Appendix 01/22

Minutes of the 35th meeting of the Asbestos Network Technical Working Group (ANTWG), 12th July 2022
Composition of TWG = ACAD, ARCA, BOHS-FAAM, HSE, Independent Industry Representative, NORAC and UKATA

Decontamination Unit (DCU) Services (Gas and Electrical)

Appendices are attached to Technical Working Group minutes when the nature and extent of discussions (or the complexity of the subject) warrants further explanation and clarification. This guidance is primarily aimed at Licensed Asbestos Removal Contractors (LARC) however it equally applies to other DCU users. The following is a summary of the discussions and conclusions on the above topic and should be read in conjunction with HSG247 and L143.

GAS SYSTEMS: DESIGN AND CONSTRUCTION OF DECONTAMINATION UNITS

Appliance Manufacture and Installation

Where gas appliances are fitted, they should meet BS EN 1949:2011+A1:2013. All gas appliances should be installed by competent gas fitters who have received relevant training including CCLP 1 (LAV) Core LPG Safety for Leisure Accommodation Vehicles from a training body accredited by UKAS.

Where liquefied petroleum gas (LPG) fired heating equipment is used, either for heating water for showers or for space heating, it is good practice that appliances of the 'room sealed balanced flue' type are installed (also see note below). Each appliance in the DCU should be provided with a separate isolating valve and a flame failure device.

Note: The Gas Safety (Installation and Use) Regulations 1998 Approved Code of Practice and guidance states that any gas heater mounted inside the DCU must be of a room-sealed type; open-flue types must not be used.

Gas Cylinder Storage

Where LPG is used, the cylinders should be stored in an adequately secured and well-ventilated cupboard or storage rack external to the DCU compartments.

Note: BS EN 1949 states if the ventilation is provided only at low level, the free area shall be at least 2% of the compartment floor area and a minimum of 10,000 mm^2. If the ventilation is provided at high and low level, the free area at each level shall be at least 1% of the compartment floor area and not less than 5,000 mm^2. Low level means in the floor, or in the side wall touching the floor (the compartment door is not classed as a side wall). It should not be possible for the cylinder to obstruct the ventilation area.

In addition:

- The label on the gas cylinder storage compartment should indicate liquefied flammable gas is being carried.
- The gas cylinder storage compartment should be sealed from the occupied sections of the DCU and accessible from the outside only.
- The cylinder must be positioned away from heat sources (exhaust system).
- The compartment must be designed so that the cylinder can be secured rigidly (to prevent movement when the vehicle is in motion) and in the upright position with the valve uppermost.
- The cylinder should be secured at both high and low level.
- Access to any connections, change over valves and pressure regulators must not be obstructed.
- A low-pressure regulator and hose to BS EN 16436-2:2018 and BS EN 16436-1:2014+A3: 2020 (generally an orange-coloured hose date stamped) should be connected directly to the valve on the cylinder.

Gas Safety Inspection Record

On delivery of a newly purchased DCU the supplier should provide a completed Gas Safety Inspection Record. This certifies that the gas pipework and appliances are considered to be in safe working order.

GAS SYSTEMS: OPERATION OF DECONTAMINATION UNITS

The following is general guidance and is not intended to replace manufacturer's instructions which should always be followed.

Normal Operation

The gas (normally LPG) system needs to be checked to ensure that it is operating safely. The gas pipework connections and boiler can be damaged during transportation and use. Therefore, the LPG system and boiler should be inspected daily by the site supervisor for any obvious damage (e.g., loose connections or physical damage), and before the next use of the DCU (including by hire companies). Emergency procedures should include the scenario where somebody can smell gas, and these should be practised periodically.

No items should be stored in the cylinder compartment that can cause damage to the LPG installation or ignite escaping gas.

Appliances should not be left on overnight. At the end of each working period, the gas supply should be turned off both at the appliance and at the cylinder. This should also take place prior to the transportation or site movement of the DCU.

The gas cylinder should remain within the ventilated storage compartment during usage. Where long term sites utilise larger cylinders, these can remain outside the unit, measures must be put in place to ensure they are on level ground and not at risk of being knocked over/struck (e.g., securing the cylinder with a chain).

Note: All vents related to the gas boiler and gas cylinder storage cupboard should remain unblocked. Blocked vents within the gas cylinder storage cupboard will allow any leaking gas to accumulate creating the risk of explosion.

Carbon Monoxide

The gas boiler has the potential to produce carbon monoxide (CO). CO forms if there is incomplete combustion such as a result of a poorly maintained boiler or inadequate flue. If a boiler is installed within the clean end of a DCU, the seals around the boiler compartment should be regularly checked and maintained. Blocking vents within the DCU, coupled with a poor seal on the boiler cupboard door, can lead to a build-up of CO within the DCU and the possibility of CO poisoning of those using the DCU which can be fatal.

Note: CO detectors/alarms have a limited shelf life and can malfunction, particularly in damp/humid environments as found within a DCU. The test button will not necessarily recognise that the sensors have stopped working. Therefore, they cannot be relied upon within a DCU. The main controls to prevent the formation and build-up of CO are regular servicing, maintenance and adequate siting and ventilation. At the job planning stage, the contracts manager should consider the potential for CO in their planned siting of the DCU including positioning in enclosed or low-level areas and where height clearance is minimal.

CO detectors are still considered useful as a warning device and may be installed by the LARC as the manufacturer does not always supply these. However, operatives and supervisors must understand their limitations (as detailed above) and also be aware of the causes and symptoms of CO poisoning. The NHS summarise these as follows for low level exposure:

- tension-type headache
- dizziness
- feeling and being sick
- tiredness and confusion
- stomach pain
- shortness of breath and difficulty breathing

And for high levels of exposure:

- impaired mental state and personality changes (intoxication)
- the feeling that you or the environment around you is spinning (vertigo)
- loss of physical co-ordination caused by underlying damage to the brain and nervous system (ataxia)
- breathlessness and a heart rate of more than 100 beats per minute (tachycardia)
- chest pain caused by angina or a heart attack
- an uncontrollable burst of electrical activity in the brain that causes muscle spasms (seizures)
- loss of consciousness – in cases where there are very high levels of carbon monoxide, death may occur within minutes

Cold Weather Considerations

During periods of cold weather (5^{o}C and below) propane should be used instead of butane as butane does not easily vaporise at low temperatures.

The DCU should be fully drained down at the end of each working day. It is not always possible to remove every drop of water from the boiler system, and so possible for water to freeze in the heat exchanger which could cause an explosion when the boiler is relit. Consideration should be given to using a low power oil filled radiator or similar to keep temperatures above freezing.

Note: It is critical the system is refilled prior to lighting when next in use.

Gas Safety Inspection and Annual Service

Gas appliances should be serviced and maintained in accordance with the manufacturer's recommendations at least every 12 months by a Gas Safe registered LPG engineer. The engineer should hold CCLP 1 (LAV), Core LPG Safety for Leisure Accommodation Vehicles, and a new Gas Safety Inspection Record issued.

The Gas Safety Inspection should include**:**

- Cylinder storage, suitability and ventilation
- Hose and Regulator within date and in good condition
- Gas pipework - check for soundness and visually inspect
- Boiler – check mounting security, strip and clean, check safety cut outs, check pilot, check flame picture, check casing and seals where fitted
- Flue – check for damage and blockings. Use flue analyser or smoke test

The Annual Service of the DCU should also include:

- Water system pipework – check for leaks and damage
- Shower – run to check water temperature and regulator
- Vent grilles in DCU - remove and thoroughly clean

Please note these lists are not exhaustive.

ELECTRICAL SYSTEMS: DESIGN & OPERATION OF DECONTAMINATION UNITS

Electrical Safety - General

The electrical equipment inside the DCU should have been inspected and tested by a qualified electrician before the unit is taken to site for the first time and regularly thereafter (1-to-3-year interval as recommended by the Electrical engineer). There should be documentation to demonstrate this.

The electrician for the initial inspection and test of the unit should be qualified to at least Level 3 Award in Initial Verification of Electrical Installations (2391-50). For the periodic tests, to at least Level 3 Award in Periodic Inspection and Testing of Electrical Installations (2391-51).

A fixed power supply should be provided wherever possible so that the DCU can run continuously (i.e., be "fully operational") when workers are in the enclosure. Continuous power will also be needed for other reasons (e.g., to operate negative pressure units (NPUs) etc). The plan of work (POW) should state the nature of the power supply.

Note: The LARC needs to justify why a fixed electrical supply cannot be provided as most sites will have power. Fixed electrical supplies are more reliable but not without risk. The absence of (or non-use of) a fixed electrical supply increases the risk of having ineffective decontamination arrangements.

Electrical Earthing When Connected to Mains Supply

If an electrical supply is taken from an existing building, there is the potential for danger from that connection. Most supplies from the public distribution system are of a PME (protective multiple earthing) type. Dangerous voltages may be exported to the DCU through the earth connection to the building if there is a fault with the supply to the building. Dangerous voltages may also occur if there is an electrical fault in the building and the buildings protection systems are not working correctly.

The risk is to anyone standing on the ground who can touch any live surface of the DCU. They could be exposed to a dangerous voltage.

Note: The risk could be avoided if the DCU manufacturer designed the electrical systems within a DCU so that an external earth connection was <u>not</u> required. One way of achieving this would be to use a method protection against electric shock called Electrical Separation (see BS 7671). This is the preferred method.

If a supply is taken from a mains socket outlet in a building, to minimise risk, **the building owner should be asked to confirm that the electrical system has been maintained (by providing copies of up-to-date records of inspection & testing) and the socket is RCD protected and safe to use**. A test with an advanced plug-in tester prior to connecting the supply will give some assurance that the socket outlet can be used. (See *Electrical Safety First Best Practice Guide: Selection and use of plug-in socket-outlet test devices* https://www.electricalsafetyfirst.org.uk/media/1205/best-practice-guide-8-issue-2.pdf)

An alternative is to install an earth rod (or other suitable earth connection) connected to the earth system in the DCU and which is **independent from the building earth**; this method must make an **effective connection to earth**. In practice this doesn't happen because:

- When pre-prepared cables are used and connected from a building to the female socket on a DCU, the cable will contain an earth from the building. This earth will be connected through to the main earth terminal in the DCU. The DCU is connected to the supply earth by default.

- Earth rods can't always be easily installed and are often placed under a road wheel or jack leg where it is unlikely that an effective earth connection will be made.

Note: Underground services could also be present meaning earth rods should never be pushed into un-surveyed ground.

Electrical Earthing for Integral Generators

This risk from dangerous mains voltages can also be avoided if the DCU is not connected to the building earth. Using a dedicated generator is one way to do this. If the generator used is below 10kVA then earthing electrodes (rods) can often be completely omitted providing certain criteria are met (refer to Modular & Portable Building Association (MPBA) guidance, TB01-2020 included at the end of this Appendix courtesy of MPBA).

Please note the MPBA guidance does state that an earth rod should be installed if practicable, but where it is not practicable, then it can be omitted. Examples where this is likely to be not practicable include shorter duration works, typically those less than one month.

For longer duration works, testing of the effectiveness of the earthing rod should be undertaken by a suitably qualified electrician.

DCU Operation (when powered by a generator)

The Control of Asbestos Regulations 2012 ACOP and Guidance states that a DCU must be "fully operational before any work (including ancillary work) starts", hence the preference for a fixed power supply.

When using a generator to power the DCU, these are usually turned off when not in active use to reduce the impact on the environment (both noise and emissions). The generator is expected to be in good working order such that it reliably starts when the DCU will be used. This includes any access to the clean end for replenishing supplies etc. A testing regime to check the ability to 'fire up' should be in place and documented and checks should be made to ensure a sufficient supply of fuel is available. In addition, the LARC emergency plan must include arrangements in the event of a generator failure, including what action to take for any contaminated workers.

A DCU should run for at least 10 minutes after each usage to allow for adequate purging of the unit.

References

HSG247 "Asbestos: The licensed contractors' guide"

L143 "Managing and working with asbestos", CAR2012 Approved Code of Practice and Guidance.

BS EN 1949:2011+A1:2013 Specification for the installation of LPG systems for habitation purposes in leisure accommodation vehicles and accommodation purposes in other vehicles

Gas Safety (Installation and Use) Regulations 1998 (GSIUR) as amended. Approved Code of Practice and guidance https://www.hse.gov.uk/pubns/books/l56.htm

BS EN 16436-2:2018 Rubber and plastics hoses, tubing and assemblies for use with propane and butane and their mixture in the vapour phase – Assemblies

BS EN 16436-1:2014+A3:2020 Rubber and plastics hoses, tubing and assemblies for use with propane and butane and their mixtures in the vapour phase - Hoses and tubings

BS 7671:2018+A2:2022 Requirements for Electrical Installations. IET Wiring Regulations

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Earthing of Mobile Portable Buildings fitted with integral generators

This article is intended to help installers and management staff clarify the requirements and take the necessary action in respect of earthing mobile and transportable units with integral generators (hereafter referred to as "units").

It sets out guidance that site-based engineers and managers can use to decide if a unit may require earthing.

It is important to ensure that the correct standards are referred to, in the case of these units usually fall within the scope of section 717 of BS 7671:2018+A1:2020 *Requirements for Electrical Installations (IET Wiring Regulations 18th Edition)*.

The internal wiring of such units is covered by BS 7671, along with connection to relevant supplies, the requirements for earthing of generators is specifically excluded under regulation 717.1 (iii).

BS 7671 does, however, contain specific requirements for the generators under section 551 *Low voltage generating sets*.

Regulation Group 551.4 relates to fault protection, but is generic in nature, and does not cover the earthing requirements for fault protection, which is covered in general terms, by Chapters 41 of BS7671 *Protection against electric shock* and 54 *Earthing arrangements and protective conductors*.

In turn, BS 7671 avoids specifying performance requirements for earth electrodes and earthing conductors used for transformers and generators, and instead refers to BS 7430:2011+A1:2015 *Code of Practice for Earthing* in Regulation Groups 542.2 and 542.3.

BS 7430 contains detailed information on the requirements for earthing low voltage generator sets. In general this standard requires that such mobile generators are earthed appropriately, typically requiring the use of an earth electrode external to the unit.

However, Clause 7.1 *Unearthed generating sets (ratings below 10 kW)* addresses the use of unearthed generating sets rated below 10 kVA. Clause 7.1.4 *Unearthed generators supplying a mobile or transportable unit* contains specific requirements for supplying a mobile or transportable unit from an unearthed single phase generator rated below 10 kVA.

This clearly shows that we can accept, for small (<10kVA) single-phase generating sets, the use of an earth electrode may not always be required. Provided the following are adhered to, electrodes can be completely omitted in cases where it is not practicable to provide one:

- The generating set must be below 10kVA. [1]
- The generating set must be single phase. [2]
- The installation shall comply with BS 7671. [3]
- All exposed conductive parts of the unit must be connected together and to the frame of the generator using a suitable conductor or cable. [4]
- The installation shall be protected by RCDs throughout. [5]
  It is recommended that an RCD be incorporated as close as possible to the generator itself. RCDs should, as far as practicable, be coordinated to prevent tripping of an upstream RCD before of a downstream RCD for faults on final circuits.
  Note: Where the generator connects via a socket-outlet rated up to 32 A, Regulation 411.3.3 of BS 7671 usually requires the socket-outlet to be protected by a 30 mA RCD. In this case, coordination of RCDs may not always be possible.
- Circuits supplying socket outlets that may reasonably be expected to supply equipment external to the unit, shall have additional protection in accordance with regulation 415.1.1 of BS 7671, i.e. a 30ma RCD shall be used. [6]
- All cables and system components shall be suitably selected to withstand the environment and use they may reasonably be subjected to.
- The system shall be regularly checked and maintained as appropriate to minimise potential risks. [7]
- Installed equipment shall preferably be of class II construction where possible to minimise the risk of shock.
- If practicable, an earth electrode should be connected to the main earthing terminal of the unit, with a resistance to earth sufficiently low enough to operate RCDs. [8]
  Note 1: It is strongly recommended that an earth electrode is used where the electrical installation within the unit may supply equipment outside the unit.
  Note 2: Table 41.5 of BS 7671 provides guidance on the resistance of earth electrodes based on RCD residual operating currents. The earth electrode resistance should be sized based on the largest RCD residual operating current rating in the installation, and also be below 200 Ω to avoid instability.

As with any electrical system design to ensure compliance with the above requirements verification must be made by a competent person and that person must ensure that the system fulfils the requirements of any applicable standards specific to that installation.

[1] Note 1 to Clause 7.1.1 of BS 7430
[2] Clause 7.1.4 (a) of BS 7430
[3] Clause 7.1.4 (b) of BS 7430
[4] Clause 7.1.4 and Figure 9 of BS 7430, and Regulation 722.411.3.1.2 and Figures 717.1 and 717.2 of BS 7671
[5] Clause 7.1.4 (c) of BS 7430
[6] Regulation 717.415.1 of BS 7671
[7] Clause 7.1.1 of BS 7430
[8] Clause 7.1.4 of BS 7430