

Pressure Relief Streams

Part Two Rupture Devices Overview

Website: www.ttetraining.ltd.uk

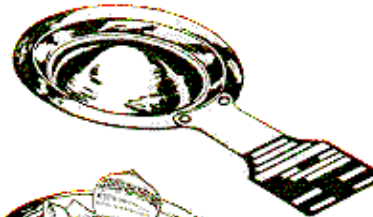


Rupture Devices

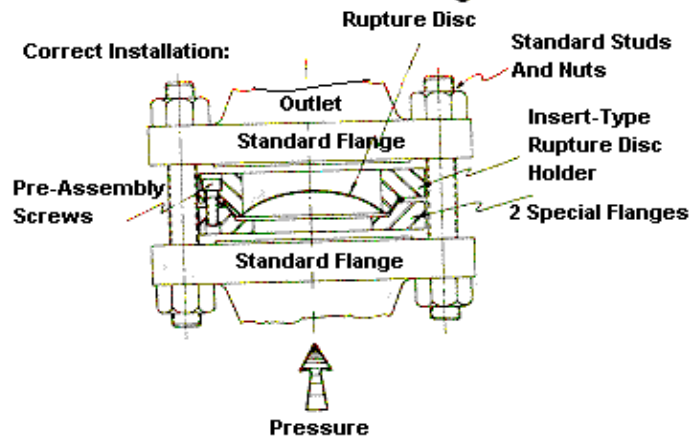
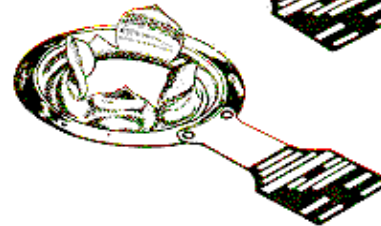
- Bursting Disc
- Rupture Pin

Conventional Metal Bursting/Rupture Disc

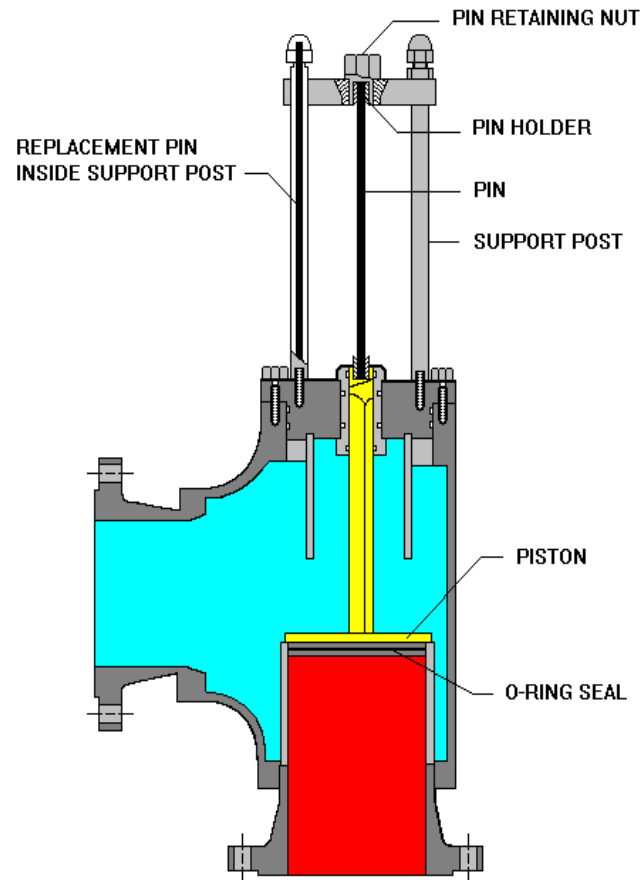
Before:



After:



Conventional Rupture Pin Device



Bursting Discs

- A bursting disc is a thin diaphragm (generally a solid metal disc) designed to rupture (or burst) at a designated pressure. It is used as a weak element to protect vessels and piping against excessive pressure (positive or negative).
- There are five major types available
 - Conventional tension-loaded bursting disc
 - Pre-scored tension-loaded rupture disc
 - Composite rupture disc
 - Reverse buckling rupture disc with knife blades
 - Pre-scored reverse buckling rupture disc

Bursting Discs Are Well Suited For Some Applications

When compared with PR valves, rupture discs have:

Advantages

- Reduced fugitive emissions - no simmering or leakage prior to bursting.
- Protect against rapid pressure rise caused by heat exchanger tube ruptures or internal deflagrations.
- Less expensive to provide corrosion resistance.
- Less tendency to foul or plug.
- Provide both over pressure protection and depressuring.
- Provide secondary protective device for lower probability contingencies requiring large relief areas.

Bursting Discs Are Less Well Suited For Other Applications

When compared with PR valves, bursting discs have:

Disadvantages

- Don't reclose after relief.
- Burst pressure cannot be tested.
- Require periodic replacement.
- Greater sensitivity to mechanical damage.
- Greater sensitivity to temperature

Comparison of Bursting Disc Types

Conventional Tension-Loaded

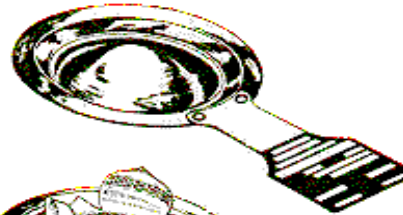
- Broad range of applicability for gas and liquids
- Available in large variety of sizes; burst pressures, temperatures and materials and coatings.

Disadvantages

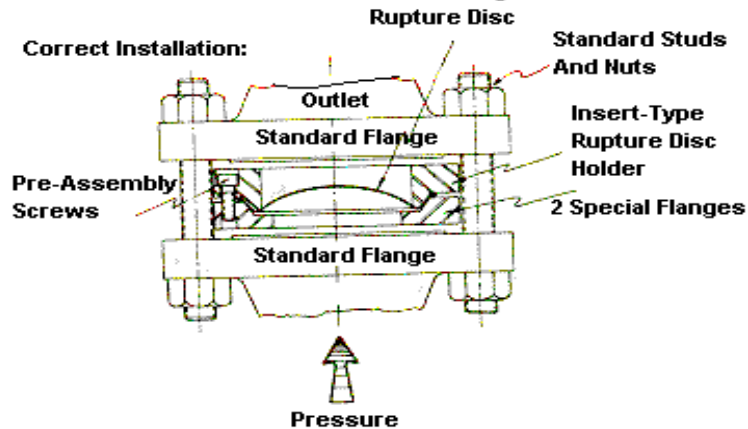
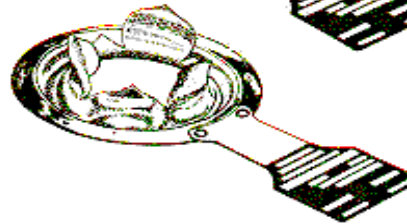
- Have tendency to fragment.
- May require vacuum support.
- Are not fail safe if installed upside down with vacuum support (require more than 1.5 X Burst Pressure).
- Subject to premature failures if operating pressure exceeds 70% of BP.

Conventional Tension-Loaded Metal Bursting Disc

Before:



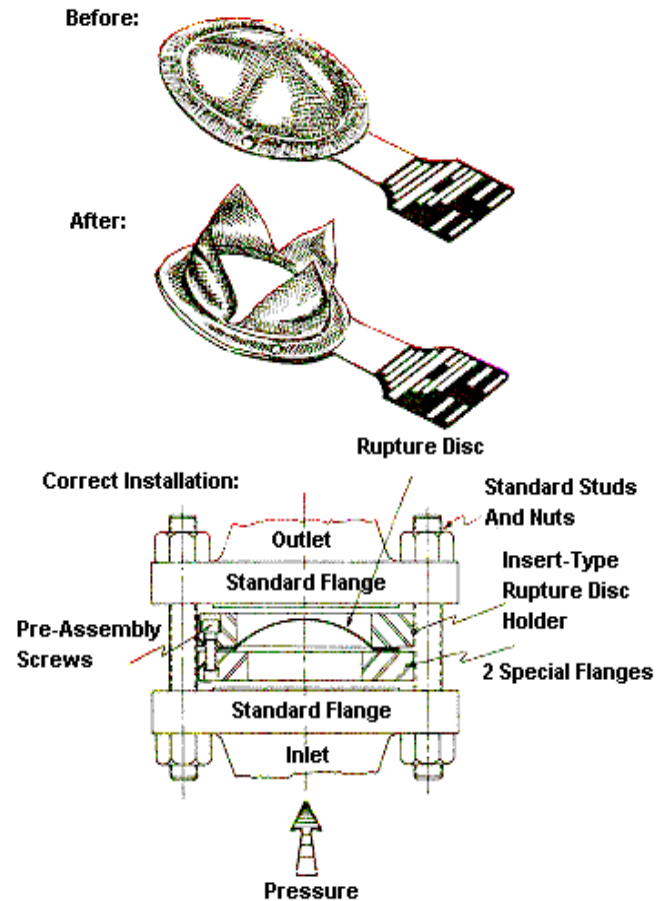
After:



Comparison of Bursting Disc Types

- **Pre-Scored, Tension-Loaded**
- Broad range of applicability.
- Readily available sizes, burst pressures, materials, etc.
- Non-fragmenting.
- Don't require vacuum support.
- Fail safe - (Rupture prematurely if upside down).
- Can operate to 85% of BP.

Pre-Scored Tension - Loaded Bursting Disc



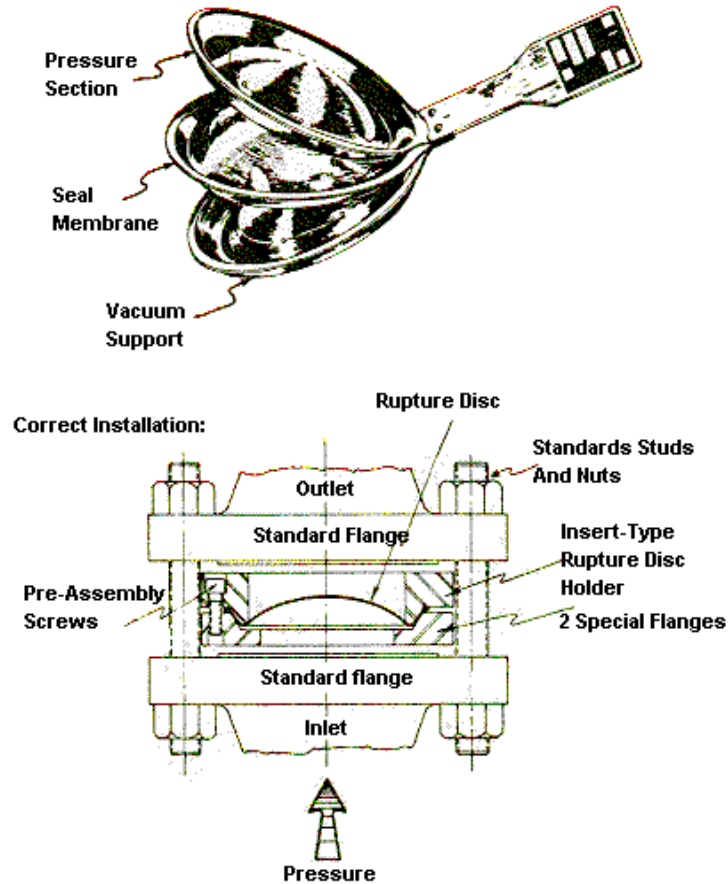
Comparison of Bursting Disc Types

Composite Discs

Advantages and disadvantages similar to conventional tension-loaded type.

- Allow use of corrosion resistant materials in lower pressure service and smaller sizes than solid metal discs.

Composite Bursting Disc



Comparison of Bursting Disc Types

Reverse Buckling With Knife Blade

Advantages

- Wide range of sizes, materials, pressures and temperatures.
- Thicker than conventional due to “snap action.”
- Don't require vacuum support.

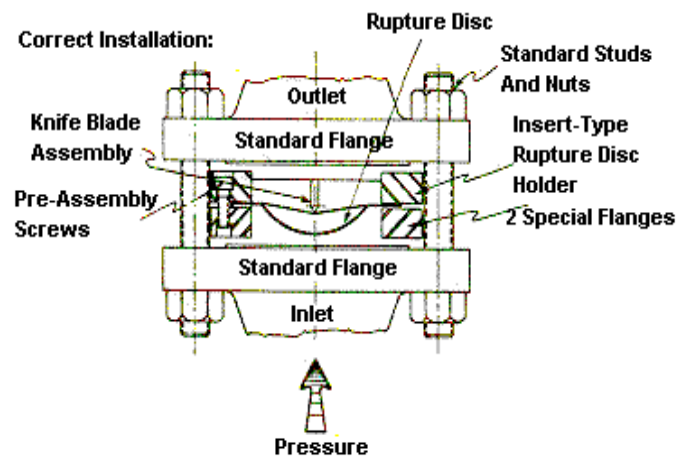
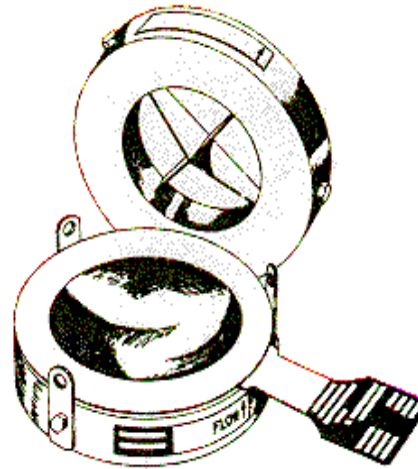
Comparison of Bursting Disc Types

Reverse Buckling With Knife Blade

Disadvantages

- Not fail safe.
- Blades corrode or get dull.
- Blades can be left out.
- Excessive burst pressure if upside down.
- Unsuitable in liquid service - (no snap action).
- Damage causes premature reversal.
- Subject to roll over.

Reverse Buckling Bursting Disc With Knife Blades



Pre-Scored Reverse Buckling

Most of the advantages of reverse buckling.

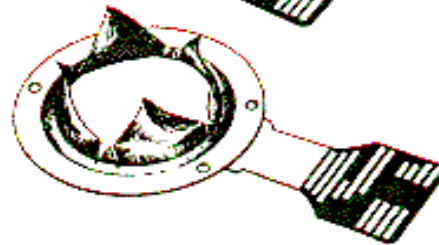
- Non-fragmenting.
- Fail safe.
- Don't need vacuum supports.
- Available in common sizes and materials.
- Limited number of burst pressures/temperatures.
- Not for high pressures (too thick required)
- Not effective in liquid service.

Pre-Scored Reverse Buckling Bursting Disc

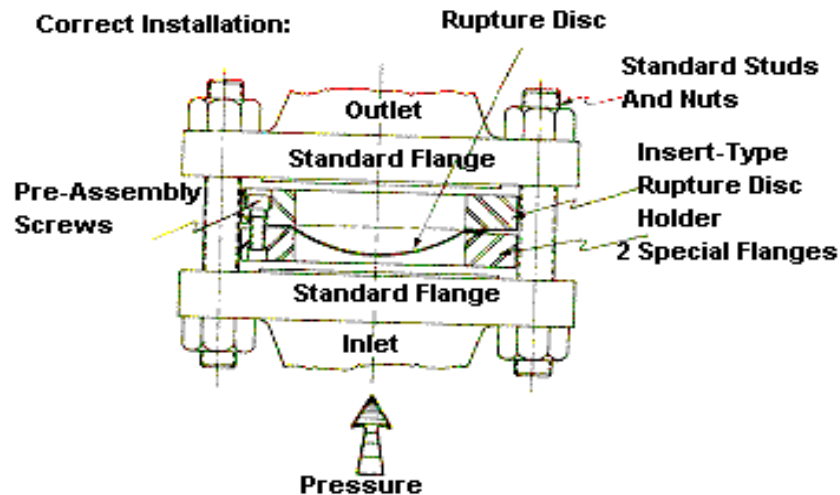
Before:



After:



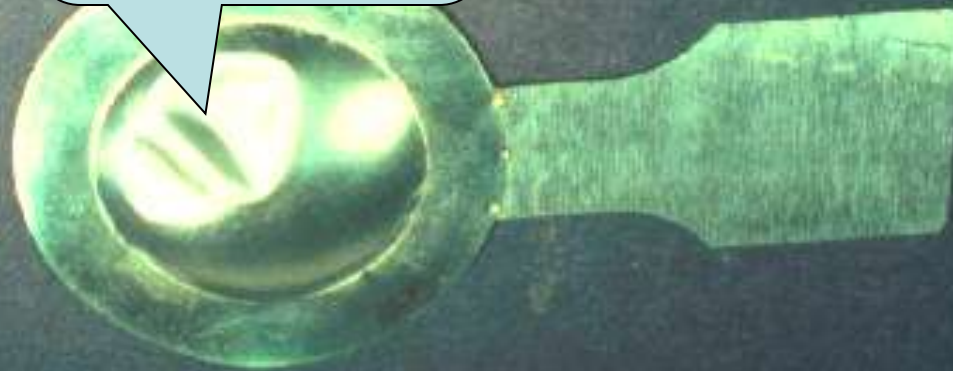
Correct Installation:





**Disc
Corroded
Through**

**Damaged during
Installation**





SIZE 4" TYPE DV80
RUPTURE PRESSURE 198 PRTG # 72
MATERIAL Inconel
REASON FOR REMOVAL Leaking
Alligatoring
FILED WITH

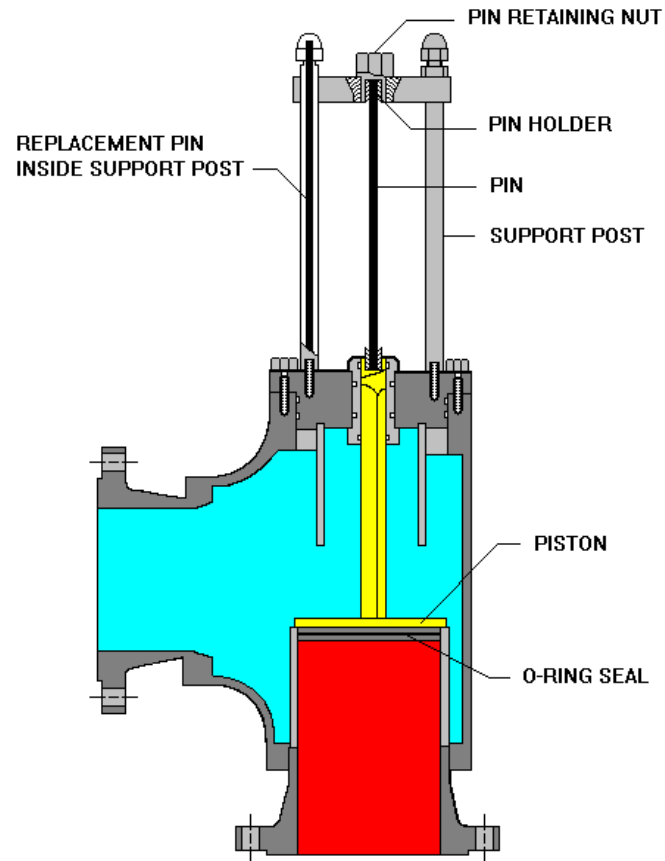
**Classic
Alligatoring**

Is caused by operating too close to the set pressure.

Rupture Pins

- A rupture pin is designed to be a non-reclosing pressure relief device, similar to a rupture disc
- A piston is held in the closed position with a buckling pin which will fail at a set pressure according to Euler's Law
- An o-ring on the piston is used to make a bubble tight seal

Conventional Rupture Pin Device



Comparison of Rupture Pins To Bursting Discs

Advantages

- Not subject to premature failure due to fatigue
- Can be operated closer to its set point
- Setpoint is insensitive to operating temperature
- Available as balanced or unbalanced device
- Capable of operating as low as 0.1 psig (0.007 barg)
- Suitable for liquid service
- Resetting after release usually requires no breaking of flanges
- Replacement pins are 1/3 to 1/4 the cost of replacement discs

Comparison of Rupture Pins To Bursting Discs

Disadvantages

- The elastomer o-ring seal limits the maximum operating temperature to about 450°F (230°C)
- Initial cost of installation is greater than for a rupture disc
- Twice as costly for 2" carbon steel
- Up to seven times as costly for 8" stainless steel

Potential Uses For Rupture Pins

- Replacement of rupture discs which have experienced frequent failures
- Replacing rupture discs with rupture pins will allow running slightly closer to design pressure possibly resulting in a capacity increase
- Higher accuracy of rupture pins at < 40 psig (2.7 barg) gives significant advantage over rupture discs
- When installed under a PSV the rupture pin can be reset without removing the PSV

Advantages / Disadvantages Conventional Valve

Advantages

- Most reliable type if properly sized and operated
- Versatile -- can be used in many services

Disadvantages

- Relieving pressure affected by back pressure
- Susceptible to chatter if built-up back pressure is too high

When to Use a Spring-Operated Valve

- Losing entire contents is unacceptable
- Fluids above normal boiling point
- Toxic fluids
- Need to avoid failing low
- Return to normal operations quickly
- Withstand process pressure changes, including vacuum

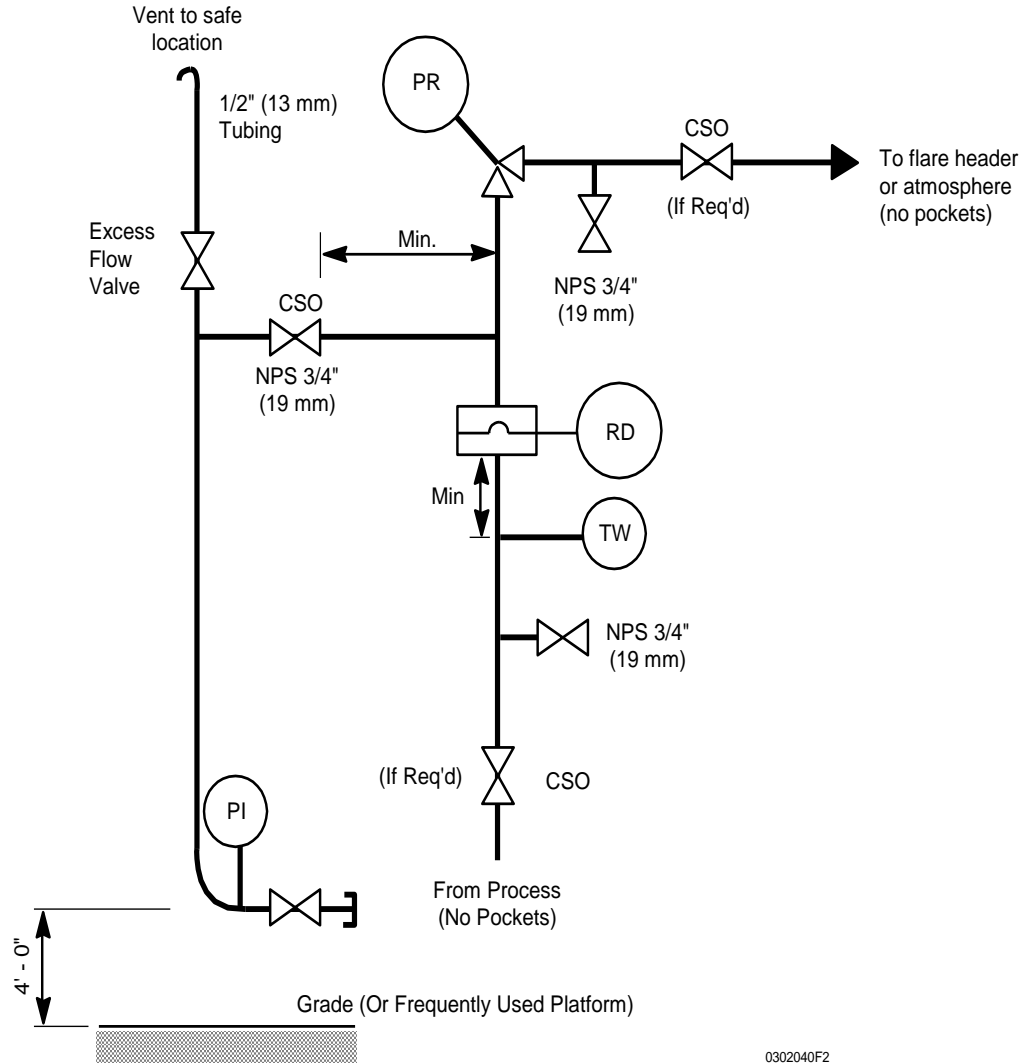
When to Use a Rupture Disc/Pin

- Capital and maintenance savings
- Losing the contents is not an issue
- Benign service (nontoxic, non-hazardous)
- Need for fast-acting device
- Potential for relief valve plugging
- High viscosity liquids

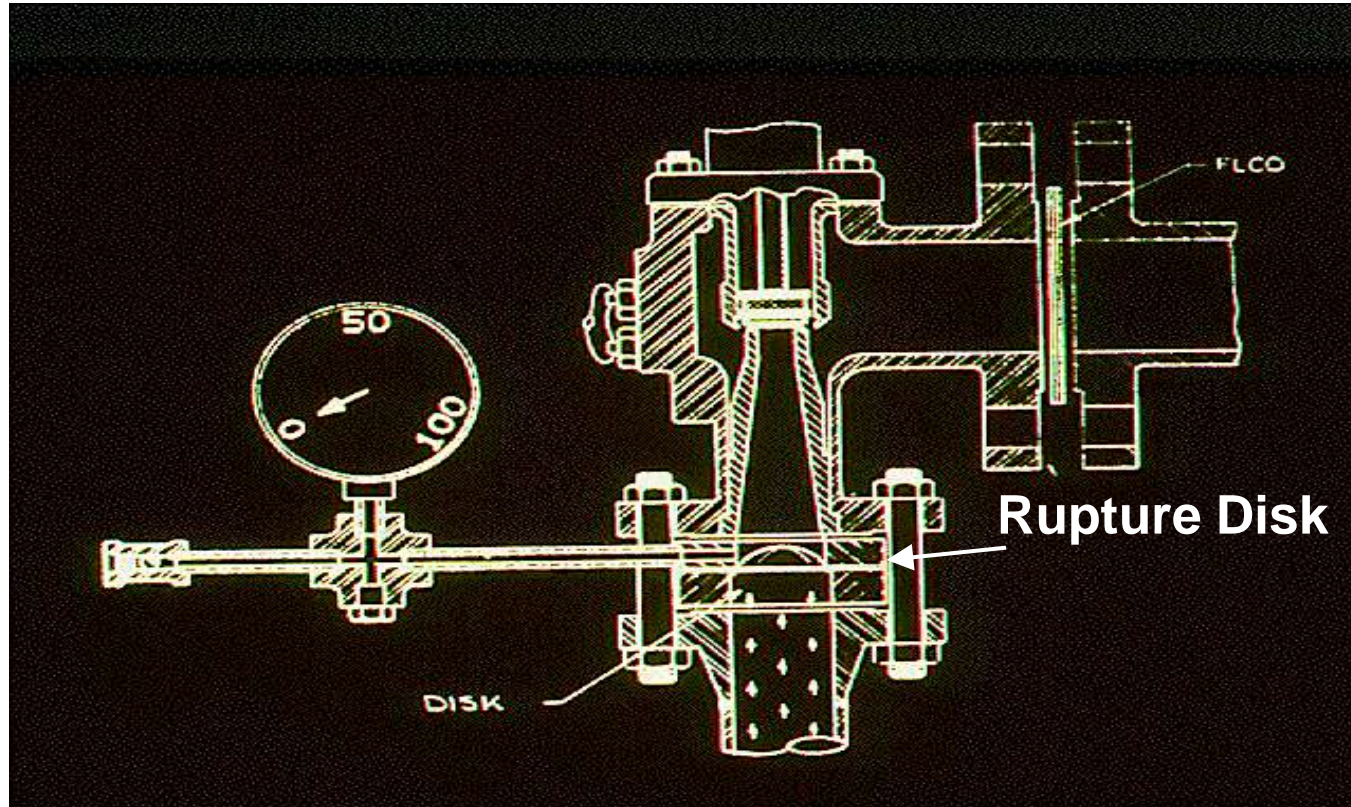
When to Use Both Types

- Need a positive seal (toxic material, material balance requirements)
- Protect safety valve from corrosion
- System contains solids

Typical RD/PRV Installation



Rupture disk is an internal device. You will need some sort of an indicator in this **multi-device system** to show a leaking or burst disk



Rupture disk will require extended downtime to break the integrity of your system to inspect or change. Rupture disk must be installed properly by experienced personnel and may require protective equipment.

**END OF
PRESENTATION**