Safety Effectiveness of Pressure Relief Devices (PRD) for Compressed Gas Transportation

Research and Development Forum
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Why Research the Effectiveness of PRDs

- PRDs that release flammable gas where there are other cylinders stored can cause a mass casualty or property damage

- A PRD that releases can cause physical injury to personnel standing nearby

What is a PRD?

A *pressure and/or temperature* activated device used to prevent the pressure from rising above a predetermined maximum to prevent rupture of a normally charged container when subject to a standard fire.

PRD Requirements in Regulations: 49 CFR §173.301 (f)

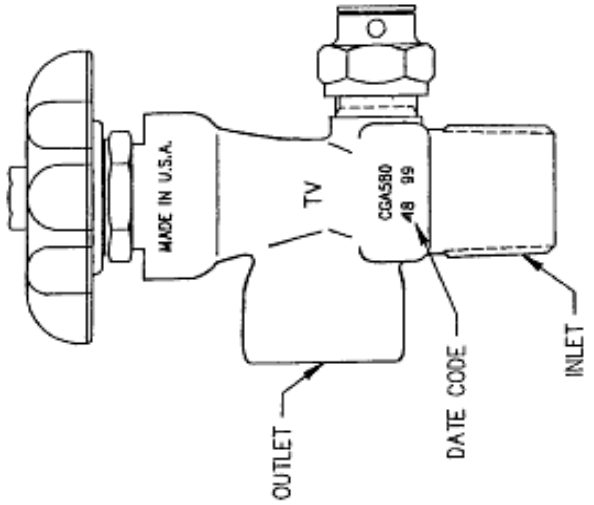
A *cylinder filled with a gas must be equipped with one or more pressure relief devices* (prohibited on cylinder with Div. 2.3 or 6.1 material in Hazard Zone A) sized and selected as to type, location and quantity i.a.w. CGA S-1.1 and CGA S-7.

The *pressure relief device must be capable of preventing rupture of the normally filled cylinder* when subjected to a fire test conducted i.a.w. CGA C-14 or in case of acetylene cylinder CGA C-12.

Valve Combined With PRD

PRD

PRD



Typical Types of PRDs

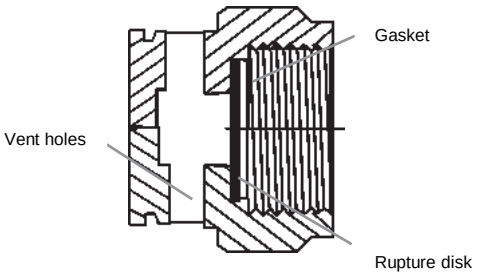


Fig. 1 Type CG-1: Rupture Disk Type Pressure-Relief Device

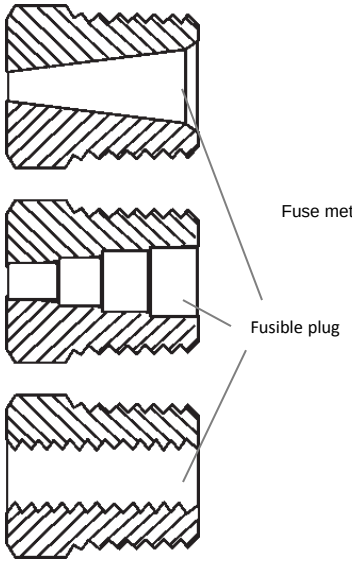


Fig. 2 Type CG-2, 3: Fusible Plug Type Pressure-Relief Devices. Normally limited to use on cylds with SP $\leq$ 500 psi

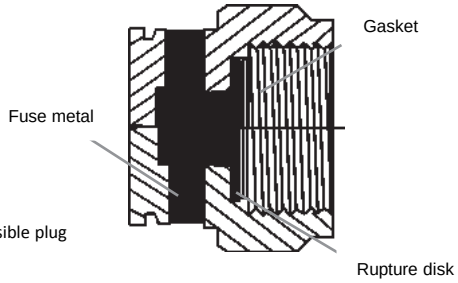


Fig. 3 Type CG-4, 5: Combination Rupture Disk/Fusible Plug Type Pressure-Relief Devices

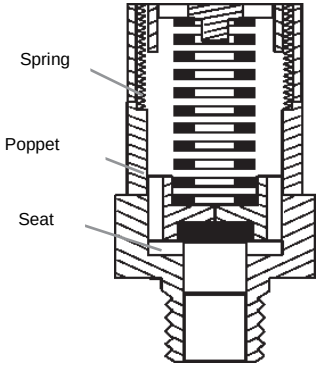


Fig. 4 Type CG-7: Reclose-able Pressure Relief Device. Normally limited to use on cylds with SP $\leq$ 500 psi

Some Accidents Involving Cylinders with PRDs

Propane cylinders

Acetylene cylinders

Propane Cylinder Fire in Central Florida (July 30, 2013)

Consequences of Florida Propane Cylinder Fire

Injuries: 9 employees, 5 critical with no fatalities

Emergency Responders: Over 200 to contain the fire

Evacuation: Neighborhoods within a mile of the plant

Property Damage: 53000 cylinders destroyed. Plant building roof completely blown away with several vehicles damaged.

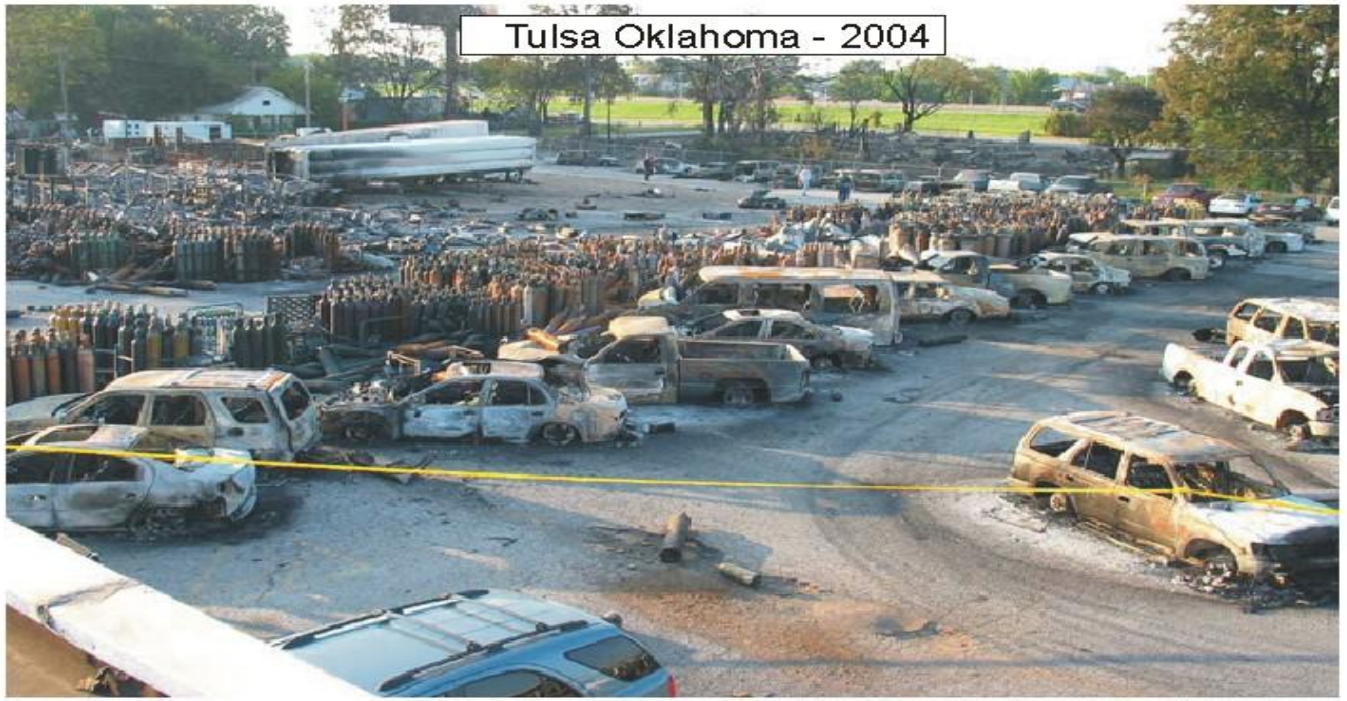
Disruption: Explosions could be heard and visible 7-10 miles away from the plant.

Acetylene Fire in Dallas, Texas – July 26, 2007

Consequences:

- Three injuries with two serious.
- Flames shooting 100 feet into the air leading to one-mile evacuation zone around the facility.
- Interstates 30 and 35, were closed in all directions. Area bridges had to be checked for damage.
- Plant building and several vehicles completely damaged
- The region's DART commuter rail service had to be suspended

Propane Fire in Tulsa Oklahoma



Nine cars, 1,100 cylinders, two tube trailers. Fire department reported that the flames were coming "from the pressure relief devices", forming a large flammable cloud. Once the fire hadstarted, the external impingement from one pressure relief device to another is what set everything on fire

Research Safety Effectiveness of PRDs

- Accidents and/or incidents involving transportation or use of compressed or liquefied gases in the US and Europe and assess the impact of using or not using PRDs on the outcome

- Whether segregation or storage arrangement of cylinders may have favorable or adverse impact on the event

- The impact of using or not using PRDs on the safety of emergency responders in fire situations involving flammable, non-flammable and low toxicity gases

- Whether existing regulatory provisions and exceptions on propane are proper considering that propane in portable gas cylinders has the greatest exposure to the public