AN INTRODUCTION TO COMPRESSED AIR QUALITY for BREATHABLE PURPOSES

Introduction

Supplied air breathing apparatus systems require a breathable compressed air source to feed the equipment. The quality of breathing air supplied by compressors will vary considerably and has the potential to cause anything from minor health symptoms, to a fatality, so it is crucial to have an understanding of compressed air systems and the demand for good quality. Growing awareness of the issues have resulted in the introduction of standards to control air quality fed to respiratory equipment users in Europe , USA and Australia. Compressed air supplied equipment is used in a variety of industries such as tank cleaning, shotblasting, paint spraying, mechanical works, nuclear decontamination and diving work.

Factors influencing compressed air quality

The quality of air generated by a compressor will depend on 2 key factors:

1. The compressor system , including its drying and filtration system
2. The quality of the air that is drawn in by the compressor

1. Compressor system

- Compressors operating at high temperatures which are too high, can produce Carbon Monoxide/ Dioxide.
- Inadequate filtration - filtration should be designed and specified for Breathing Air use.
- Filtration is not properly maintained.
- Operating temperature of the compressed air - filter efficiency diminishes with increased temperature to the point it may not be effective at all, so air should be cool enough to effectively filter.
- Improper filter media, which is not designed for breathing purposes, can result in changing the balance of gases in normal air, such as heightened oxygen.
- Breathing damp air will result in poor health symptoms, such as colds, sore throats or more serious conditions such as pneumonia.
- Too much water in the compressed air system can cause freezing especially where air passes through the small passages of valves and regulating devices, which can result in their malfunctioning.
- Exhaust gases generated by the compressor -for diesel or petrol compressors precautions should be taken to ensure that the exhaust gases are not drawn in to the air intake.

2. The quality of the air drawn in by the compressor

- The quality of air drawn in may be affected by the general environmental conditions – high humidity, high temperature air will be more of a challenge to air quality.
- Artificial or local conditions – air will be degraded by exhaust fumes and other contaminants which surround the compressor.

Breathing Air Standards

Please note: the below is guidance only taken from the full standards – the full standards should be referred to if necessary.

Region	Europe	US	Australia and New Zealand
Relevant Standard	BS EN12021 & EN12021:2014	CGA G-7.1-2011 Grade D	AS-NZS 1715: 2009*
Odour	The gas shall be free from unsatisfactory odour or taste.	None (No pronounced odour)	No objectionable or nauseous odour
Oxygen	(21 ± 1)%	19.5% - 23.5%	19.5% - 22%
Carbon Dioxide	≤ 500 PPM	≤ 1000 PPM	≤ 800 PPM
Carbon Monoxide	≤ 5 PPM	≤ 10 PPM	≤ 10 PPM
Oil	≤ 0.5 mg/m^3	≤ 5 mg/m^3	≤ 1 mg/m^3
Water Airline <40Bar	Where the apparatus is used and stored at a known temperature the pressure dewpoint shall be at least 5°C below likely lowest temperature. Where the conditions of usage and storage of any compressed air supply is not known the pressure dewpoint shall not exceed -11°C.	Dewpoint ≤50°F (67 PPM v/v), for SCBA use in extreme cold a dew point not to exceed -65°F (24 ppm v/v) or the dewpoint must be 10°F lower than the coldest temperature where the respirator is worn.	
Water High Pressure	40 to 200 bar ≤50 mg/m^3 >200 bar ≤35 mg/m^3 HP Charging Comp ≤25 mg/m^3		Contain not more than 100 mg/m^3 for cylinders initially filled to pressure of at least 120 bar.

Equipment for testing Air Quality

There is a variety of equipment available for testing air quality but it is important to establish that the equipment will cover the tests required by the standard. Some equipment will measure gases but not water vapour or dewpoint. Some equipment is designed to perform a test at a point in time, where other equipment is designed to monitor real time constantly. Equipment may use a variety of technology including thermo desorption tubes (eg Draeger tubes) , electrochemical sensors, and infra red sensors.

Some laboratories will provide analysis of a collected sample also.

How often should air quality be tested?

Compressed air should be tested to ensure it meets the required standards. Mobile breathing air systems according to the COSHH Regulations state that siting a compressor is critical, and air quality is tested where it is site and whenever it is moved.

In the UK the COSHH Regulations state that breathing air should be tested at least once every 3 months or more regularly if the reliability is questionable.

With a high pressure system, the air quality is dependant on regular filter changes so many systems will have a mechanism to indicate filter change built in to the compressor.

Testing regularity should be performed also according to risk assessment - where reliability of equipment is poor.

Records should be kept of each test, these may be hard or soft copy and should be retained for a minimum of 5 years.

Limitations of the standards

The standards deal with the basic requirements for breathable air quality. However, it is possible that air can be contaminated with a variety of other toxics which may not be detected by the equipment used for testing. For example the main toxic constituent in diesel fumes is Nitrogen Dioxide, which is not specifically required to be tested under the standards and which is not detected by all test equipment. Plants may have a high risk of other toxics being released to atmosphere which can in turn be drawn in by the compressor's intake.

References

EN12021.2014 Respiratory Protective Devices – Compressed Air for Breathing Apparatus

EN529.2005 Respiratory Protection Devices

COSHH Regulations .2002

HSG53: Respiratory Protective Equipment at work : A Practical Guide

For further information on breathing air compressors or equipment for testing air quality please contact Breathe Safety Ltd, 0844 915 1111 or sales@breathesafety.com