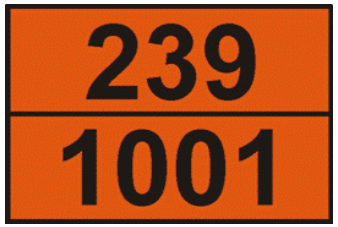
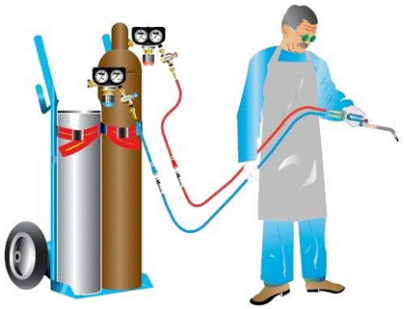
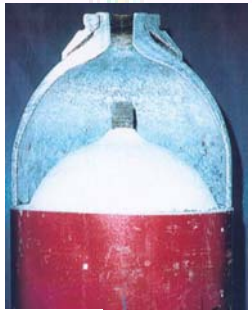
ACETYLENE GAS SAFETY SEMINAR 2010
MALAYSIA







Jointly organised by:

Asia Industrial Gases Association

FMM MIGMA

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Vincent Moreau

Regional Engineering and Commodity Manager, South & East Asia

Linde

Vincent Moreau has 20 years experience in the gas industry with BOC and now Linde. He moved from France to Australia with his family where he obtained a Honors Degree in Mechanical Engineering and then a Diploma in Business Management. He has held roles in Production Engineering, in Project Engineering, in Customer Applications, and in the development of non-cryogenics on-site plants. He has managed Technical Services, and now across Asia. Vincent had also established, and was the inaugural Executive Director of the Australia New Zealand Industrial Gas Association (ANZIGA).

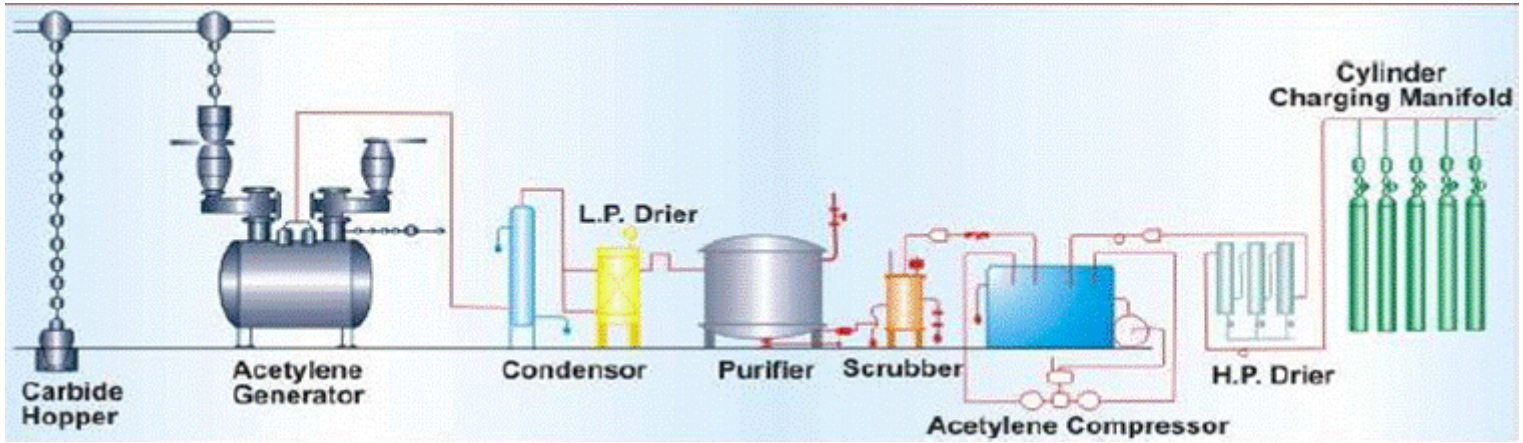
Vincent lives in Bangkok with his wife and three children. He also enjoys sport and learning about Asian culture.

What a DA cylinder can do

What can happen if Flashback Arrestors are not used

(LPG + O_2 in this case)

DA Incidents



PRODUCTION

1. Compressor explosion
2. Acetylene Gas Holder Explosion
3. DA cylinder exploded while in transit on customer pick-up truck
4. Leak of Acetylene

USE

5. Acetylene pallets transport incident
6. Fire from fallen acetylene cylinders
7. Cylinder Explosion
8. Damage to an acetylene cylinder station

Incidents related to Purification, Compression & Drying

1. Compressor explosion
2. Acetylene Gas Holder Explosion

1. Compressor explosion

INCIDENT DETAILS

Description:

- In the afternoon, an explosion and fire occurred in the crank case of Seager acetylene compressor #1.
- The crank case inspection doors were blown off the machine by the force of the explosion.
- The acetylene supply was isolated by activating the plant emergency stop button and by closing the compressor suction valve.
- The fire was then extinguished by plant personnel with dry powder fire extinguishers.
- Nobody was injured in the incident.
- No permanent damage to the plant occurred.
- The plant was shut down for a full investigation until it was deemed safe to restart.

1. Compressor explosion

1. Compressor explosion

Key Points

Immediate causes:

- Flammable atmosphere in the crankcase created by high leakage of acetylene past the worn compressor piston rods and gland packing.
- Source of ignition (suspected to be friction from loss of oil to the piston rod and gland packing, as evidenced by scuff marks on the piston rods and wear on the packing rings).

Basic causes:

- The guards fitted to the compressors prevent adequate dispersion of gas between the bath and crank case.
- The guards also hinder condition monitoring.
- Reason for loss of lubrication unknown – either due to lack of oil top-up or to loss of prime in the lubricator.

1. Compressor explosion

LESSONS LEARNED

- Compressor guarding was inappropriate, as it hindered condition monitoring and also prevented adequate ventilation of acetylene escaping past the piston rods.
- Compressor oil lubricators were not overhauled, since the sight glasses were found very dirty which prevented oil level monitoring.
- Routine condition monitoring and preventative maintenance plans are essential to ensuring equipment is in good operating order.

Area of concerned

q Personnel – trained and competency
q Operating Procedure
q Properties of gases
q PPEs
q Management of Change (EMoC)
ü Equipment used
ü Preventive Maintenance

2. Acetylene Gas Holder Explosion

2. Acetylene Gas Holder Explosion

Incident Description:

- Broken support bracket on gasholder dome required repairing.
- Plant shut down, system purged with nitrogen for 4 days.
- Permit to Work issued after testing for acetylene in the gasholder.
- Welding started - there was an instant explosion.
- The gasholder dome shot up in to the air.
- The welder fell from his ladder - not hurt.

Area of concerned

Personnel – trained and competency
Operating Procedure
Properties of gases
PPEs
Management of Change (EMoC)
Equipment used
Preventive Maintenance

Lessons Learnt:

- Pellistor sensors require the presence of air and acetylene in order to function.
- They cannot detect acetylene in nitrogen.
- Acetylene dissolves in the water in gasholders.
- The acetylene may be released if the temperature rises or the pressure drops.

Incidents related to DA Cylinders Transportation

3. DA cylinder exploded while in transit on customer pick-up truck
4. Leak of Acetylene

3. DA cylinder exploded while in transit on customer pick-up truck

Incident Details

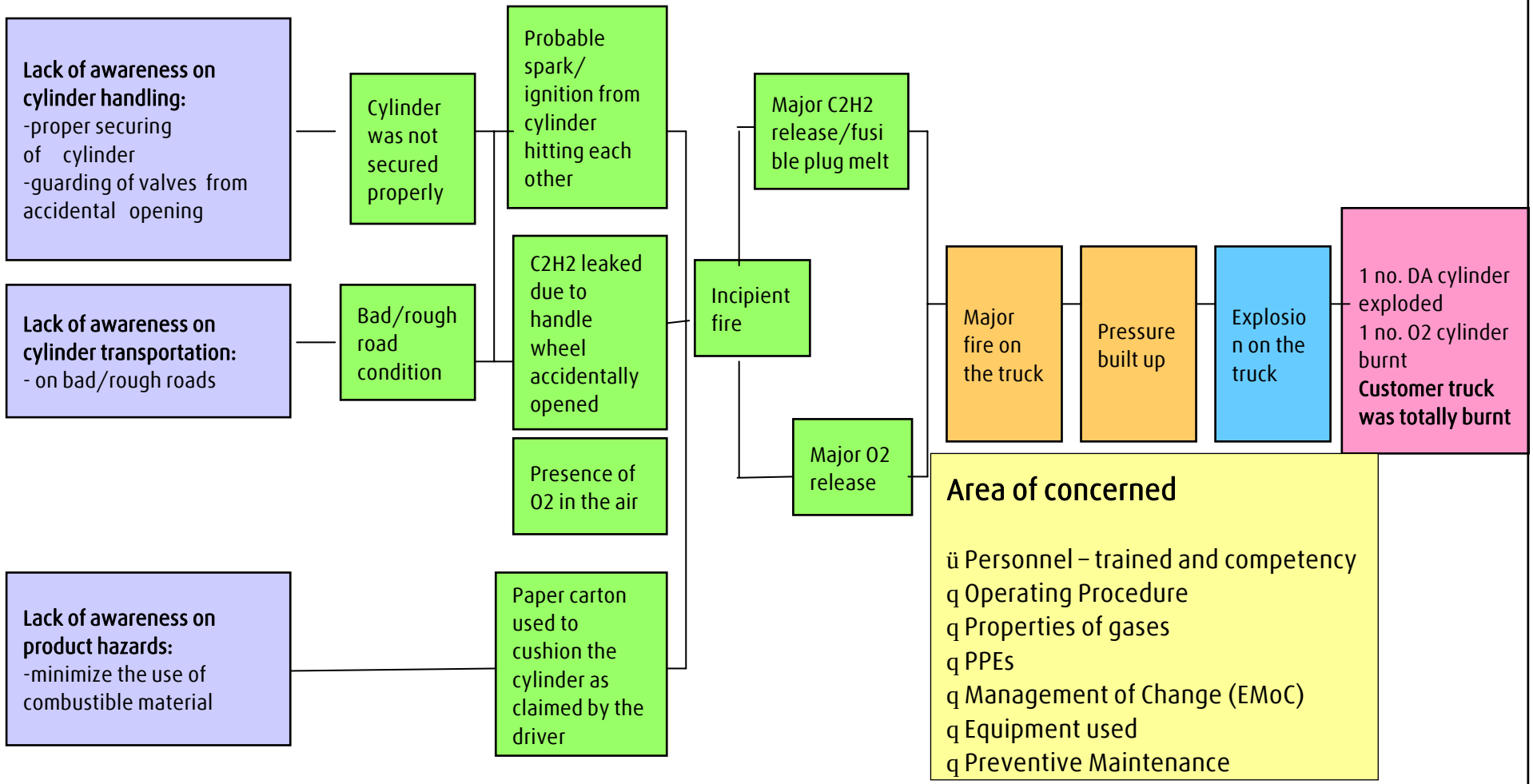
The cylinders were transported on a pick-up truck. The two cylinders were lying diagonally on the pickup bed tied with nylon string. The size of the pickup bed was just sufficient to allow the taller O2 cylinders to be laid in this diagonal position. (Friction between nylon string and cylinders may cause electrostatic charges)

The road from the pump house to the main site is very bumpy which could have aggravated the movement of cylinders causing them hitting each other (cylinders hitting each other potential for spark)

3. Cylinder Details

Cylinder no :	156307
Cylinder spec:	DOT-8
Manufacturer :	Coyne Cylinder Company, Huntsville, Alabama.
Process :	Cold forming of 2 seamless shells, joined by a circumferential seam weld.
Mass :	lime silica with porosity 88-92 %
Manufactured in :	Nov 1995
Valve detail:	BBB Neriki G11 3.94, side outlet, hand wheel
TW :	53.5
WC :	2.5L

3. Causal Tree Analysis



4. Leak of Acetylene

Incident Description:

DA cylinder left on the back seat over the week end.

Acetylene cylinder valve was not fully closed and a leak occurred.

Acetylene accumulated in the van.

On Monday morning, as soon as the fitter opened the door, a large explosion took place.

Ignition may have been caused by either :

- Internal light circulatory
- Automatic door control
- Mobile phone which was on the front seat
- Lighting a cigarette (The fitter was a smoker)

4. Leak of Acetylene

Consequences:

The fitter has damage to his ear drums & injuries on the face.

The cab was badly damaged.

Lesson Learnt:

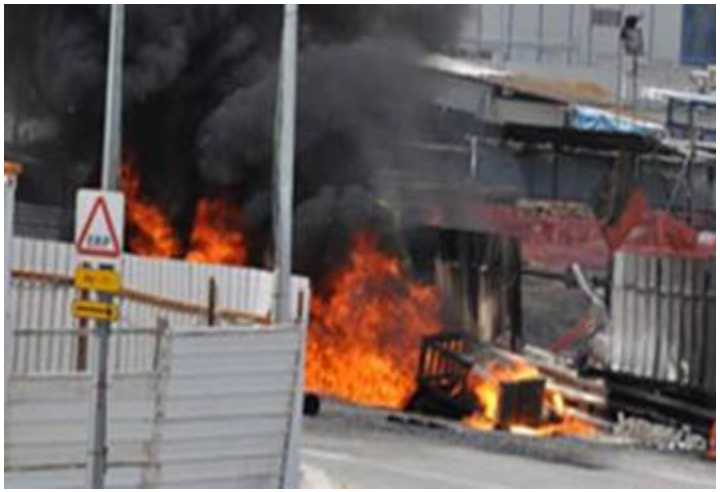
Never store cylinders in an enclosed vehicle or area.

5. Acetylene pallet transport incident (Fire & Explosion - 2009

- A contracted cylinder delivery truck carrying 5 oxygen cylinder pallets and 5 Acetylene cylinder pallets was making a delivery to a construction site.
- It negotiated a sharp corner near the site [unplanned route] as the usual road was closed on that day.
- 3 acetylene pallets fell off the truck.

5. Sequence of events

- The 3 Acetylene pallets that fell out of the truck immediately ignited. Each pallet has 6 cylinders.
- Acetylene gas was released and burned rapidly in the pallets.
- 3 cylinders were ejected skyward from the pallets and landed some 100 metres away
- All 18 cylinders (3 x 6) were completely destroyed, with the valves detached from the cylinders or burned.



5. Analysis of incident

Causes for pallets to fall off the truck:

- Truck was going around the corner too fast.
- Pallets were not properly secured on the truck. Wooden sideboard on the truck was not strong and high enough to prevent pallets from tipping over.

Causes of fire in cylinders:

- Cylinders were connected with a flexible hoses to a manifold with a main isolation valve.
- All the cylinder valves were opened to the manifold from the production site, relying on the main outlet valve on the pallet as the stop valve.
- Cylinders were loosely packed in the pallets.

Upon impact from the fall, the following could have occurred:

- The cylinders hit the top of the pallets, causing the valves to be damaged.
- Cylinders fell out of the pallet frames.
- Acetylene gas would be released if any of the above occurred.
- Acetylene released in air ignited. Cylinders on fire could be propelled in different directions.

5. Remedial measures

- All cylinder trucks that carry pallets to have strapping or lashing to secure the cargo during the transportation.
- Sideboards on truck have to be strengthened and height raised.
- Review is required on pallet design and operation:
    - Cylinders are filled individually and placed in the pallet. Cylinders need to be locked in place in the pallet to prevent movement.
    - All cylinder valves should be closed during transportation.

Note

- There is a fire risk associated with opening of cylinder valves to a manifold too rapidly (due to adiabatic compression of acetylene) as the manifold is on the high pressure side (before regulator). Moreover, there is also possibility of air in the manifold which creates an acetylene-air mixture and increases the risk of such an ignition.
- Incidents on adiabatic compression on manifold have been documented in the U.S. and Europe.

Incidents related to use of cylinders

6. Fire from fallen acetylene cylinders
7. Cylinder Explosion
8. Damage to an acetylene cylinder station

6. Fire from fallen acetylene cylinders

Description:

–At a cylinder filling site, while unloading a pallet of acetylene cylinders in the yard, two cylinders fell to the ground.

–The first cylinder valve hit the ground and caused a leakage of acetylene from the valve.

–When the second cylinder fell it caused a spark and ignited the leaking acetylene.

–Local personnel extinguished the fire quickly and the situation was made safe by cooling the cylinders.

–Nobody was injured.

6. Fire from fallen acetylene cylinders

6. Fire from fallen acetylene cylinders

Key Points

Immediate causes:

–Flammable atmosphere due to acetylene leaking from damaged valve.

–Ignition source – falling cylinder generated a spark on impact.

Basic causes:

–Cylinders not properly secured.

–Cylinder caps not fitted securely.

–Lack of procedures for forklift driver to check the load and move cylinders in pallets.

LESSONS LEARNED

- Cylinders and cylinder caps are to be checked to make sure they are secure before moving them.

– Because acetylene has the widest flammability range (2.5%-82% in air), leaking acetylene can form a flammable atmosphere.

–Leaking acetylene can be readily ignited, e.g. from impact sparks.

7. Cylinder Explosion

Incident Description:

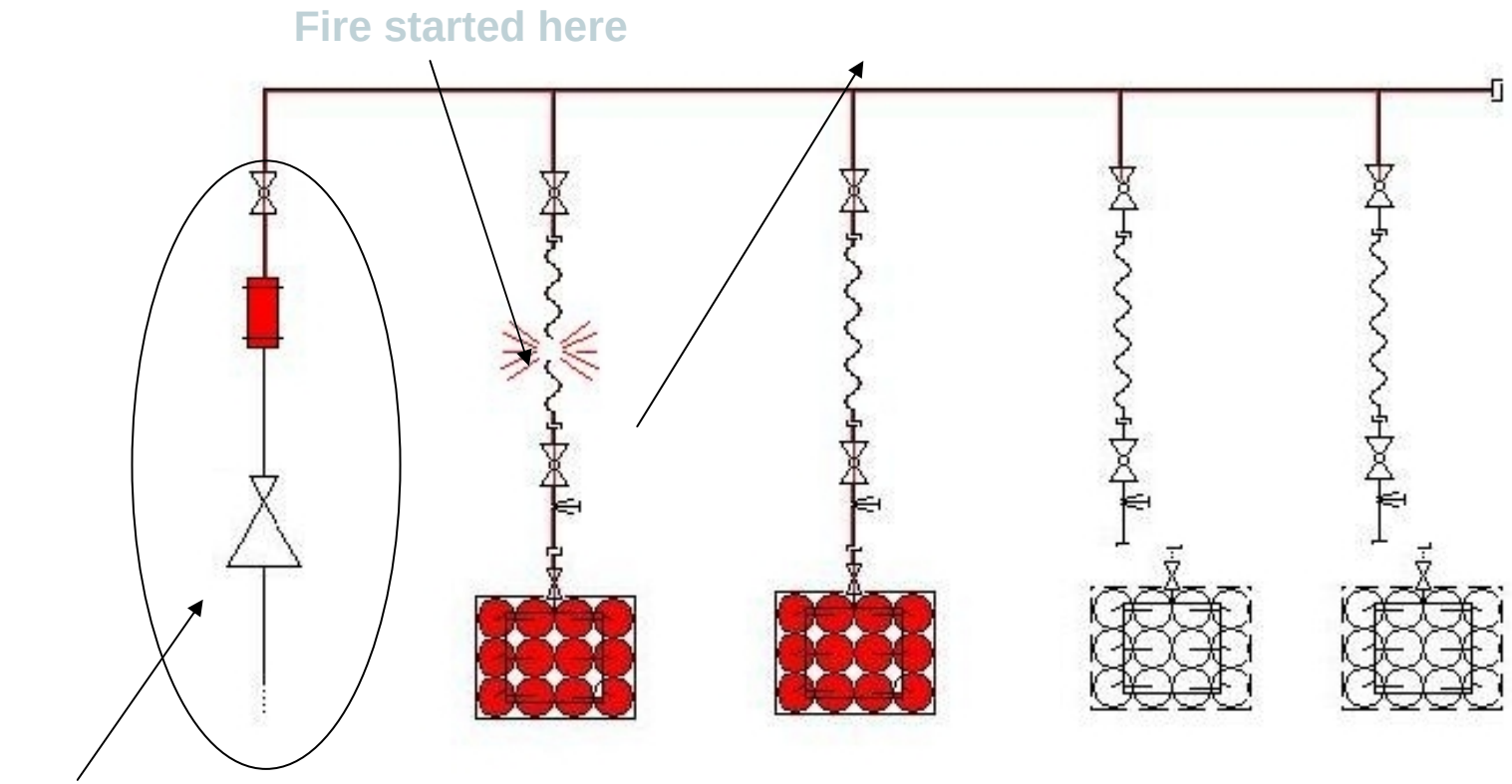
A contractor was reported to have been trying to **decant acetylene into a beer gas cylinder**.

At this stage it appears that there was a **backfire into the cylinder** with associated **contamination** from the beer gas cylinder, resulting in an **explosion**.

One fatality and two minor injuries were suffered, as well as substantial damage to the building.

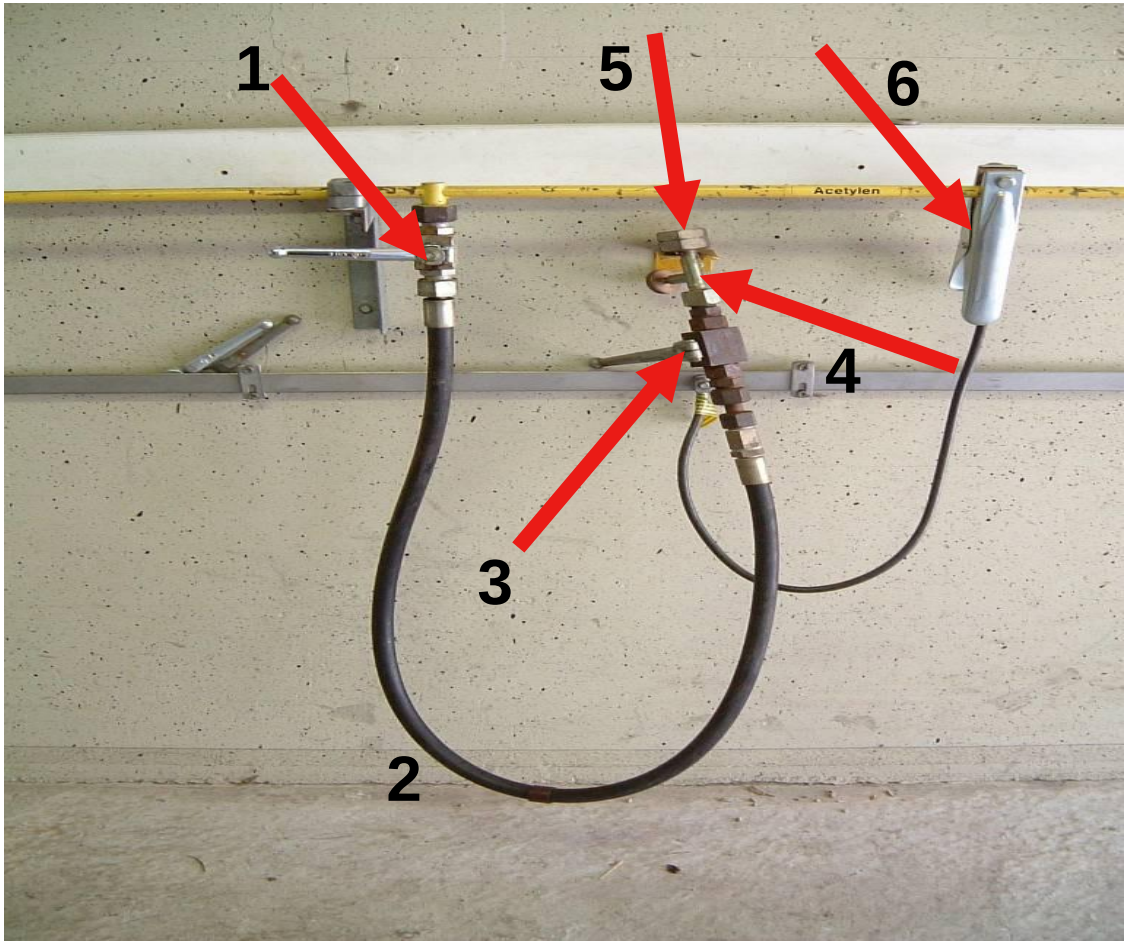
8. Damage to an acetylene cylinder station

QUIZ: Situation at time of ignition



Connection design to the manifold used in the fire that burned down the entire station

Can you identify the missing safety features after this presentation?



THANK YOU