KENYA STANDARD DKS 2441:2012

Ultra High Purity Oxygen —Specification

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TECHNICAL COMMITTEE REPRESENTATION

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BOC Kenya Ltd
Noble Gases International Ltd
Chemigas Ltd
Synergy Gases Ltd
Carbacid (CO_2) Ltd
Government Chemist's Department
Kenya Industrial Research and Development Institute (KIRDI)
Kenyatta University, Chemistry Dept
Kenya Science Teachers College
Ministry of Roads and Public Works – Materials Branch
Kenya Industrial Estates
Kenya Medical Association
Kenyatta National Hospital
Ministry of Medical Services
Kenya Bureau of Standards — Secretariat

REVISION OF KENYA STANDARDS

In order to keep abreast of progress in industry, Kenya Standards shall be regularly reviewed. Suggestions for improvements to published standards, addressed to the Managing Director, Kenya Bureau of Standards, are welcome.

KENYA STANDARD

Ultra High Purity Oxygen — Specification

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Forward

This standard has been prepared by the Technical Committee on Gases under the guidance of the Standards Projects Committee, and it is in accordance with the procedures of the Kenya Bureau of Standards.

Ultra High purity oxygen is for specialized applications and demanding laboratory applications Oxygen is used in analytical instruments such as AAS. Furnace atmospheres require low moisture levels to maintain instrument sensitivity and impurities limits. This standard covers characteristics touching on their purity, packaging and marking.

The standard also specifies limits impurities on water, Nitrogen, Argon, carbon monoxide, carbon dioxide, Hydrogen and total hydrocarbons (THC) as methane.

Any enrichment of the atmosphere by oxygen enhances rates of combustion. The effects are greatly increased atmospheres containing more than 25 per cent of oxygen and great care should be taken using oxygen in a confined space to prevent increase in concentration. It is essential that oil be excluded from any cylinder, container, valve or equipment coming into contact with clothing. The analytical procedures given in the annexes are designed by for the determintion of trace impurities. Special care and attention is needed in carrying them out.

During the development of this standard, reference was made to the following documents:

BOC SGEM_2006 Section 5_Pure gases specifications, Ultra High purity grade Oxygen

EN 1089-3:2004 Transportable gas cylinders—Cylinder identification, Part 3: Colour coding

KS 647: 2010 Specification for industrial oxygen

Acknowledgement is hereby made for the assistance received from these sources.

Ultra High Purity Oxygen —Specification

1. Scope

This Kenya Standard specifies requirements for and test methods for Ultra high purity oxygen. The requirements apply to oxygen as delivered. It does not apply to the gas intended for medicinal use or inhalational purposes.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this Kenya Standard. For undated reference, the latest edition of the normative document referred to applies.

KS 648, Industrial Acetylene gas— Specification

KS ISO 7225, *Gas cylinders — Precautionary labels*

KS 09-532, *Specification for standard atmospheric conditions for test purposes*

3 Terms and Definitions

For the purposes of this Standard the following terms and definitions shall apply.

3.1
STP
standard atmospheric temperature and pressure as per KS 09-532

4. Requirements

4.1 Description

The gas shall be colourless, odourless at ordinary temperatures and pressures and shall consist essentially of Oxygen 0_2, which has a density of 1.354 6 kg/m^3 at a temperature of 23 ^{0}C and 760 mm Hg pressure.
It shall be supplied as compressed gas or as a liquid for vaporization.

4.2 Purity

When tested in accordance with the method specified in annex B the product shall have a minimum of 99.997 % v/v Oxygen content.

4.3 Impurities

The product shall comply with the impurities limits given table 1.

Table 1 - Impurity limits

SL NO.	Characteristic	Requirement	Test method
1.	Nitrogen ppm , max	10	Annex C
2.	Argon ppm, max	2	
3.	Hydrogen ppm, max	1	
4.	Carbon Monoxide, Max	2	
5.	Carbon Dioxide, Max	2	
6.	Total hydrocarbons as Methane, ppm, Max	0.1	
7.	Water ppm , max	4	Annex D

5. Sampling

5.1 Samples of compressed oxygen shall be taken from a steel cylinder containing the gas direct to appropriate apparatus for all determinations. The valve and connecting lines shall be carefully purged before taking a sample.

5.2 Samples of liquid oxygen shall be taken in accordance with the method described in Annex A or by any alternative method that can be shown to ensure complete vaporization of the sample.

6 Packing and marking

6.1 Packaging

The product shall be supplied as a compressed gas or liquid at cryogenic temperature, in appropriate steel cylinders/containers complying with relevant Kenya standards. Valves or taps shall not be lubricated with oil or grease.

6.2 Marking

6.2.1 Cylinder

Each cylinder/container shall have labels which are clearly and indelibly marked with the following information:

a) The words " Ultra High Purity Oxygen";

b) The name or registered trade mark and address of the manufacturer;

c) Purity;

d) The impurities limits in table 1, as applicable;

e) Batch number;

f) Date of filling;

g) Net Weight of contents in Kg for product in liquid form

h) Filling pressure (at STP) for product in gaseous form;

i) Cautionary note — *see* Annex E

6.2.2 Colour and chemical formula

Each cylinder shall in addition to the markings in 6.2.1, be painted with the colour black and clearly and indelibly marked with the chemical formula corresponding to oxygen.

6.2.3 Precautionary labels

Each cylinder shall in addition to the markings in 6.2.1, be clearly and indelibly marked with precautionary labels as specified in KS ISO 7225.

Annex A

Treatment Of Liquid Samples

A1. OUTLINE OF METHOD

The liquid is forced under pressure into an evaporaitng coil. By use of small bore tubing complete evaporaitng of the liquid is ensured, and hence the gas produced has the same composition as the liquid.

CAUTION: Liquid oxygen requires careful handling and all flames should be extinguished in the vicinity during sampling operations, and care taken to avoid spilling it on to clothing. Liquid oxygen boils at – 183 ^{0}C so precautions should be taken to prevent it coming into contact with the skin and eyes.

A2. APPARATUS

The apparatus is shown in Figure 1 and comprises:

(*a*) *Mercury lute* — Arranged so that the head of mercury can easily be adjusted.

(*b*) *Dewar flask* — Of copper designed to withstand an internal pressure of 68.9 kPa and with a capacity of about 2½ litres, fitted with a screw-on brass cap carrying a bursting disk set at 34.5 kPa and two connections of 1.5 mm internal diameter drawn copper tubing.

(*c*) *Evaporator* — Consisting of a 500-mm length of 1.5 mm internal diameter drawn copper tubing formed into a spiral and immersed in water at 50 ^{0}C to 60 ^{0}C.

A3. PROCEDURE

Cool the dewar flask by introducing a small quantity of the liquid oxygen and after a few minutes empty the flask and discard the liquid.

Immediately introduce more liquid oxygen until the flask is about two-thirds full. With stopcock T_1 open, screw on the brass cap and make the connections as shown in Figure 1. Control the rate of gas flow to the analysis apparatus by adjusting the control valve and the head of mercury in the lute.

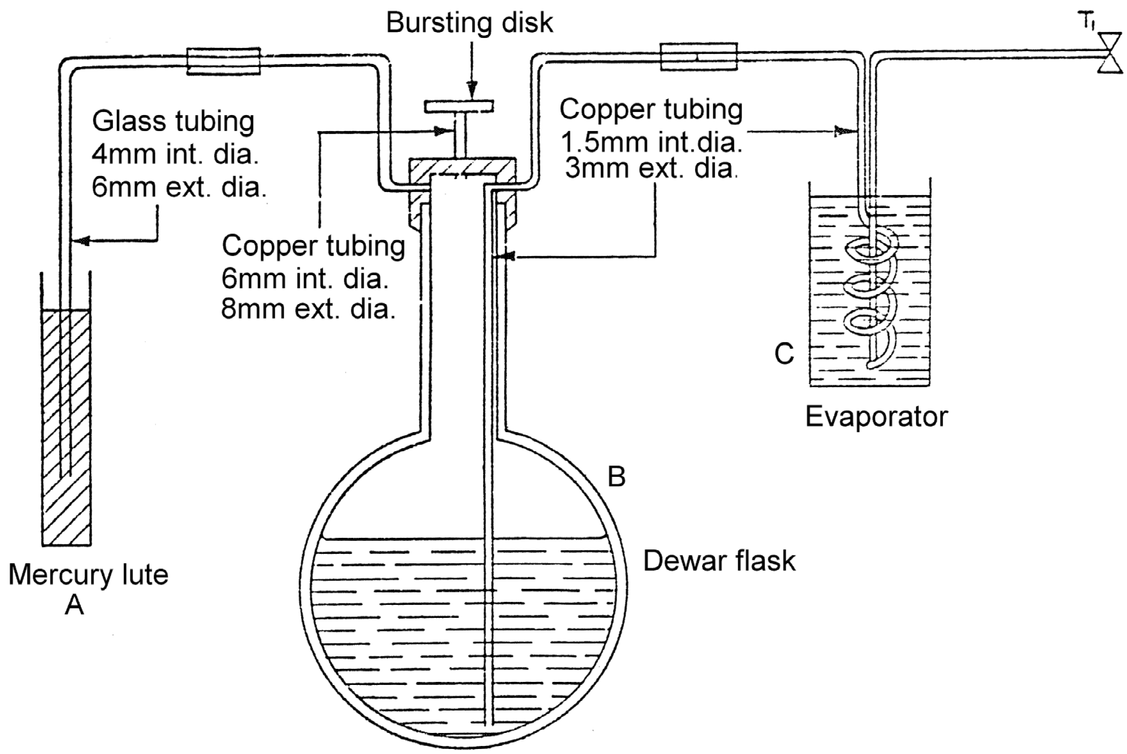

FIG. 1 — Apparauts For Treatment Of Liquid Samples

Annex B
(Normative)

Method for the determination of Purity of Oxygen

A.1 Principle

Oxygen content is determined by determining the total content of specified impurities as per annexes C to D and reporting the balance as Oxygen, plus any traces of noble of gases present.

A.2 Procedure

Determine total specified impurities by adding the results obtained in Annexes C to D.

A.3 Calculation

Purity of Oxygen is calculated as:

$$P = 100 - T$$

Where P = Purity (% v/v)

T =Total specified impurities (% v/v)

Report Purity results to three decimal places.

Annex C

(Normative)

Determination of Nitrogen, Argon, Carbon Dioxide, Carbon Monoxide, Hydrogen and total hydrocarbons (as methane)

C.1 Principle

This method covers the determination of Nitrogen, Argon, Carbon Dioxide, Carbon Monoxide, Hydrogen and total hydrocarbons (as methane) content of oxygen by means of gas chromatography.

C.2 Apparatus

C.2.1 Gas chromatograph, with thermal conductivity detector with stainless steel column (4m × 4.6mm) packed with molecular sieve 5A and using Ultra High purity Helium as the carrier gas. The carrier gas shall be purified further by passing through argon gas purifying system. Maintain the column at 60 °C and the detector at 130 °C.

Note Many other variables, such as column type, length, carrier flow, detector temperature, detector type and oven temperature, may be left open, and still provide a suitable system for determination of these impurities.

C.3 Reagents

C.3.1 Reference gas, commercially available calibration gas mixture of Nitrogen, Argon, Carbon Dioxide, Carbon Monoxide, Hydrogen and methane in Ultra high purity oxygen.

C.4 Procedure

C.4.1 Set the GC conditions in accordance with the manufacturer’s instructions. Calibrate the instrument by injecting a suitable volume of the reference gas (C.3.1).

C.4.2 Inject a suitable volume of both the test gas and the reference gas (C.3.1).

C.4.3 Adjust the volume, as well as the conditions specified above (C.2), to produce a peak response for the reference gas (A.3.1) that gives a height of not less than 35 % on the recorder.

C.4.4 Measure the areas of the peak responses obtained in the chromatograms from the injections of test gas and reference gas, and calculate the percentage content of each analyte by comparing with the peak response obtained from the reference gas (C.3.1).

C.4.5 The result of the calibration for hydrocarbons shall be expressed as total hydrocarbons calibrated as Methane**.**

Annex D

(Normative)

Method for the determination of water content

D.1 Principle

The gas is passed through a direct reading hygrometer.

D.2 Apparatus

D.2.1 A direct reading hygrometer – of one of the following types:

a) cooled mirror dew point;
b) electrolytic;
c) capacitance;

D.3 Calibration

Ensure that the instrument has a current certificate of calibration demonstrating traceability to a physical standard held at the KEBS Metrology Laboratory or a recognized international body.

D.4 Procedure

Operate the direct reading hygrometer in accordance with the manufacturer's instructions. Keep all sample lines as short as practicable and, together with all ancillary equipment, ensure that they have only polytetrafluorethylene or stainless product in accordance with the manufacturer's instructions.

Record the water content that is displayed by the instrument.

Annex E

Caution Note On Oxygen

Oxygen can be supplied for industrial use in both gaseous and liquid form. Oxygen is applied in the gaseous phase only.

When oxygen supplied in liquid state it can cause cold ‘burns’ and make certain material sufficiently brittle to lead to structural.

Oxygen enrichment or deficiency poses hazards and should be avoided.

Oxygen enrichment increases the combustability of materials.

Hydrocarbon oil and grease should never be used to lubricate oxygen or enriched air equipment as they can ignite spontaneously and burn with explosive violence.

Many burning accidents which occur are triggered off by the lighting of a cigarette, therefore it is impossible to overemphasis the danger of smoking in oxygen enriched atmosphere or where oxygen enrichment can occur. In such areas smoking should be forbidden.

Oxygen deficiency leads to the following physiological hazards:

— loss of mental alertness.

— distortion of judgement.

— in a relatively short time considerable brain damage.

Oxygen enrichment can be avoided by taking the following precautions:

— ensure the equipment used has no leaks.

— in many metallurgical processes such as gauging, cutting, scarfing, thermic lancing, etc., employing oxygen, a surplus of the gas escapes into the atmosphere. Therefore the ventilation in areas where such processes are undertaken must be sufficient to ensure that oxygen enrichment does not occur.

— blowpipes must be used properly by correct section of the nozzles and gas pressures.

— Improper use of oxygen such as driving pneumatic tools, inflating vehicle tyres, rubber boats, etc., must be strictly forbidden.

Any oxygen dificiency of the atmosphere is best guarded a gainst by careful attention to the following.

— avoid leakage of gases other than oxygen.

— avoid spillage of liquid gases other than oxygen.

— avoid vent outlets venting into the atmosphere.

— do not vent purging and cryogenic gases into the atmosphere.

— ensure that welding and cutting processes have sufficient workspace and ventilation.

The Industrial Cases Committee (IGC), and International Association of Companies who produce gases like oxygen, nitrogen and acetylene has published Document No. 8/76 entitled ‘Prevention of accidents arising from enrichment of deficiency of the oxygen in the atmosphere’.

People who have special responsibility for safety or who are engaged in teaching or training others in the ues of oxygen should study the complete IGC document in order to get more comprehensive information on the subject.