

CARBON DIOXIDE CYLINDER OVER-PRESSURIZATION RESULTING IN CYLINDER FAILURE

There has recently been an incident in GCC in which a 1 kg CO₂ cylinder has burst due to over pressurization while being transported in an open truck. The subsequent investigation revealed that this problem though rare is not unique and similar things are happening in this region.

Gas cylinders are normally very safe. In fact, the British Compressed Gas Association (BCGA) states that instantaneous release of the contents of a compressed gas cylinder is “an almost inconceivable event, and not foreseeable as part of normal working”.

However, in view of recent experiences here and elsewhere, Organizations should review their risk assessments for CO₂ cylinders in use, in storage and in transit (particularly in lifts and any other confined space). The following information and advice is offered:

Cylinder structures vary with the type of compressed gas and many are not fitted with pressure relief devices. CO₂ cylinders have bursting discs which are designed to rupture at 180-200 bar - hence, if pressures approaching this value are noted when the regulator has been fitted then rupture would appear to be imminent.

- The bursting disc failure allows total loss of contents i.e. it does not relieve pressure and re-seat, as a pressure relief valve would.
- CO₂ is stored as a liquid under pressure. The suppliers' procedures allow for ullage expansion, under normal temperature fluctuations, but if procedures are not strictly followed, it is possible for solid CO₂ to form at the base of the cylinder. Formation of solid CO₂ will not give rise to over filling to occur. Weight of the CO₂ filled will be present in any form.
- Cylinders should be stored below 50°C (away from local heat sources, glazing which is subject to direct sun, etc) and used only in well-ventilated areas.
- Staff required to handle cylinders and change regulators must have received suitable training to ensure they are competent.
- If the cylinder discharges into an unoccupied room, and people enter at a later time, there is a risk that they could be affected by an asphyxiating atmosphere, or experience symptoms of CO₂ exposure. These include headache, nausea, and loss of consciousness. Risk assessments should take into account the amount of gas that could be released into the room and whether this will result in an unsafe atmosphere. Where it is possible that oxygen levels could be reduced to below 19% oxygen depletion monitoring should be considered. Fixing of CO₂ Monitoring system inside rooms is recommended.

The bursting of CO₂ cylinder in most cases is due to the moisture present in the cylinder reacting with CO₂ and forming as Carbonic acid. This corrodes the internal layer of the CO₂ cylinder and

abruptly bursting of the cylinder when the thickness reduces and could not withstand the developed pressure even though the burst disc is present.

A good cylinder preparation during initial implementation into the service and use of residual pressure valves (RPV) will overcome this problem.

Action to take if Over-Pressurization is suspected.

Over-pressurization will become apparent after attaching the regulator to the cylinder and opening the cylinder valve, so always check this carefully.

If the pressure on the inlet gauge is in excess of the filled pressure, (The pressure normally goes up to 90- 100bar in summer) CO₂ , close the valve, remove the regulator , allow the cylinder to stand for a few more minutes, then reconnect and check pressure again.

If the cylinder is still over pressure close the valve, orientate the cylinder with the bursting disc facing away from any circulation route. Do not put the cylinder into service.

Do not handle the cylinder further as movement may result in the bursting disc failing.

On no account should the cylinder valve be used to 'throttle back' the inlet pressure.

Evacuate the area and contact the cylinder gas supply company immediately and ask them to remove the cylinder.

Action in the event of bursting disc rupture.

It will be immediately obvious to those present when the bursting disc ruptures as gas will be emitted at very high pressure and velocity into the room.

All personnel must immediately leave the space and take steps to prevent re-entry until the full contents have been discharged and the oxygen levels within the room are safe (i.e. above 19%).

If possible open any external windows, but only if safe to do so. This will assist in dispersing the gas and restoring oxygen to safe levels.

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