THE LINDE GROUP

Safety Advice. 2 – Handling of Gas Cylinders at and after Fire / Heat Exposure

1. Treatment of gas cylinders exposed to fire or heat (except acetylene cylinders)

Any gas cylinder that is exposed to fire or extreme heat may rupture due to increase of temperature and pressure. This is valid even for cylinders that have pressure relief devices as in extreme circumstances the device can not operate quickly enough. Hazards arise from pressure shock, flying cylinder pieces and from flammable, toxic or corrosive content of the cylinder. A ruptured gas cylinder can fly a distance of 100 meters or more.

1.1. Cylinders containing non toxic or non corro-sive gases, arranged in bank or in a storage area

- Warn personnel and evacuate the area.
- Prevent access to the area by roping off and warning notices.
- Call the fire brigade and the gas supplier.
- Immediately start the cooling of cylinders by deluging them with water from a safe place – behind heavy machinery or solid wall.
- Establish the time the fire started and the con-tent, number and location of gas cylinders involved.
- Give this information and all recommendations in this leaflet to the fire brigade on arrival.

Cylinders containing liquefied gases (e.g. LPG, carbon dioxide, and nitrous oxide) must be stored in an upright position. Restore any overturned cylinder to avoid liquid being expelled from the valve or pressure relief device.
Care must be taken not to knock cylinders over when cooling.

Acetylene cylinders present increased dangers and require special treatment as outlined below.

1.2. Single cylinders in use containing non toxic or non corrosive gases

1.2.1. Time of fire or heating not established

- Apply recommendations in 1.1. above.

1.2.2. Starting of fire or heat exposure witnessed

- If safe to do so considering the fire or heat exposure, close cylinder valves if open and remove all cylinders nearby if any.
- Warn personnel and evacuate the area.
- Prevent access to the area by roping off and warning notices.
- Call the fire brigade and the gas supplier.
- Establish the time the fire or heating started, cylinder(s) content, and give this information and all recommendations in this leaflet to the fire brigade on arrival.
- Immediately start the cooling of the cylinders by deluging them with water from a safe place – behind heavy machinery or solid wall.
- Interrupt cooling for short time after the fire has been extinguished.
- If the cylinders dry quickly or steam forms on cylinder surface, immediately continue cooling.
- Stop cooling when the cylinders remain wet for 10 minutes without water spraying.

1.3. Single cylinder in use containing a flammable gas leaking and burning at the valve

Close the cylinder valve if safe to do so. This will usually stop the gas flow and any flames from the valve.

A flame from a gas cylinder which is in a room and whose valve can not be closed shall normally be left to burn while cooling the cylinder with water. If the flame is extinguished the gas continues to escape and can cause an explosion. The flame may only be extinguished if :

- It can give rise to a dangerous situation. In such a case, apply the relevant recommendations in 1.2 above and ventilate abundantly and naturally.
- The gas flow is very small and the cylinder can be safely and quickly carried out in the open air, in a safe place.

1.4. Cylinders containing toxic or corro-sive gases

In addition to the extent of the source of heat or fire, the degree of hazard depends on the properties, quantities of gases involved and storage conditions. Therefore, any action must be decided and directed by a person properly trained who is able to quickly take the adequate measures to reduce the risks.
Prior to such action:

- Warn personnel and evacuate the area.
- Prevent access to the area by roping off and warning notices.
- Call the fire brigade and the gas supplier.
- Establish the time the fire or heating started, cylinder(s) content, and give this information and all recommendations in this leaflet to the fire brigade on arrival.

2. Treatment of acetylene cylinders exposed to fire or heat

The safety system of an acetylene cylinder (porous mass and solvent) normally prevents any dangerous decomposition reaction of acetylene. But if acetylene cylinders are exposed to fire or extreme heat or if flashback from the burner into the cylinder occurs, a decomposition reaction can develop. This will be promoted if additionally acetylene escapes from the hot cylinder. Owing to the decomposition reaction temperature and pressure increase and the cylinder can burst. Hazards arise from flames, pressure shock and flying cylinder pieces. A ruptured acetylene cylinder can fly a distance of 100 meters or more.

2.1. Acetylene cylinders in fire, arranged in bank or in a storage area

- Warn personnel and evacuate the area.
- Prevent access to the area by roping off and warning notices.
- Call the fire brigade and the gas supplier.
- If safe to do so, immediately start the cooling of heated cylinders by deluging them with water from a safe place – behind heavy machinery or solid wall.
- Establish information about number and location of acetylene cylinders involved, and the time the fire started.
- Give this information and all recommendations in this leaflet to the fire brigade on arrival.

2.2. Single acetylene cylinders in use

2.2.1. Time of fire or heating not established

- Apply recommendations in 2.1. above.

2.2.2. Starting of fire or heating witnessed

- If safe to do so considering the fire or heat exposure, close cylinder valve if open.
- Warn personnel and evacuate the area.
- Prevent access to the area by roping off and warning notices.
- Call the fire brigade and gas supplier.
- Establish the time the fire started and give this information and all recommendations in this leaflet to the fire brigade on arrival.
- Immediately start cooling the cylinder(s) by deluging the whole cylinder(s) with water from a safe place – behind heavy machinery or solid wall.
- If acetylene cylinders dry quickly or steam forms on the cylinder surface, continue cooling with water.

When the cylinders remain cool and wet at least 30 minutes, it is usually safe to approach them to check for leakage. If no leakage is observed, remove them from the place and immerse them in water for at least 24 hours. Afterwards place them in a safe location. A leaking cylinder should be left, cooled and the area roped off during 24 hours.

2.3. Acetylene cylinder affected by flash back or leaking and burning at the valve

Flash back from the burner into an acetylene cylinder or burning acetylene at the cylinder valve create a dangerous situation. Only when it can be done immediately after ignition, close the cylinder valve to stop the gas flow.
Feel the cylinder shell with the bare hands for any rise in temperature. If

- the cylinder becomes hot,
- the flame or gas flow does not stop or
- any doubt of other reason, apply recommendations in 2.2. above.

A flame from an acetylene cylinder which is in a room and whose valve can not be closed shall normally be left to burn while cooling the cylinder with water.

If the flame is extinguished, the acetylene continues to escape and can cause an explosion. The flame may only be extinguished if :

- It can give rise to a dangerous situation. In such a case, apply the relevant recommendations in 2.2. above and ventilate abundantly and naturally.
- The acetylene flow is very small and the acetylene cylinder can be safely and quickly carried out in the open air, in a safe place.

2.4. Acetylene bundles

When a flashback has occurred, close only the central bundle valve – not the valves of single cylinders – if safe to do so and if it can be done immediately after the ignition. Apply the checking procedure and recommendations as mentioned in 2.1. and 2.2. above.
As the cylinders in a bundle are close to each other, effective cooling with water can not be guaranteed. For this reason, bundles in which decomposition is suspected should be hosed down with water at least 24 hours after the source of fire or heat has been removed and the cylinders have remained cool and wet at least 30 minutes. Do not approach such bundles during this period and prevent access to the area by roping off and warning notices.

2.5. Shooting of acetylene cylinders

Rupture of a hot acetylene cylinder can usually be prevented by perforating the cylinder with at least two holes by rifle shots.
The method is allowed and occasionally used by some countries emergency services. The following conditions must be considered:

- Shooting must be proposed and duly authorized by the relevant authority.
- Shooting will only be carried out by an experienced rifleman from the authorized emergency services.
- Shooting will only be carried out at single acetylene cylinders located in a free area.
- Shooting will be carried out from a distance of at least 100 meters in order not to endanger the rifleman.
  After the cylinder has been punctured it may be regarded as harmless.

3. Final remark

It is of utmost importance that customers and emergency services could at emergencies receive proper and immediate advice on the handling of gas cylinders in fire. As with any recommendation of this nature, each situation requires a careful assessment of the risks involved.

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