UK Steel: Operation and Maintenance of Works Oxygen Systems

Contents

1 Introduction

This document was developed from the BCGA Guidance Note 34 and UK Steel CoP: Design, Installation and Maintenance of Oxygen Pipework Systems. It is intended to give guidance on safe operation and maintenance of works oxygen systems. If major changes are to be made or a new system installed the two documents detailed above should be consulted.

It is essential to ensure that all operations on oxygen systems are carried out to a high standard and that all personnel involved observe the appropriate safety procedures and are competent to fulfil all aspects of their role.

Oxygen is classified as a dangerous substance and must be treated with the appropriate respect at all times. Whatever the incentive, procedures should never be short cut and if in doubt, a competent person should be consulted.

Employers are legally required to assess the risks in the workplace and take all reasonable practical precautions to ensure the safety of workers and include a careful examination of the risks from using and working on oxygen systems in the Risk Assessment/Method Statement documentation.

At all times a safe system of work must be applied in accordance with the Health & Safety at Work Act 1975 section 2(a)

The information detailed within this document covers the dangers and precautions to be taken to ensure that every user working on oxygen systems can do so with confidence and without danger

Anyone undertaking work on oxygen systems must be familiar with the properties and hazards associated with oxygen.

This Code of Practice incorporates best practices and sets out the minimum requirements for the modification and maintenance of gaseous oxygen systems to ensure safety both in any engineering activity and subsequent operation of the system

In this Code of Practice, the word 'shall' is used to indicate a mandatory requirement while the word 'should' is used to indicate a recommended practice. Pressures are expressed in bar and should be assumed, unless otherwise stated to be gauge pressure.

This Code of Practice shall not be held as limiting any right of companies using it or any obligation of contractors under any contractual arrangement.

2 Ownership

The information contained in this document is based on joint work by UK Steel (representing steel producers and steel converters in the UK), BCGA and BOC**.** This Code of Practice is owned and published by UK Steel. As owners, UK Steel are accountable for the ongoing review and are the only persons authorised to amend this document.

3 Implementation & Compliance

This document is aimed at delivering practical advice and assistance on modification, re-commissioning and intrusive maintenance of gaseous oxygen pipework systems. Adherence to guidance is not an absolute legal requirement.

4 Scope

This document is intended to give guidance on safe operation and maintenance of works oxygen systems. It does not deal with the design and installation of new systems or major system changes. It applies to gas mixtures containing more than 90% oxygen by volume.

This document covers all components of fixed oxygen transmission and distribution systems, including but not limited to, pipework systems, valves, flexible connections. It is limited to gaseous oxygen in a temperature range between minus 30^{o}C to plus 200^{o}c, pressures up to 40barg and a dew point of minus 30^{o}C.

The Code of Practice does not cover:

- Liquid oxygen storage vessels.
- Compressed gas cylinders, and associated equipment, including lances and flexible hoses connected to a portable system.
- Ultra-pure oxygen systems

5 References

A list of reference documents and standards is given in Appendix A

6 Properties of Oxygen

Gaseous oxygen is non-flammable but supports combustion vigorously when the ignition temperature has been reached. Oxygen is classified as an oxidising substance. Materials that will burn normally in air do so much more vigorously and at higher temperatures in oxygen. At increased pressures the ignition temperatures of all materials are reduced. In addition, materials that normally do not burn in air, e.g. steel, will burn in oxygen.

Oxygen is denser than air and so there is the risk of it collecting in confined spaces. It is colourless, odourless and tasteless so it is not normally possible for human senses to detect enrichment. For these reasons when working in confined spaces, monitoring equipment shall be capable of detecting enrichment (which can be due to leaks from pipework or from cylinders and hoses being used for maintenance tasks), as well as oxygen depletion which could be even more serious and can lead to asphyxiation i.e. death.

Do not use any hydrocarbons, such as oil and grease, in any system where there may be contact with oxygen. High oxygen velocities can result in ignition, especially if entrained particles impact on other internal surfaces.

Cleanliness in the preparation, fabrication and installation of any oxygen system is of the utmost importance to avoid any circumstances that may cause ignition and subsequent combustion.

Generally, there are three factors that combine to produce an oxygen fire or explosion and therefore should not be allowed to coincide. They are:

- Ignition
- Material for combustion
- Oxygen to support combustion

7 Definitions

7.1 Competent Person

A competent person is someone who has sufficient training and experience or knowledge and other qualities to carry out the appropriate tasks including risk

assessments. The level of competence required will depend on the complexity of the situation/task.

7.2 Pipework system

A pipe or system of pipes together with associated valves, pumps, compressors and other pressure containing components and includes a hose or bellows but does not include a pipeline.

See UK Steel COP: Design, Installation and Maintenance of Oxygen Pipework Systems, section 4.

8 Safety

8.1 Competent Person

When installation or maintenance work on any gaseous oxygen system is to be carried out a competent person shall be appointed to take complete control of the safety management of the task and establish all necessary communication routes. A competent person is someone who has sufficient training and experience or knowledge and other qualities that allow them to assist you properly. The level of competence required will depend on the complexity of the situation and the particular help you need.

8.2 Safety Considerations

All installation and maintenance work on any gaseous oxygen system irrespective of its ownership shall be carried out in accordance with local safety requirements, safe working procedures and relevant statutory requirements. Preparation of a risk assessment relevant to the work is mandatory.

Information shall be available to all on the actions to be taken by personnel, first aiders and fire-fighting teams in the event of an incident.

Operating personnel must at all times obey works rules and regulations and, where called for, suitable Personal Protective Equipment (PPE) must be worn.

8.3 Fire Safety Management

Under oxygen-rich conditions the optimum fire-fighting materials are water or extinguishers containing dry chemical powder or carbon dioxide. Fire-fighting equipment should be properly maintained and all workers should know where it is located and how and when to safely operate it.

In the event of a major escape, if safe to do so (i.e. switches are remote from the oxygen enriched area), switch off all electrical appliances in the area concerned and extinguish all naked flames.

The Dangerous Substances and Explosive Atmospheres Regulations (DSEAR) and Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations (EPS) assessments should be done as part of the overall fire safety management regime. Outputs from the DSEAR assessment will be relevant to various considerations required to be made under the Regulatory Reform (Fire Safety) Order, including the Fire Risk Assessment. DSEAR compliance and general fire safety therefore are closely linked.

If an operatives clothing catches fire, they should be thoroughly soaked from a suitable clean water supply and removed into fresh air as soon as possible.

It is very dangerous to attempt a rescue of a person on fire in an oxygen enriched atmosphere as the rescuer may be at risk of catching fire themselves. In certain cases,

it may be possible to enter such a space if the rescuer is totally deluged with water and protected by constant water hosing.

8.4 Causes and Avoidance of Oxygen Enrichment

Oxygen enrichment of the atmosphere is best guarded against by careful attention to the following points:

- Where practicable ensure all areas that may be subject to oxygen enrichment are well ventilated
- Sources of ignition, i.e. electrical equipment, hot work, etc. should be closely controlled and isolated from areas where oxygen enrichment could occur
- Newly installed or recently maintained equipment for oxygen service should be thoroughly leak tested by a competent person and a timed gas pressure drop test carried out. See UK Steel COP: Design, Installation and Maintenance of Oxygen Pipework Systems, Section 5.3
- An alternative method of testing with an approved leak test fluid which is compatible with the equipment may be used
- All equipment, for instance welding/cutting nozzles and hose connections, must be properly maintained and fitted. Hoses and other equipment should be kept leak tight and protected from damage
- All maintenance and repair work shall be carried out by a competent person using an appropriate procedure
- When the work period is over, the cylinder valve or oxygen supply stop valve must be turned off. This is to avoid possible oxygen leakage between the work periods
- The gas valves on blow pipes/lances or cutting torches should not be relied upon on their own for isolation of the oxygen supply
- Gas cylinders in use should be secured in an upright position
- A means of positive isolation should be in place during any maintenance procedure

8.5 Confined Spaces

Work undertaken in confined spaces must be carried out in accordance with Confined Spaces Regulations. This must recognise the potential hazards of both oxygen enrichment and deficiency. A specific confined space risk assessment is required with control measures identified and put in place.

If used monitoring equipment, which is correctly calibrated, should be capable of detecting enrichment, as well as depletion which could lead to impairment or asphyxiation.

See HSE INDG258 Confined Spaces

8.6 Fire Hazards from Oxygen Enrichment

Oxygen reacts with most elements. The initiation, speed, vigour and extent of these reactions depend in particular upon:

- Concentration, temperature, pressure of the reactants
- Ignition energy
- Mode of ignition

8.7 Combustibility of Materials

Nearly all materials will become more combustible in an enriched oxygen atmosphere; even materials that are usually not flammable.

Note: Anyone exposed to oxygen should not smoke or go near naked flames until they have been properly ventilated. Clothing exposed to high oxygen levels can remain saturated for some time and therefore be at risk of combustion. A minimum period of 5 minutes in fresh air with movement of the arms and legs and coat unbuttoned is recommended. Fire resistant dense clothing, such as MM1 type will require a longer ventilation period, usually a minimum of 10 minutes.

8.8 Clothing/PPE

PPE and clothing must be clean and free of grease to avoid contamination being transferred to pipework. Additionally, hydrocarbons such as oils and greases which are impregnated into clothing, tools and equipment have a higher risk of combustion in oxygen enriched atmosphere, and the hydrocarbons themselves may be an ignition source upon contact with oxygen.

8.9 Hotwork

Safe systems of work documentation prior to commencement of work shall be in place for all hotwork activity. If any hotwork is to be carried out on any steel pipe, vessel or component containing oxygen, they shall be vented and purged with an inert gas. Oil-free nitrogen is the preferred gas for purge applications. Other inert gases may be used, but potential asphyxiation hazards must be managed as the fluid is discharged from the system. See UK Steel document: Design, Installation and Maintenance of Oxygen Pipework Systems, Section 13.3. Similar work shall only be executed on copper pipe work when the oxygen pressure has been reduced to the atmospheric equivalent.

8.10 Smoking

Smoking shall be forbidden in any areas where there is the potential for oxygen enrichment.

8.11 Earthing

Oxygen pipe work systems shall not be used to provide an earth return for welding equipment.

8.12 Oxygen Cleanliness

Cleanliness is of vital importance. The presence of dust and/or dirt in an oxygen system can cause fire inside the pipework which in turn can cause the pipework to rupture or in the case of steel, the pipe itself can ignite like a thermic lance.

Oil and grease are particularly hazardous in the presence of oxygen as they can ignite spontaneously and burn with explosive violence. Oils and Greases should never be used to lubricate oxygen or enriched air equipment. Special lubricants which are compatible with oxygen must be used.

When cleaning for oxygen service only approved degreasing agents shall be used, in accordance with an approved application procedure, and the appropriate precautions taken in accordance with COSHH regulations.

8.13 Leakage

Any leakage should be immediately reported, work stopped, the immediate area evacuated, and control measures put in place to prevent escalation of the hazard.

9 Maintenance Tasks

9.1 General

All maintenance personnel shall have clean oil-free clothing, boots, and tools, and ensure they have clean grease free hands. Work shall be carried out in well-ventilated areas, with oxygen upper and lower limits in air of 23.5%, and 19.5% by volume. Oxygen monitors shall be used, suitable for purpose, checked for operation and within calibration. Further guidance is available in BCGA GN 11: Management of Risk When Using Gases in Enclosed Work Spaces.

9.2 Preventative Non-Intrusive Maintenance

A maintenance programme should be in place. The EIGA Standard IGC Doc 13/12/E, Appendix F lists main tasks to be performed, but task frequency may be tailored to comply with company practices.

Frequency controlled preventative tasks should include: -

- testing of cathodic protection system and its isolation from non-protected parts
- integrity of earthing/grounding system
- visual inspection of external coating system, and use of specialised surveys, such as The Pearson Survey, The Current Attenuation Survey, or The Close Interval Potential Survey

  The results of these investigations shall be compared to previous and "as installed" data, to judge the integrity of the cathodic protection system. Investigations to be carried out in accordance with the designed maintenance program and typically by a specialist contractor.

- visual check on above ground flanges, supports and anchor points
- visual check for signs of unauthorised interference, land subsidence, accidental damage, and that pipework marking devices are in place

  If leakage is suspected but cannot be located through visual or audible evidence, the pipework shall be isolated in sections, and pressure tested to identify the source of the leak, or prove the pipework is sound.

9.3 Intrusive Maintenance

9.3.1 General

A positive shut off is required before any work is carried out that requires pipework to be opened up. This shall include locking and tagging isolation points. The section of the system to be worked on should then be decommissioned with oxygen safely vented to a safe location; an unoccupied area, free from other hazards, such as ignition sources, combustion engines and overhead power lines. It shall be vented in a controlled manner.

The section of the system to be worked on shall be purged using oil-free nitrogen. Dry oil free compressed air may be used if available and of sufficiently high quality.

Flanges and adjacent pipework shall be cleaned externally before being disconnected so as to prevent foreign matter entering the pipe. Special care must be taken to ensure that the surrounding area is as clean as practicable prior to and during intrusive maintenance.

During maintenance work the same attention to cleanliness shall be observed as for a new installation. In particular no foreign matter, especially oil and grease shall be allowed to enter the pipe and projections in the pipe shall be avoided. All open ended

pipework and equipment should be suitably encapsulated to prevent ingress of contaminants.

9.3.1 Replacement/extension of pipework

Inspect the section of the system to be worked on and ensure that pipework that is being left in operation and/or connected is sound. Any sections that are suspect should be included in the remedial work.

Before work commences the competent person shall review the work to be carried out checking the design of the repair/modification to ensure that appropriate materials, pipe sizes etc. are being used.

They shall then ensure the availability of all suitable materials for the work being carried out. This should include new/replacement pipework and associated fittings, flanges, gaskets and valves etc. All shall be suitable for use on oxygen.

Pipework should be degreased and sealed prior to delivery to site where possible. Valves and other proprietary equipment shall be delivered certified for oxygen use in sealed bags.

Fabrication of oxygen pipework shall be generally in accordance with ISO 3834 Quality requirements for fusion welding of metallic materials - Part 1: Criteria for the selection of the appropriate level of quality requirements.

Welding shall, wherever possible, be done under a quality-controlled environment. Site welds should be kept to a minimum. Weld penetration shall be complete but shall give a minimum of projection and scaling in the pipe bore.

Where the back of a butt weld is inaccessible for dressing and de-scaling, inert gas shield arc welding shall be used for the root run, in conjunction with, if so desired, an internal argon or other suitable backing gas.

Backing rings and strips shall not be used.

Commercially available butt-welding steel fittings should be used for the fabrication of tee-pieces and branches. Where oxygen flow is unidirectional or where higher velocity flows are foreseen, swept tee-pieces should be used. Note: ISO 3834 requires that, with certain amendments, welding shall be Class 1 quality in accordance with BS 2633. The required weld surface finish can be achieved by using welding systems outlined in The EIGA Standard IGC Doc 13, Section 7.3.1. Valves that are to be welded into Pipework shall be open and if necessary the valve's top work parts removed to avoid heat/fume damage of soft parts.

9.3.2 Non-Destructive Examination

The level of examination necessary will depend on the extent of the work to be carried out.

Butt-welded joints shall be examined radiographically or by other suitable techniques in accordance with BS EN ISO 17636.

Final closing welds shall be subject to 100% X-ray examination in which case pressure testing may be unnecessary.

Socket and fillet welds should be tested with a suitable non-destructive testing method, such as dye-penetrant tests or X-ray.

Where radiological hazards are not acceptable, 100% ultrasonic examination by qualified operator, with a specific report on each weld, shall be carried out. When pipe wall thickness is less than 8mm, ultra-sonic testing is not suitable and alternative jointing or non-destructive test methods shall be used.

The number of joints examined may be reduced as appropriate for individual welders after initial satisfactory results have been produced.

9.3.3 Gaskets

Gaskets shall be made from material compatible and approved for oxygen service. Gaskets shall be machine cut and be correctly sized to ensure that no part of the gasket projects beyond the inner wall of the pipe into the gas stream.

The use of gasket sealants is prohibited. The re-use of any gasket is prohibited. A new gasket will be inserted each time a flanged joint is released.

Where PTFE tape is used on joints it must be suitable for oxygen at the service pressure foreseen, and must not be in contact with the oxygen flow.

9.3.4 Quality Inspection

An inspection of the fabrication for quality should follow the relevant piping codes and procedures, and as a minimum should include:

- Pipework identification/colour coding
- pipe concentricity
- protective coating integrity
- mechanical imperfections
- weld quality
- review of X-ray examination documentation

Above ground piping shall be prepared for corrosion protection painting and colour coding for identification. Further references are to be found in ISO 8501-1 “Preparation of steel substrates before application of paints and related products, visual assessment of surface cleanliness part 1.” Appendix G 6.17 to 6.20 for painting specifications.

9.3.5 Cleaning of pipework systems after installation/repair

Wherever possible, pipe fabrications and completed systems shall be cleaned by 'pigging', but the competent person shall decide whether this is practicable and/or necessary.

Where cleaning by pigging is impracticable, e.g. size limitation, extreme care shall be taken to ensure that pipes are clean before fabrication and before introduction of oxygen. For welded joints where the back of a butt weld is inaccessible for dressing and de-scaling, inert gas shield arc welding shall be used for the root run so as to maintain the pipe in a clean condition suitable for oxygen use (see EIGA Document 33).

Where the completed pipework has been contaminated by either oil or grease a degreasing agent shall be passed through the pipe at full bore flow, and a check shall be made to ensure all traces of hydrocarbon are removed, e.g. by swab test or fluid sampling.

9.3.6 Removal of Degreasing Agents

Where degreasing agents have been used as in UK Steel COP: Design, Installation and Maintenance of Oxygen Pipework Systems, Section 9.3.1 (e), or 9.3.2 extreme care shall be taken to ensure that all traces of degreasing agent are removed. Low

points in the pipework shall be drained and other trapping points stripped, drained and thoroughly dried.

Note:

1. Some chlorinated hydrocarbon degreasing agents are combustible in oxygen and have caused severe explosions when the degreasing agent has not been removed from the system. See Appendix B of UK Steel COP: Design, Installation and Maintenance of Oxygen Pipework Systems
2. Equipment suitable for the detection of degreasing agents is commercially available. A competent authority should be consulted upon the choice of equipment.
3. Attention is drawn to the fact that build-up of toxic levels of degreasing fluid vapours can easily occur unless adequate ventilation is provided.
4. Some degreasing agents may be carcinogenic and as such necessary safety precautions shall be in place when using these substances in line with COSHH requirements.

9.4 Blowing out of Pipework

When pigging is not practicable, before pressure testing and commissioning, it is recommended that new Pipework is blown out using, dry oil-free nitrogen or dry air to remove loose debris. The velocity of the nitrogen should be substantially in excess of the design maximum for oxygen operation. Care shall be taken to ensure that the blow-out residue is safely handled (i.e. the pressurised gas or gas/mixture plus any particulate or solids that the gas stream may contain). Blow-out aims to achieve, a minimum requirement, a surface finish in accordance with ISO 8501-1.

All soft-seated valves should either be removed or isolated to prevent damage. Filters should be either removed or inspected and cleaned afterwards.

If the system is not complete then any openings should be capped following the blow out.

In the event that sections of pipework are fabricated and stored or a partially complete system is capped off for a period and internal surfaces may deteriorate, then the cleaning and blowout operation should be repeated following completion of the system as described above before final pressure testing and commissioning.

9.5 Replacement of equipment

Where the maintenance task is the simple replacement of a proprietary item or items then much of section 9.3 must still be adhered to. It is still imperative that a competent/responsible person is appointed and all the safety aspects addressed as if pipework is to be replaced.

Cleanliness of the adjacent pipework and surroundings is just as important. The competent person must be satisfied that the replacement part or parts are suitable for the designated task and for use on oxygen.

If flanges are broken then new appropriately prepared gaskets suitable for oxygen shall be used. If valves or other equipment are to be welded into place then any sensitive parts should be removed during the welding operation.

The welds shall be inspected and only when pronounced fit for purpose can the components be re-assembled, with great attention to cleanliness. Once the task is complete appropriate inspection and re-commissioning can follow.

9.6 Cleanliness

Where inspection for cleanliness is necessary at any stage, the appropriate method of testing and procedure should be carried out in accordance with appropriate guidance in EIGA Doc. 13 Oxygen Pipeline and Piping Systems and Doc. 33 Cleaning of Equipment for Oxygen Service or for further guidance refer to sections 9.3.5 to 9.3.8 of the UK Steel COP: Design, Installation and Maintenance of Oxygen Pipework Systems.

9.7 Initial Leak Test

The purpose of initial leak testing is to identify and repair leaks before a system is placed under significant pressure. This practice reduces risk, and also saves time and costs associated with depressurising and re-pressurising systems in the event of finding a leak. For gases, most leaks are found at approximately 0.25bar or lower.

Leak testing is carried out using the 'drop test' method, and in incremental stages no greater than 1 bar, with suggested initial pressures of 0.25 and then 0.5 bar. A "drop test" should be carried out over a period of 30 minutes. If there is no detectable fall in pressure proceed to the next stage. If a drop in pressure is detected, leak testing should be carried out using an approved leak test fluid which is compatible with the equipment that is being tested.

The minimum final pressure of a leak test shall be pressurised to a minimum of 7 bars regardless of the system design. All leaks shall be rectified prior to progressing to further testing.

9.8 Pressure Testing

Oxygen Pipework shall be pressure tested using clean dry oil free nitrogen or dry air. The pressure shall be increased gradually in steps providing sufficient time to equalise strains in the system, and to allow inspection for leaks, signs of mechanical stress or other untoward events.

Hydraulic testing is rarely practicable. If pneumatic testing is used then only personnel involved in the testing shall be allowed near the test area, and consideration given to whether an exclusion area is required in the immediate area. Refer to UK Steel COP: Design, Installation and Maintenance of Oxygen Pipework Systems, Section 11.2

9.9 Commissioning/De-Commissioning

All commissioning and de-commissioning shall be subject to a Safe Working Procedure and a risk assessment which will take into account such things as general location of vents vis-à-vis buildings, sources of ignition, competent personnel, gas monitoring and testing, copper fittings, tools and equipment as specified within this and associated documents.

The oxygen shall be admitted into the pipework at a carefully controlled rate. Rapid pressurisation of the pipework shall be avoided. The pipework shall be pressurised by means of the main valve bypass (where fitted) after which the main valve shall be opened slowly. Branch lines shall be pressurised in turn and each branch line vented and a gas analysis test carried out to determine that all other gases have been expelled from the system. Venting shall be carried out so as not to generate additional hazards. Refer to UK Steel COP: Design, Installation and Maintenance of Oxygen Pipework Systems, Section 11.

Appendix A - Relevant Standards

The following are referred to and or taken into consideration in this Code of Practice:

BS 1306	Specification for copper and copper alloy pressure piping systems
BS 1710	Specification for identification of Pipework and services
BS 1723	Specification for brazing
BS EN 837-1	Pressure gauges. Bourdon tube pressure gauges. Dimensions, metrology, requirements and testing
BS 2633	Specification for Class I arc welding of ferritic steel pipework for carrying fluids
BS EN 1057	Copper and copper alloys. Seamless, round copper tubes for water and gas in sanitary and heating applications
BS EN ISO 17636-2	Non-destructive testing of welds. Radiographic testing. X- and gamma-ray techniques with digital detectors
BS EN ISO 17636-1	Non-destructive testing of welds. Radiographic testing. X- and gamma-ray techniques with film
BS 4515-1	Specification for welding of steel pipelines on land and offshore. Carbon and carbon manganese steel pipelines
BS EN 10217-1	Welded steel tubes for pressure purposes. Technical delivery conditions. Non-alloy steel tubes with specified room temperature properties
BS EN 10216-1	Seamless steel tubes for pressure purposes. Technical delivery conditions. Non-alloy steel tubes with specified room temperature properties
BS EN 10217-3	Welded steel tubes for pressure purposes. Technical delivery conditions. Alloy fine grain steel tubes
BS EN 10217-5	Welded steel tubes for pressure purposes. Technical delivery conditions. Submerged arc welded non-alloy and alloy steel tubes with specified elevated temperature properties
BS 4800F	BS 4800 Colour matching fan
ISO 8501-1	Preparation of steel substrates before application of paints and related products -- Visual assessment of surface cleanliness -- Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings
BS EN ISO 3183	Petroleum and natural gas industries. Steel pipe for pipework transportation systems
BS EN 14324	Brazing. Guidance on the application of brazed joints
BS EN 13636	Cathodic protection of buried metallic tanks and related piping
BS EN 15112	External cathodic protection of well casing
BS EN 60079-0:2012+A11:2013	Explosive atmospheres. Equipment. General requirements
ASME B31.3	Process Piping
CP 2010-2	Code of practice for Pipework. Design and construction of steel Pipework in land
EIGA-IGC Doc 13/12/E	The European Industrial Gasses Association (EIGA) Oxygen Pipework and Piping Systems

EIGA-IGC Doc 33/06/E	The European Industrial Gasses Association (EIGA) Cleaning of Equipment for Oxygen Service
API 1104	Welding of Pipework and Related Facilities
BOC	Oxygen Gas Risks
EPS	Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations

HEALTH AND SAFETY REGULATIONS:

The Control of Major Accident Hazards Regulations

The Health and Safety at Work ETC. Act

The Management of Health and Safety at Work Regulations

The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations

Pressure Systems Safety Regulations

The Dangerous Substances and Explosive Atmospheres Regulations (DSEAR)

The Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 1996 (EPS)

GS4 Safety requirements for pressure testing

Confined Spaces Regulations

GS5 Confined spaces

Control of Substances Hazardous to Health (COSHH)

Pipework Safety Regulations

The Construction (Design and Management) Regulations

HSE Oxygen use in the workplace

HSE Design Codes - Pipe work

HSE INDG258 Confined Spaces

BCGA GN11

BGCA GN34

Health and Safety (First-Aid) Regulations

HSE Publications: Free Leaflets - First Aid

Reporting of Injuries, Diseases and Dangerous Occurrences Regulations

Unless stated otherwise, the latest edition of any standard or document and amendment thereto, current at the date of any order or contract shall apply.

Appendix B - Maintenance checklist

Maintenance checklist with section references for this document and the UK Steel COP: Design, Installation and Maintenance of Oxygen Pipework Systems:

O&M Ref	CoP Ref	Prompt	Comments/Notes
5.1	7.1	Who is the competent person undertaking the work?	
8.4	5.3	What are the control measures to prevent injury from oxygen enrichment?	
8.3	5.5	What are the fire hazards on the job? What are the control measures necessary?	
8.11	5.9	Where are you connecting weld earthing to?	
	6.2	How do you know that the materials you are using are suitable for oxygen use?	
	7.3	Do you need to install a filter? If so, how do you know it is suitable for oxygen use?	
9.3.3	9.2.5	What materials are you using for gaskets and seals and how do you know they are suitable for oxygen use?	
	9.1 9.3.5 9.3.6	How do you know that all the components you are using have been suitably cleaned for oxygen use?	
9.6	5.10 9.3	How are you making sure that the system is clean enough for oxygen use?	
8.6 9.3.1	9.3.3	How are you ensuring that the line is grease free?	
9.3.5 9.3.6	9.3	How are you cleaning out the line? Are there any hazards created?	
9.7	10.2	Do you need to do any leak or proof testing of the pipework, if so, how?	
9.3.1 9.8	11.3	How are you purging and re-pressurising the system? Are there any hazards created?	

Completed by: ……

Signed: ……

Date: ……