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Breathing-Air Quality Testing Regulations

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AIR QUALITY TESTING – WHY?

The required quality of breathing air is stated in EN12021 is to provide information on the safe limits of potential contaminant gases within breathing air and to ensure that the life support gas of oxygen is of an adequate level.

Compressed air for breathing normally originates from a compressor system installed or operating at the place of use and there are various factors that can affect the quality and safety of this air.

- The air intake to the compressor can ingest airborne contamination from local processes and vehicle exhaust fumes which are not removed by standard breathing air filtration. Such air borne contamination may not be continuous but the pollution of the air supply may persist for hours or days.
- Malfunctioning compressors, especially reciprocating type, can produce unsafe levels of both carbon monoxide and carbon dioxide.
- Breathing air filtration has a finite life and can fail causing high levels of oil and water contamination to be present in the air.
- The performance of desiccant filters is dramatically affected by operating temperature. Infrequent validation may result in poor quality air being supplied for an extended period
- Failure of the compressed air aftercooling will result in air entering the filtration at too high a temperature, this will cause the filtration to prematurely fail and pass excess levels of oil and water.
- Malfunctioning dryers can disturb the oxygen concentration to outside safe levels within the breathing air.
- High levels of water in breathing air can freeze within RPE demand valves causing the air supply to fail.
- Insufficient air flow or pressure to the RPE will reduce the protection factor of the RPE and potentially expose the user to ingress of external contaminants.
- The effects of contaminants when breathed at elevated pressure can have a much greater effect on users than it would at normal pressure.
- Changes in the performance of compressor and filtration equipment are usually rapid in nature. Any failure affecting outlet air quality may injure users for an extended period if quality validation is infrequent.
- Odour alone is a poor indicator of air quality, toxic as asphyxiant gasses are often odourless, the limits for oil pollution are lower than the threshold detection level that most people will notice.

All employers have a duty of care to their employees to ensure that the breathing air they are supplied with is adequate for the RPE they are using and safe to breathe. The points raised above may form the basis of the risk assessment called for in the European guidance document for the selection and use of respiratory protective devices EN 529 which says in annex A :-

A.4.5 Compressed air for breathing apparatus from EN529

A.4.5 Compressed air for breathing apparatus (EN12021)

A.4.5.1 General

A compressor system will have produced the compressed air supplied to a breathing apparatus. The compressor system may be used for filling individual high-pressure vessels or those on a mobile trolley or to supply air direct to breathing apparatus and other air-tools used in the workplace.

Contaminants can mix in compressed air at various stages of its production and supply. Any presence of contaminants in acceptable quantities will render the air unsuitable as “breathable air” and can threaten the health and safety of the respiratory protective device wearer. For this reason quality assured compressed air should be supplied to a breathing apparatus. EN12021 stipulates the minimum quality standards for breathable compressed air and includes the levels for oxygen, carbon monoxide, carbon dioxide, lubricants, water and other types of contaminant and odour.

A.4.5.2 Compressor system

A.4.5.2.1 General

A competent person should be consulted when planning or installing a compressed air system for producing breathable air. This will help to minimise problems associated with compressors and the down stream effects on the quality of the air supplied. Table A.2 provides a summary of the main elements associated with a compressor system for producing breathable air. In addition to the careful and installation of the system it should be maintained by a competent person to ensure the safe operation of the system.

The compressor should be installed in an area providing sufficient space on all side to ensure good ventilation. The area should be cool as possible but avoid place where freezing is possible. The air intake point should be located in open air and away from potential contaminants (e.g. not close to ventilation outlets or in down stream of the outlets or near vehicle exhaust emission points).

A.4.5.2.2 Air purification elements

The air purification elements should be placed in the correct sequence to ensure the delivery of acceptable quality breathing air. These purification elements should be replaced in accordance with the advice provided by the competent person and the manufacturers of these elements.

A.4.5.2.3 Testing and inspection

The volume flow and quality of the supplied air should be thoroughly tested as specified by a competent person after risk assessment.

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COSHH L5 (Fifth Edition 2005)

EXTRACTS FROM CODE OF PRACTICE RELATING TO RESPIRATORY PROTECTIVE EQUIPMENT (RPE)

- 178 The maintenance, examination and tests should be in accordance with the manufacturer's instructions. Examinations should comprise a thorough visual examination of all parts of the respirator or breathing apparatus, to ensure that all parts are present, correctly fitted, and the equipment is in good working order. In particular, the examination should ensure that the straps, facepieces, filters and valves are sound and in good working condition. For powered, and power-assisted respirators, test should:
- (a) be made on the condition and efficiency of those parts;
 - (b) ensure that the battery pack is in good condition; and
 - (c) ensure that the respirator delivers at least the manufacturer's recommended minimum flow rate.
- 179 For RPE incorporating compressed gas cylinders, tests should include the condition and efficiency of all parts, the pressure in the cylinders and the volume flow rate.

Frequency of examination and tests

- 180 The quality of the air supplied to breathing apparatus should be tested at least once every 3 months and more frequently when the quality of the air supplied cannot be assured. Where the air supply is from mobile compressors, the employer should ensure that wherever a compressor is located, the quality of air it supplies is not compromised by nearby contaminants. In every case, the air supplied to a breathing apparatus should meet the quality standard recommended in clause C.1.2 of BS: 4275: 1997 *Guide to implementing an effective respiratory protective device programme*.¹⁹ However, BS: 4275 recommends that all contaminant levels should be below one tenth of the OELs. As it is not reasonably practicable to test for all contaminants, the risk assessment made under regulation 6 should guide what other contaminants will require testing.
- 181 Thorough maintenance examinations, where appropriate, tests of items of RPE, other than one shift disposable respirators, should be made at least once every month, and frequently where the health risks and conditions of exposure are particularly severe.
- 182 However, in situations where respirators are used only occasionally an examination and test should be made prior to next use and maintenance carried out as appropriate. The person who is responsible for managing the maintenance of RPE should determine suitable intervals between examinations, but in any event, the intervals should not exceed three months. Emergency escape-type RPE should be examined and tested in accordance with the manufacturer's instructions.
- 183 Suitable arrangements should ensure that no employee uses RPE which has previously been used by another person unless it has been thoroughly washed and cleaned in accordance with the manufacturer's instructions.

Suitable Records

- 184 The record of each thorough examination and test carried out should include:
- (a) the name and address of the employer responsible for the RPE;
 - (b) particulars of the equipment and of the distinguishing number or mark, together with a description sufficient to identify it, and the name of the maker;
 - (c) the date of examination and the name and signature or other acceptable means of identifying the person carrying out the examination and test;
 - (d) the condition of the equipment and details of any defect found, including the canister or filter respirators, the state of canister and the condition of filter;
 - (e) for self-contained compressed air/gas breathing apparatus, the pressure of air/gas in the supply cylinder; and
 - (f) for powered/power-assisted respirators and breathing apparatus, the volume flow rate to ensure that they can deliver at least the manufacturer's minimum recommended flow rate.

Keeping Records

185 Employers may keep records in any format, e.g. on paper or electronically. They should be kept readily accessible and retrievable at any reasonable time for examination by safety representatives or inspectors etc.

Cleaning protective clothing

186 When necessary, protective clothing contaminated by substances hazardous to health should be cleaned before their next use. For example, where protective equipment such as plastic aprons become contaminated, they should be thoroughly washed and hung up to dry before employees leave the work area for a rest, meal or break. This is important to prevent any hazardous substance on the apron from later contaminating the wearer when it is reused.

Accommodation for personal protective equipment

- 187 Employers should ensure that accommodation is provided for PPE so that it can be safely stored or kept when it is not in use. The adequacy of the accommodation will vary according to the quantity, type and its use e.g. pegs, (labeled) lockers, shelves or containers etc. The storage should be adequate to protect the PPE from contamination, loss or damage by, for example, harmful substances, damp or sunlight. Where quantities of PPE are stored, equipment, which is ready for use, should be clearly segregated from that which is awaiting repair or maintenance. Where PPE becomes contaminated during use, and especially by biological agents, accommodation should be separate from any the employer provides for ordinary clothing and equipment. Employers may also have duties under the Workplace (Health, Safety and Welfare) Regulations 1992 to provide accommodation for PPE
- 188 All PPE should be checked regularly to ensure it continues to function and provide protection. The types of checks should be suited to that item of PPE and able to detect significant deterioration. The more likely the performance of a particular item of PPE is to deteriorate the more often it needs checking. Who ever does this work should be sufficiently trained to identify deterioration and significant faults. Equipment, which has deteriorated significantly or is faulty, should be effectively repaired or disposed of safely.

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Respiratory Protective Equipment at Work

Appendix 3: Quality of Air for BA

Air quality

1. Air supplied to BA should be clean and safe to breathe. The COSHH ACOP¹ requires that the quality of air supplied to BA should be assured.

Fresh air hose

2. You should securely anchor the inlet for fresh air hose BA in an area that is free of contaminant. This can usually be achieved by siting the inlet well way from the work area (eg in free air outside the building), and upwind of any local sources of airborne contamination (eg vehicle exhaust).

Compressed air

3. Compressed air for BA normally originates from a compressor system. The maintenance, examination and testing of compressors should be carried out according to the manufacturer's instructions. The siting of air inlets to compressors should follow the same principles as for fresh air hose. However, because compressors themselves can generate and concentrate a wide range of contaminants, you should take extra care in assuring air quality. As the BA wearer's life and health depends on the air supplied by the compressor, you should ensure that the air supplied meets the quality requirements in Table A3.1, which is based on recommendations in BS 4275,¹⁸ and the air flow rate requirements of the BA manufacturer. Compressors which are moved from site to site, such as those used by the emergency services, will require a higher standard of maintenance, and should be sited so that the quality of air they provide is not compromised by nearby contaminants.

Substance	Requirement
Oxygen	20.8% by volume \pm 1%
Carbon monoxide	< 5 ml/m ³ (< 5ppm by volume)
Carbon dioxide	< 500 ml/m ³ (< 500ppm by volume)
Oil mist	< 0.5 mg/m ³
Other contaminants	None present at > 10% of the relevant exposure limit
Odour/taste	No significant odour or taste
Liquid water	None present
Water vapour	Air up to 40 bar: Pressure dewpoint 5°C below minimum storage temperature if known or <-11°C if unknown Air from 40 to 200 bar: < 50 mg/m ³ Air > 200 bar: < 35 mg/m ³ Air for filling cylinders: < 25 mg/m ³

Periodic testing of air quality

4. The purpose of periodic tests of air quality is to ensure that the control measures you have put in place are delivering air quality as indicated in Table 13. The frequency of such tests should be based on a risk assessment, but the COSHH ACOP¹ recommends that periodic tests should be carried out at least every three months, and more often when the quality of air cannot be assured to these levels. Testing for these components may be carried out using any appropriate method, eg:
 - simple colour change tubes;
 - on-line gas testers;
 - sample collection for laboratory analysis elsewhere.
5. The supplier of your compressor or BA should be able to advise you on the best method for you. Records of air quality tests must be kept for five years.

Continuous monitoring

6. Compressors are available which include purifiers with automatic self-monitoring systems. These may be used as a substitute for periodic testing of the quality of breathable air if:
 - they can remove and effectively monitor for contaminants listed in BS 4275,¹⁸ including foreseeable substances identified in your risk assessment. If the system cannot monitor for all these contaminants, then you will have to have additional procedures in place to ensure that the air delivered is suitable for breathing;
 - it has been shown to be reliable for the substances being monitored;
 - the air quality monitoring takes place at a suitable point in the supply line;
 - safety systems are in place to cope with possible malfunctions of the self-monitoring system.
7. If such a system is fitted and used, the need for quarterly (or more frequent) periodic testing of air quality may be removed. However, it will not be possible to dispense with periodic testing of air quality altogether. The compressor and purifier is an 'engineering control system', for which thorough examination and testing is still required by COSHH (typically at a maximum interval of 14 months). This thorough examination should include tests of the air quality produced by the system.

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Source Acknowledgement:

HS(G)53 Respiratory Protective Equipment at Work ISBN 071762904 Health and Safety Executive 2005

Material:

Excerpt from Appendix 3 and one table "Quality of air for Breathing Apparatus" from HG(S)53 Respiratory Protective Equipment at Work. Health and Safety Executive (ISBN 071762904).

F2187 Draeger Deluxe Tube Tip Cutter

Opening the Draeger Detector Tubes by breaking off both ends has become safer and simpler than before. A slight turn of the tube is all that is needed in order to score the tip against three metal discs in the upper opening and then to break off the tip.

The F2187 is especially designed to prevent glass from falling out of the opener by accident. The reservoir for the broken-off tips is easy to empty.

Instructions

1. Place the end of the tube between the three blades, and turn to score the end.



2. Push the tube at an angle to break the tip.



3. Repeat steps 1 and 2 with the other end of the tube

For Oil (6728371) Tubes only

4. Once the air quality test is complete, place the ampoule section in the platform at the bottom. Note: Make sure the tube is against the back wall of the cutter. Line up the black dot nearest the end of the tube with dot on the cutter.



5. With one hand holding the cutter and the other holding the tube, applying pressure. This should break the inner tube.



6. Place your used detector tubes in the F2154 Travel Container, until they can be disposed off properly as "sharps" or glass.



Ensure the oil tube is kept vertical through out this process

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