

DRAFT UGANDA STANDARD

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Liquefied Petroleum Gases (LPG) —Product Specifications



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Foreword

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- a) a member of International Organisation for Standardisation (ISO) and
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- c) the National Enquiry Point on TBT Agreement of the World Trade Organisation (WTO).

The work of preparing Uganda Standards is carried out through Technical Committees. A Technical Committee is established to deliberate on standards in a given field or area and consists of key stakeholders including government, academia, consumer groups, private sector and other interested parties.

Draft Uganda Standards adopted by the Technical Committee are widely circulated to stakeholders and the general public for comments. The committee reviews the comments before recommending the draft standards for approval and declaration as Uganda Standards by the National Standards Council.

The committee responsible for this document is Technical Committee UNBS/TC 16, [Petroleum Products and Facilities], Subcommittee SC 1, [Petroleum and Petrochemicals Products].

This second edition cancels and replaces the first edition (US 971-4:2014), which has been technically revised.

Introduction

Liquefied petroleum gas products are composed of those readily liquefiable hydrocarbon compounds that are produced in the course of processing natural gas and also in the course of the conventional refining of crude oil. The composition of liquefied gases can vary widely depending upon the source and the nature of the treatment to which the products have been subjected.

There are many uses for liquefied petroleum gases. Important uses include,

- a) as domestic, commercial, and industrial fuels,
- b) as a carbon source material in metal treating operations,
- c) as refinery raw materials for synthesis of gasoline components, and
- d) as petrochemical raw materials.

In substance, this specification is designed to properly define acceptable products for domestic, commercial, and industrial uses. In many cases it will be found that products meeting the specifications will also be usable in applications other than the ones for which they were designed. The following can be accepted as a general guide in the more common use applications of the three types of fuels:

Commercial Propane—This fuel type is adequate for domestic, commercial, and industrial use, particularly in geographical areas and in seasons where low ambient temperatures are common, and where uniformity of fuel is an important consideration. Commercial propane can be suitable for certain low severity internal combustion engine applications.

Commercial PB Mixtures—This fuel type, since it covers a broad range of mixtures, permits the tailoring of fuels to specific needs. The various mixtures find application as domestic, commercial, and industrial fuel in areas and at times when low ambient temperature conditions are not encountered. This fuel type is not suitable for vapor withdrawal applications in cool or cold climates.

Commercial Butane—This fuel type finds limited application as a domestic fuel in areas of warmer climates. It is similarly used in industrial applications where problems of fuel vaporization are not present, such as direct liquid injection.

Liquefied Petroleum Gases (LPG) — Specification

1 Scope

This draft Uganda standard prescribes the requirements and methods of sampling and test for those products commonly referred to as liquefied petroleum gases, consisting of commercial propane, commercial butane, and commercial propane butane mixture

This specification is applicable to products intended for use as domestic, commercial and industrial heating

HEALTH AND SAFETY WARNING - The use of this draft Uganda Standard involves potentially hazardous materials, operations and equipment. This Standard does not purport to address all of the safety problems associated with its use. It is the responsibility of the user to consult the relevant safety and health regulations, determine the applicability of regulatory limitations, and establish appropriate safety and health practices, prior to use.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

DUS ISO 3993, *Liquefied petroleum gas and light hydrocarbons - Determination of density or relative density – Pressure hydrometer method*

DUS ISO 4256, *Liquefied petroleum gases – Determination of vapour pressure - L PG method.*

DUS ISO 4257, *Liquefied petroleum gases - Method of sampling*

DUS ISO 4259, *Petroleum products - Determination and application of precision data in relation to methods of test*

DUS ISO 4266, *Petroleum products and hydrocarbons - Determination of sulphur content - Wickbold combustion method*

DUS ISO 6251, *Liquefied petroleum gases – Corrosiveness to copper - Copper strip test*

DUS ISO 7941, *Commercial propane and butane – Analysis by gas chromatography*

DUS ISO 8819, *Liquefied petroleum gases - Detection of hydrogen sulphide - Lead acetate method*

DUS ISO 8973, *Liquefied petroleum gases – Calculation method for density and vapour pressure*

DUS ISO 13758, *Liquefied petroleum gases -- Assessment of the dryness of propane -- Valve freeze method*

DUS ISO 7225, *Gas cylinders-Precautionary labels*

DUS ISO 13758, *Liquefied petroleum gases — Assessment of the dryness of propane — Valve freeze method*

DUS ISO 13757, *Liquefied petroleum gases — Determination of oily residues — High-temperature method*

DUS 2147:2019, *Standard Test Method for Determination of Ethyl Mercaptan in LP-Gas Vapour*

DUS 2148:2019, *Standard test method for determination of total volatile sulphur in gaseous hydrocarbons*

and liquefied petroleum gases by ultraviolet fluorescence

3 Terms and definitions

For the purposes of this standard, the following terms and definitions shall apply

3.1

LP Gases

liquefied petroleum gases consisting of readily liquefiable hydrocarbons predominantly of C₃ and C₄ compounds that are intended primarily as fuel in domestic, commercial, industrial heating and in spark ignition internal combustion engines.

3.2

Commercial propane:

hydrocarbon products composed predominantly of propane and/or propene (C₃) with a characteristic added stench; the remaining part may consist mainly of ethane/ethene and butane/butene isomers. It's normally used where high volatility is required

3.3

Commercial butane:

hydrocarbon products composed predominantly of butane and/or butene (C₄) with a characteristic added stench; the remaining part may consist mainly of propane/propene and pentane/ pentene isomers. It's normally used where low volatility is required

3.4

Commercial PB mixture:

mixtures of predominantly propane and butane (C₃ and C₄) with a characteristic stench added; for use where intermediate volatility is required.

3.6

defective

a test sample of the liquefied petroleum gas that fails in one or more respects to comply with the relevant requirements of this standard.

3.7

Cross filling

when one operator fills another operator's cylinder

4 Requirements

4.1 General

4.1.1 LPG gas shall have a characteristic odour, and an appearance that is clear, bright and free from suspended particles on visual inspection

4.1.2 LPG gas described as commercial propane, shall be of an aliphatic hydrocarbon mixture that consists predominantly of C₃ hydrocarbons, free from entrained moisture and complies with the appropriate requirements as specified in Table 1.

4.1.3 LPG gas described as commercial butane shall be of an aliphatic hydrocarbon mixture that consists predominantly of C₄ hydrocarbons, free from entrained moisture and complies with the appropriate requirements as specified in Table 1.

4.1.4 LPG gas described as commercial BP mixture shall be aliphatic hydrocarbon mixture that consists predominantly of C₃ and C₄ hydrocarbons, free from entrained moisture and complies with the appropriate requirements given in table 1

4.2 Specifications

When determined in accordance with the methods given in table 1, the properties of LPG gases shall conform to the requirements prescribed.

Table 1 — Specifications for liquefied petroleum gases

Characteristics	Commercial propane	Commercial butane	Commercial BP mixture	Test methods
Vapours pressure (Gauge) at 40 °C, kPa, max.	1434	483	1430 ^A	DUS ISO 4256
Volatility; Total acetylene content, mol% max	2.0	2.0	2.0	DUS ISO 7941
Total dienes content, mol% max (including 1,3 butadiene)	Nil	0.5	0.5	
Total C ₄ and higher, mol% max	2.5	Nil	Nil	
C ₅ and higher hydrocarbons, mol% max	0	2.0	2.0	DUS ISO 13757
Residues on evaporation of 100ml, max ml	0.05	0.05	0.05	
Copper strip corrosion, max	1	1	1	DUS ISO 6251
Total Sulphur (after stenching), mg/kg max.	185	140	140	DUS 2148
Hydrogen sulphide	Nil	Nil	Nil	DUS ISO 8819
Moisture content (dryness)	Pass	-	-	DUS ISO 13758
Free water content	-	None	None	Visual
Density at 15°C or relative density at 15.615°C ^B	Should be reported	Should be reported	Should be reported	DUS ISO 3993 or ISO 8973.
Odurization: ethyl mercaptan, µL/mL, min	15	15	15	DUS 2147
^A The permissible vapour pressure of products classified as BP mixtures shall not exceed 1430 kPa and additionally, shall not exceed that calculated from the following relationship between the observed vapour pressure and observed relative density: Vapour pressure, max. = 1167- 1880 (relative density at 15/15.6 °C)				
^B Although not a specific requirement, the density or relative density can be needed for other purposes and should be reported. Additionally, the relative density of BP mixture is needed to establish the permissible maximum vapour pressure (see Foot note A)				

Note Individual contractual agreements, national safety codes, regulations and/or requirements of distribution systems shall be complied with in addition to the specifications in table 1.

5 Precision and interpretation of tests results

Most of the methods of test given in table 1 contain a statement of the precision, i.e. the repeatability and reproducibility, to be expected from them but, in cases of dispute, the procedure described in DUS ISO 4259, which uses precision data in the interpretation of test results, shall prevail.

6 Packing and Marking

6.1 Packing

The condition of cylinders and road tank vehicles shall be such as not to be detrimental to the quality of the gas during normal transportation and storage.

The containers shall be acceptably sealed or leak proof, clean, and free from materials soluble in the gas

Note: For safety purposes, all cylinders should not be cross filled among the operators

6.2 Marking

The following information shall appear in legible and indelible marking on each cylinder and tank container, or in the case of gas filled into bulk storage tanks, in the storage and consignment documents of each road tanker or rail tank wagon:

- a) the supplier's name or brand name or trade mark;
- b) Product name — LPG ;
- c) the type of liquefied petroleum gas supplied, i.e. commercial propane, commercial butane or commercial propane butane mixture.
- d) the batch/lot number;
- e) net weight in Kilograms (kg);
- f) Precautionary labels that apply to safety and proper handling of LPG in accordance to DUS ISO 7225
- g) Expiry date

7 Sampling

7.1 Sampling

Representative sample of non-refrigerated liquefied petroleum gases shall be taken in accordance with the procedure given in ISO 4257. The sample so drawn shall be deemed to represent the lot and shall be tested for the respective properties in table 1 to determine whether or not the lot complies with the requirements of this standard.

For refrigerated liquefied petroleum gases a sampling procedure shall be agreed upon between the parties concerned.

Note Proper sampling of the liquefied petroleum is extremely important if the test results are to be significant.

7.2 Lot

The quantity of Liquefied Petroleum gases in containers and bearing the same brand name or trademark, grade designation and batch identification, from one manufacturer, and submitted at any one time for inspection and testing shall constitute a lot.

Annex A (informative)

Significance of this specifications for liquefied petroleum (LP) gases

A.1 General

This specification addresses commercial liquefied petroleum gases consisting of either propane or butane or mixtures thereof. Consequently, the important characteristics of these products can be defined and controlled by a relatively few simple measurements. The specification test methods provided achieve the desired results. The significance of the various tests as they can apply to consumer problems is summarized here.

A.2 Vapour Pressure, Volatility, and [Relative] Density:

A.2.1 Vapour Pressure—indirect measure of the most extreme low-temperature conditions under which initial vaporization can be expected to take place. It can be considered as a semi-quantitative measure of the amount of the most volatile material present in the product. It can also be used as a means for predicting the maximum pressures which can be experienced at fuel tank temperatures. Vapour pressure becomes more significant when it is related to volatility.

A.2.2 Volatility—Expressed in terms of the 95 % evaporated temperature of the product, is a measure of the amount of least volatile fuel component present in the product. Coupled with a vapour pressure limit, it serves to assure essentially single-component products in the cases of commercial propane and commercial butane fuel types. When volatility is coupled with a vapour pressure limit which has been related to density or gravity, as in the case of the commercial PB-mixture type of fuels, the combination serves to assure essentially two component mixtures for such fuels. When coupled with a proper vapour pressure limit, this measurement serves to assure that special-duty propane products will be composed chiefly of propane and propylene and that propane will be the major constituent.

A.2.3 Density or Relative Density—by itself, has little significance. It becomes of value when related to vapour pressure and volatility. Since density or relative density is of importance in meeting transportation and storage requirements it is always determined for all liquefied petroleum gas products.

A.3 Other Product Characteristics

While the vaporization and combustion characteristics of commercial liquefied gas products are completely defined for the normal use applications by vapour pressure, volatility, and relative density, as given in A.2, there are other properties which either affect or might affect the results obtained in some specific use applications. For that reason, limits are specified for residue content, copper corrosion, sulphur content, moisture content, and free water content to provide assurance of product dependability under the more extreme conditions of use.

A.3.1 Residue—A measure of the concentration of soluble hydrocarbon materials present in the product which are substantially less volatile than the liquefied petroleum gas product being sampled. Control of residue content is importance in applications where the fuel is used in liquid or vapour feed systems (where fuel vapours are withdrawn from the top of the LPG storage container). In either case, failure to limit the permissible concentration of residue materials can result in troublesome deposits or regulating equipment can become fouled, or both. In gas processing plants, LP gas generally is produced relatively free of residues, but the product can become contaminated by heavier hydrocarbons and other organic compounds during distribution, especially in multiproduct pipelines or while it is in contact with elastomers used in hoses. The current limit on residue contamination, while generally satisfactory for many conventional uses, may not be suitable for newer applications such as fuel cells and micro-turbines without some form of remediation.

A.3.2 Copper Corrosion—Limits are for the purpose of providing assurance that difficulties will not be experienced in the deterioration of the copper and copper-alloy fittings and connections which are commonly used in many types of utilization, storage, and transportation equipment. The copper corrosion test will detect

the presence of elemental sulphur and hydrogen sulphide, which is highly toxic. The copper corrosion limits also provide assurance that the LP-Gas will not contain H₂S in such quantities as to present a health and safety hazard if it is known that the product does not contain corrosion inhibitors or other chemicals which diminish the reaction with the copper strip. In addition, Test Method ISO 8819 is recommended as a field test and added safeguard to ensure that LP-Gas does not contain detectable amounts of hydrogen sulphide.

A.3.3 Sulphur Content—Limits are provided to more completely define liquefied petroleum gas products. Historically these products were lower in sulphur content than most other petroleum-derived fuels. This is generally no longer the case in areas where gasolines are typically below 30 mg/kg (ppm by mass) sulphur and diesel fuels are less than 15 mg/kg (ppm by mass) sulphur. The limit on sulphur content minimizes sulphur oxide emissions and limits potential corrosion by exhaust gases from combustion of LPG.

A.3.4 Moisture Content—limits the percent saturation of the product with water. This measurement using Test Method ISO13758 is a requirement only on commercial propane type of liquefied petroleum gas which must be subsaturated with water at temperatures above about -26°C. The purpose of moisture content control is to provide assurance that pressure reducing regulators and similar equipment will operate consistently without troublesome freeze-ups caused by the separation of dissolved water from the product.

The presence of an antifreeze agent such as methyl alcohol which prevents separated water from freezing can allow use of propane containing excessive dissolved water in many applications.

Note Commercial propane and special duty propane should be produced to comply with the moisture content requirement, and de-icer additives should not routinely be used to pass dryness test requirements.

That is, these products must be so dry that they are subsaturated with water at most ambient temperatures. They should be maintained dry during storage and distribution. A de-icer such as methyl alcohol (methanol) should not be added to these products without specific agreement and approval of the purchaser. During short-term upsets in production, or inadvertent contamination by trace water during storage or distribution, addition of 50 ppm methyl alcohol has proven to be acceptable to prevent valve freezing in normal applications. For guidance, based on historical experience and phase separation data, the maximum cumulative addition of methyl alcohol should not exceed 200 ppm by volume.

A.3.5 Free Water Content—of importance only on the commercial PB-mixtures and commercial butane type products. These two types of products are normally used under ambient conditions which are mild and, as a consequence, the only requirement is vigilance to ensure that no free water is present.

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- [3] ASTM D1835 – 11, *Standard specifications for liquefied petroleum (LP) Gases*
- [4] ISO 9162:2013 *Petroleum products — Fuels (class F) — Liquefied petroleum gases — Specifications*
- [5] SANS 1774, *Liquefied petroleum gases*

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