Appendix 1 to BBAC Propane Code

Filling Balloon Flight Cylinders from a static LPG Bulk Tank / storage installation

Introduction.
These procedures and information have been produced by the BBAC for its members.The BBAC would like to thank representatives from BABO, from the Balloon manufacturers and pilots / crew who have contributed,reviewed the procedures and who have given their advice. In addition, thanks to the the UKLPG (the trade association representing companies that operate in the LPG industry in the UK).They have given a considerable and extensive amount of assistance in helping with this procedure and information. Their website has additional user information on handling , treatment of cold burns,etc. https://www.uklpg.org/resources/information-sheets

Whilst the operation of filling flight cylinders needs to comply with the main sections of the BBAC Propane Code, this appendix summarises the procedures and additional information that is specific to filling flight cylinders from a static LPG storage installation / bulk tank – it does not include procedures and information for the filling of Balloon Flight Cylinders at public LPG Refuelling Facilities / Commercial Automotive (Autogas, etc) or from a road tanker.This information and procedures will be in Appendix 2 to the BBAC Propane Code.

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1) Balloon Flight Cylinders

These cylinders are designed and manufactured in stainless steel, aluminium or titanium to comply with EASA and TPED legislation. All cylinders are inspected annually by a BBAC approved Inspector and are inspected internally, then proof pressure tested every, 10 years at an approved testing facility.

Filling of these cylinders is to be carried out in a designated filling area with the cylinders
- Secured in the basket - on an open trailer, on an open vehicle or on the ground,
- Secured on an open trailer or open vehicle (a closed trailer or vehicle with open back doors is not acceptable)
- Loose on firm level ground.

2) Some information on LPG

LPG is stored as a liquid under pressure in storage vessels or cylinders. The liquid is stored at ambient temperature and remains a liquid due to the pressure containment; with a release of pressure to the atmosphere, the liquid readily evaporates, resulting in the formation of vapour. In the UK, bulk supply cylinders are filled with commercial propane but in other countries may be filled with an LPG having different proportions of Propane and Butane.

2.1 Some properties of LPG

- LPG is classified as highly/extremely flammable and an odorant has been added to it to help detect leaks by smell.
- LPG is not toxic but at high concentrations can act as an asphyxiant.
- LPG is non-corrosive but the liquid can dissolve some lubricants, plastics or rubbers.

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- LPG may leak as a vapour or a liquid.
- If a liquid leaks it will quickly evaporate and form a relatively large cloud of flammable vapour.
- Leaks of vapours are potentially less hazardous.
- LPG vapour is about one and a half times heavier than air, so will initially drop to the ground. However, as the vapour mixes with air, the density of the mixture reduces and may not necessarily be at ground level.
- LPG vapours can travel some distance along the ground and can collect in drains or basements.
- If a mixture of LPG in air is in the flammable range and meets a source of ignition it can ignite resulting in a fire or even an explosion.
- If involved in a fire, cylinders may fail, resulting in a BLEVE (Boiling Liquid Expanding Vapour Explosion)
- Release of liquid LPG onto the body can cause cold burns.

2.2 Cold Burns treatment summary

- Immerse the affected part in cold or tepid running water for at least 10 minutes or pour cold water on the burn.
- Do not break blisters.
- Do not remove clothing if it is stuck to the skin
- Loosely cover the affected area with a clean, dry dressing.
- Remove restrictive clothing or jewellery before swelling starts.
- Keep contaminated clothing away from ignition sources as some gas may be given off during thawing.
- Do not allow smoking or drinking of alcohol; these reduce the blood flow to any affected area.
- If medical help has not been summoned, recommend the person contacts their GP or hospital A & E department for a check up as soon as possible. Do not alarm the person; stress that medical attention is a wise precaution and that all injuries or potential injuries are treated in the same way. See UKLPG Leaflet – Cold Burns https://www.uklpg.org/media/DOC5A27C1AC9B8C5/Kenilworth%20UIS027%20-%20COLD%20BURNS.pdf

3. Training

Training is essential for the safe operation of filling and to minimise the consequences should an incident occur. Training should include:
- The safe operating procedures.
- Understanding roles for normal operations.
- Actions to be taken in the event of an emergency.
- Dangers of overfilling cylinders.

4. Personnel

- Any personnel involved with filling should be over 18, trained and receive refresher training at regular intervals.
- A training record should be maintained for each individual.
- Training shall be completed for the specific site before individuals are allowed to fill cylinders.

5. Clothing and Footwear

Release of liquid LPG can cause cold burns and damage to the eyes. Personnel are to wear the appropriate PPE including :
- Eye protection.

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- Gloves.
- Clothing with long sleeves and trousers, preferably natural fibres to minimise static.
- Enclosed footwear. If cylinders are being moved, then these should be safety footwear.

6. Location See diagram at end of this appendix for separation distances.
Ensure the area around the filling area is:
- Well-ventilated and in the open air.
- Clear of drains.
- Clear of parked vehicles/trailers.
- Away from potential sources of ignition.
- Illuminated when filling out of daylight hours.
- Clear of people and vehicles not involved with the filling operation.
- Ensure that “No smoking”, “No Mobile Phones” and other warning notices are located in prominent positions.
- Provided with one fire extinguisher (2kg dry powder) readily available for personnel in a basket and at least one fire extinguisher (6 kg dry powder) in the filling area.
- There should be no electrical equipment within the separation distance,unless it is certified as being suitable for use within a hazardous area.(see section 7)

7. Electrical installation

7.1 Power supply / wiring The power supply and wiring should be suitable for a potentially hazardous area (details in BS EN 60079 series of standards and UKLPG Info sheet 008(https://www.uklpg.org/media/DOC5A26B849DF888/Kenilworth%20UIS008%202010%20-%20ELECTRICAL%20INSTALLATIONS%20ASSOCIATED%20WITH%20BULK%20LPG%20INSTALLATIONS.pdf) Any generator being used should be positioned outside the separation distance and the associated wiring meet “BS7909 Code of Practice for temporary electrical systems for entertainment and related purposes”.

7.2 Dead Man's Handle If the “dead man's handle” is used in the separation distance, then it should be suitable for use in hazardous areas. If it is used attached to a cable, then the circuit should be protected, so no spark could occur in the event of the cable being damaged; e.g. by using an IS (intrinsically safe) supply.

7.3 Lighting Ensure adequate lighting is used when refuelling. Preferably lighting should be outside the hazardous area. If within the hazardous area, lights and torches shall be suitable for the application.(e.g ATEX) Once lights are switched on, leave on until filling is complete. Only turn lights off when filling is complete and bulk vessel is secured.

8. Requirements when filling cylinders

8.1 Weather Do not fill in unstable weather conditions e.g. when the weather can change quickly, especially with the risk of thunderstorms and lightning.

8.2 Couplings Ensure correct fill couplings are available (e.g. 1¼” or 1¾" Acme screw/Tema quick release)

8.3 Preparation Flight cylinders shall only be filled when:

- Secured in the basket on an open trailer, on an open vehicle or on the ground
- Secured on an open trailer or open vehicle (a closed trailer or vehicle with open back doors is not acceptable)
- Loose on firm level ground.
- Before filling cylinders, remove any trailer cover (flapping covers are a potential source of static)
- The number of personnel involved in the filling process should be kept to a minimum, but should be no less than two.

8.4 After the vehicle and/or trailer enters the filling area ensure:

- That the handbrake is applied.
- No personnel are in the vehicle during filling.
- The engine is switched off and the ignition keys removed from the vehicle.

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- No auxiliary equipment is switched on or off during filling.
- Any trailer remains attached to the vehicle.
- Vehicle doors are not opened/closed during refuelling.
- The ignition keys are not returned to the vehicle until filling has ceased and the system is secured.
- Personnel are aware of the correct operation and location of fire extinguishers.
- Personnel remain present and in control during the filling process.
- Personnel are aware of any potential sources of approaching danger, e.g. people smoking or approaching the area (especially downwind of the filling area).
- Pre and post filling checks are completed.

9. Emergency Procedures

9.1 If filling with an electrical driven pump -

- Release the dead man's handle.(this will stop the pump motor and the flow of LPG).
- Press any emergency stop buttons
- **If safe to do so** - Isolate the power supply and isolate the source of the LPG leak by turning off all valves.

9.2 In the event of a fire Only providing it is safe to do so -

- **Attempt to isolate the source of the LPG leak by turning off all valves and**
- **Attempt to extinguish the fire -** If, after 30 seconds the fire cannot be extinguished -
- **Evacuate** all persons to a safe location, a minimum of 75m (preferably upwind).
- **Contact** the emergency services, informing them that there is a fire involving LPG.

9.3 In the event of a leak without fire If leak does not or cannot be stopped:

- **Evacuate** all persons to a safe location a minimum of 75m (preferably upwind)
- **Contact** the emergency services,informing them that there is a leak involving LPG

9.4. In the event of an incident.

Report the details to the owner/ operator of the system and the BBAC Safety Officer.

The defect shall be rectified and the system checked by a competent person before being used again.

10. Filling cylinders

10.1 General. Switch off all mobile phones and electronic devices or leave outside the filling area.

10.2 When filling:

- Make the fire extinguishers accessible and check they are serviceable.
- Ensure that you have access to bleed valve and cylinder supply valve at all times to prevent overfilling.
- Only fill one cylinder at a time.
- Only vent one cylinder at a time.

10.3 In addition when filling cylinders secured in a basket.

- Check that there are no sources of ignition in basket or filling area (strikers / lighters / radios/ instruments etc).
- Do not check burner/piezo operations.
- Unless required for cylinder monitoring, do not stand in the basket when filling.
- Ensure only personnel directly involved in the filling operation be allowed in the basket,whilst any cylinder is being filled.
- Do not to lean on or crush the fuel safe vent hoses.

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10.4 Filling procedure

- Ensure all the valves are closed on the cylinder.
- When fitted, ensure the valve on the filling hose end is closed.
- If filling cylinder in the basket, connect fuel safe vent hose to bleed/ullage valve and ensure that the discharge end of fuel safe vent hose is below and outside of the basket.
- Connect the filling hose from bulk vessel to the cylinder.
- Open all valves in the filling system and check for leaks - If a leak is suspected, immediately close all valves.
- Check connections, hoses and valves to identify leak.
- Rectify in accordance with the balloon manufacturer's manual.
- Do not continue until the leak has been rectified.
- Open cylinder bleed / ullage valve.
- Open flight cylinder valve.
- Start pump to fill the cylinder.
- Watch the end of the bleed/ullage valve or fuel safe vent hose for the first signs of the liquid "white jet",this indicates the cylinder is 80% full.

10.5 When the first sign of LPG liquid "white jet" is seen

- Close cylinder valve.
- Close bleed/ullage valve.
- Stop the pump.
- Close hose end valve (if fitted).
- Disconnect filling hose coupling from cylinder.
- Disconnect fuel safe vent hose.
- Repeat filling procedure for other cylinders.

10.6 When last cylinder has been filled

- Ensure that all cylinder and bulk vessel valves are turned off and any self- sealing valves have been released and dust caps replaced.
- Secure bulk LPG tank.

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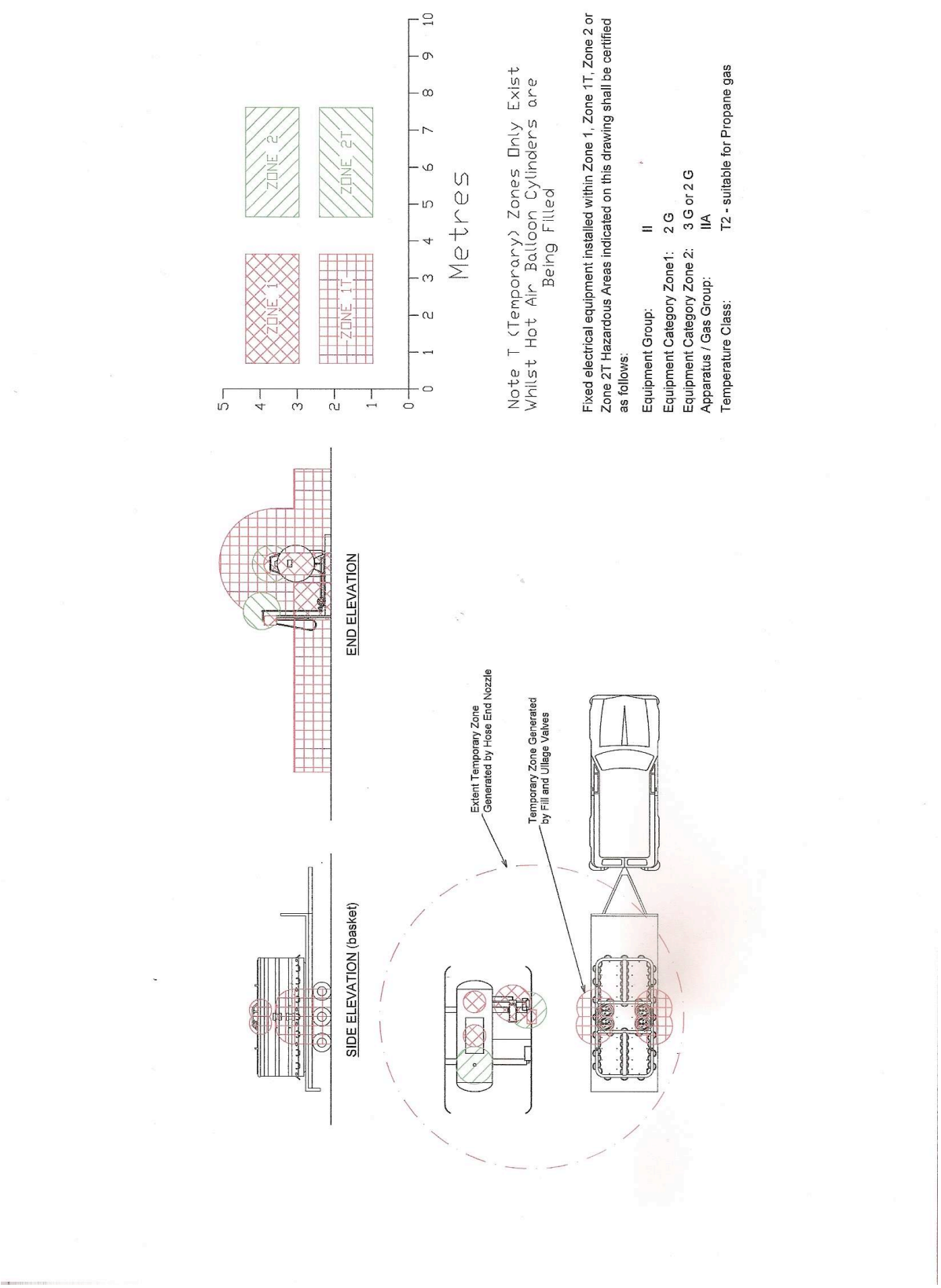
11. Typical separation distances and hazardous area classification.



12. Definitions.

ATEX Equipment and protective systems intended for use in explosive atmospheres

BFC Balloon flight cylinders,in this appendix called “cylinders”

BLEVE Boiling Liquid Expanding Vapour Explosion

CAA Civil Aviation Authority

“Dead Man's Handle” or “Push and Hold to Run” - a mechanism which,when released, turns off the power to a pump and at the same time stops the flow. This system of control is required to be fitted to all electrical driven pumps.

EASA European Aviation Safety Agency

Fuel safe vent hose Extension fitted to the cylinder ullage/bleed valve so that any release of LPG is outside the basket.

LPG Liquefied Petroleum Gas; in the UK taken as being propane to BS4250.

PPE Personnel Protection Equipment.

TPED Transportable Pressure Equipment Directive.

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