!

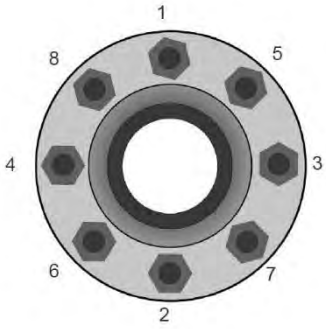
- Inspect the rupture disc(s)
  - Look for dents and damage
    - ✓ The rupture disc may have precision indents which are put there by the manufacturer to control burst pressure
    - ✓ Reference the installation instructions to determine whether a dent is meant to be in the rupture disc or not
  - Check for deep scratches
  - Ensure that the burst pressure, temperature, size, material, etc., is correct on the tag

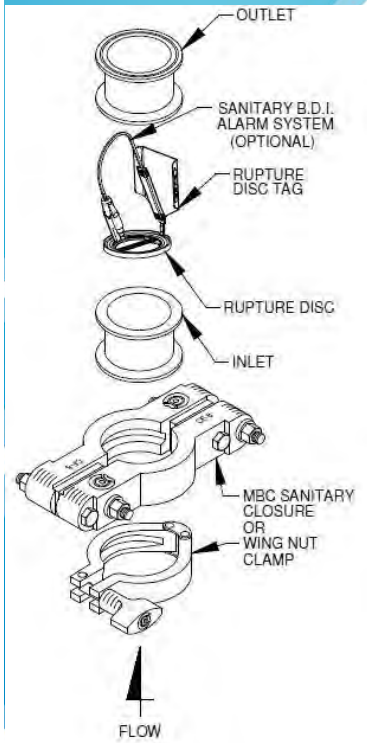
- Inspect the rupture disc holder(s)
  - Check for damage
  - Look for deep scratches in sealing areas
    - ✓ Where the holder seals on the rupture disc
    - ✓ Where the holder seals on the mating flanges or piping
- Inspect all other accessories for damage

Installing the Rupture Disc and Holder (if applicable)

- Reference the installation instructions for guidance on how to install the rupture disc and holder.
  - The installation instructions will give detailed information on how to install the rupture disc, including:
    - ✓ Warnings
    - ✓ Assembly of components (written and/or visual)
    - ✓ Cleaning of surfaces
    - ✓ Recommended torque and torqueing procedure
- If you accidently damage the rupture disc when handling or installing it, do not install the rupture disc!







What To Do When a Rupture Disc Bursts?

Stop your process

- Most likely, something involving the process caused the rupture disc to burst
- Stop the entire process or the part of the process that is causing pressure buildup in the equipment

Assess your personnel and equipment

- Ensure that anyone in close proximity to the rupture disc, equipment and relief system is unharmed
- Check your equipment to make sure that it has not been damaged in some way due to the rupture disc bursting

Inform required personnel and/or organizations

- Inform required personnel about the rupture disc burst per your operating procedures and directives
- Contact local municipalities to inform them of the release of media, if required, such as the police and fire department
- Contact governmental agencies to inform them of the release of media, if required, such as the EPA

Why did the Rupture Disc Burst at a Pressure Which was Not Expected?

Low Pressure Burst

- The rupture disc was damaged during handling or installation
- The rupture disc became damaged while in service
  - Corrosion
  - Fatigue
  - Struck by an object in the media
- Pressure spike
- Process temperature is higher than specified

High Pressure Burst

- Process temperature is lower than specified
- Media buildup on the rupture disc
- Process temperature significantly exceeded the specified temperature at some point and then was reduced to at, or below, the specified temperature

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