Oil Lubricated Compressors

IMCA D 056 Rev. 0.1
June 2021

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IMCA D 056 Rev. 0.1 – Version History

Date	Reason	Revision
June 2021	Minor additions made during review process	Rev. 0.1
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1 Introduction

A large number of oil lubricated piston type compressors are in use in the commercial diving industry for gas pumping and transfer. Concern has been expressed that these may introduce contaminants into the breathing gas, particularly from the oil used as a lubricant.

2 Objectives

The objectives of this guidance are to:

- inform contractors how improperly maintained or operated oil lubricated compressors may introduce contaminants into diving breathing gas supplies; and
- provide recommendations on how to prevent the contamination of diving breathing gases when oil lubricated piston type compressors are used as a means of compressing such gases.

3 Application

This guidance is intended to apply internationally, but it is recognised that some countries will have regulations that require different standards or practices to be followed. Where local or national regulations are more stringent than those contained herein, they will always take precedence over this guidance.

4 Controlling the Risk of Breathing Gas Contamination from Oil Lubricated Compressors

In order to minimise the risk of diving breathing gas contamination arising from the use of oil lubricated piston type compressors, the following points should be observed:

4.1 Lubricant

It is important that the only lubricant used is an oil intended for use in compressors for breathing purposes. Other oils should not be used.

If there is any doubt as to the suitable lubricant, reference should be made to the compressor manufacturer, stating clearly the purpose of the compressor.

4.2 Filtration

A properly designed filtration and purification system should be fitted to the high-pressure outlet from the compressor. The consumable units in this system should be changed regularly in accordance with the manufacturer's recommendations.

Compressors that compress gas in stages are designed to cool the gas as it passes through the stages of compression. Cooling of the gas will produce moisture which is collected in water traps. The effectiveness and life span of the filtration system can be increased by regular draining of moisture in water traps and air receivers. This may be done manually or by means of a solenoid valve.

4.3 Temperature

If a compressor overheats then the oil will degrade and give off contaminants. If an air-cooled compressor is used then it should be properly ventilated. Cooling water, if used, should be

monitored. All compressors should be fitted with a visible means of indication of overheating. This could be an alarm or even heat sensitive paint.

The temperature rise of the gas due to compression should be considered when arranging cooling for the compressor.

4.4 Sampling

Air samples from compressors should be analysed for purity on a regular basis according to company procedures. Such routine sampling is normally carried out at a maximum interval of six months from the date of the last sample taken, although the authorities in some parts of the world may require more frequent analysis. In addition, sampling should be undertaken after any maintenance, repairs or modifications to the compressor and after any incident or accident. There should be a separate certificate for each analysis.

Most contractors specify that the purity of air supplies should conform to a particular standard. If national legislation requires stricter standards, these need to be observed. The British and European standard BS EN 12021 specifies the following maximum levels of contaminants in compressed air for breathing apparatus:

Carbon monoxide	5 ppm
Carbon dioxide	500 ppm
Oil	0.5 mg/m^3
Water	25 mg/m^3 (at compressor outlet)
Water	50 mg/m^3 (at cylinder outlet, pressure 40-200 bar)
Water	35 mg/m^3 (at cylinder outlet, pressure over 200 bar)
The air shall be free from unsatisfactory odour or taste	

BS EN 12021 also specifies that 'compressed gas for breathing shall not contain contaminants at a concentration which can cause toxic or harmful effects' and that 'all contaminants shall be kept to as low a level as possible'. Contaminants that are not specifically listed in the standard may also be present for various reasons.

Please refer to section 9.13 of IMCA D 022 – *Guidance for diving supervisors* – for further information.

4.5 Water

There is always a certain amount of water vapour present in any gas.

Arrangements should be made to keep this as low as possible in order to protect equipment from any corrosion effects. (Statutory testing of storage cylinders may be much less demanding if records can be produced showing that only dry gas has been stored.)

4.6 Maintenance

It is essential that regular maintenance is carried out to a suitable schedule and in accordance with manufacturers' recommendations. It is particularly important to ensure that piston rings are not allowed to deteriorate.

The requirements for compressors contained in the following IMCA publications should also be observed:

- IMCA D 018 – *Code of practice for the initial and periodic examination, testing and certification of diving plant and equipment*;
- IMCA D 023 – *DESIGN for surface orientated (air) diving systems*;
- IMCA D 024 – *DESIGN for saturation (bell) diving systems*;
- IMCA D 037 – *DESIGN for surface supplied mixed gas diving systems*;
- IMCA D 053 – *DESIGN for the hyperbaric reception facility (HRF) forming part of a hyperbaric evacuation system (HES)*.

4.7 Helium Recovery

There are no special additional problems when using oil-lubricated compressors in helium recovery systems, other than the fear that any contaminant present will simply be recirculated. It is very important, therefore, that the points highlighted in this guidance are carefully considered in any helium recovery system.

5 Conclusion

Oil lubricated piston type compressors have been used with few problems over many years and they should perform safely if the basic measures identified in this guidance are followed. The principal problems encountered in the past have involved compressors which were allowed to overheat, or where the piston rings were allowed to deteriorate.

It must also be remembered that the compressor is only one part of the gas system and all other parts must be well maintained and kept in good condition to ensure safe operations. In addition, the intakes of all compressors must be sited in an area where they are not exposed to any pollution – particularly exhaust fumes.

6 References

1. IMCA D 022 – *Guidance for diving supervisors*;
2. IMCA D 018 – *Code of practice for the initial and periodic examination, testing and certification of diving plant and equipment*;
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