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Section 2

Product Specifications

The Product Specifications section contains specifications and guidelines for natural gas liquid (NGL) products. Fig. 2-1 contains GPA Midstream specifications for commercial propane, commercial butane, commercial butane-propane mixtures, and Propane HD-5.[1]

FIG. 2-1
GPA Midstream Liquefied Petroleum Gas (LPG) Specifications
(Table Extracted from GPA Midstream Standard 2140-23)[1]

	Product Designation				
Product Characteristics	Commercial Propane	Commercial Butane	Commercial B-P Mixtures	Propane HD-5	Test Methods
Composition	Predominantly propane and/or propylene.	Predominantly butanes and/or butylenes.	Predominantly mixtures of butanes and/or butylenes with propane and/or propylene.	Not less than 90 liquid volume percent propane; not more than 5.0 liquid volume percent propylene.	ASTM D-2163 GPA 2177 or GPA 2186 (if no olefins are present) (NOTE D)
Vapor pressure at 100 °F, psig, max. at 37.8 °C, kPa (ga), max.	208 1434	70 483	208 1434	208 1434	ASTM D1267 or D2598 or ASTM D6897 (Note C)
Volatile residue (VR):					
VR - temperature at 95% evaporation, °F, max.	–37	36	36	–37	ASTM D1837-17
°C, max.	–38.3	2.2	2.2	–38.3	ASTM D1837-17
or butane and heavier, liquid volume percent max.	2.5	—	—	2.5	ASTM D2163
or pentane and heavier, liquid volume percent max	—	2.0	2.0	—	ASTM D2163
Residual matter (RM):					
RM -residue on evaporation of 100 ml, max.	0.05 ml	—	—	0.05 ml	ASTM D2158 or
RM -oil stain observation	pass (1)	—	—	pass (1)	ASTM D7756 (Note E)
Corrosion, copper strip, max.	No. 1	No. 1	No. 1	No. 1	ASTM D1838 (NOTE A)
Total sulfur, parts per million by weight (ppmw)	185	140	140	123	ASTM D6667 ASTM D5623 GPA 2199 (NOTE B)
Moisture content	pass	—	—	pass	ASTM D2713 (Note F)
Free water content	—	None	None	—	
Hydrogen Sulfide	pass	pass	pass	pass	ASTM D2420

(1) An acceptable product shall not yield a persistent oil ring when 0.3 ml of solvent residue mixture is added to a filter paper in 0.1 increments and examined in daylight after 2 minutes as described in ASTM D2158.

Note A: This method may not accurately determine the corrosivity of the LPG if the sample contains corrosion inhibitors or other chemicals which diminish the corrosivity of the sample to the copper strip. Therefore, the addition of such compounds for the sole purpose of biasing the test is prohibited.
Note B: Be advised that the total volatile sulfur limits in these specifications do include sulfur compounds used for odorization purposes, but do not include elemental sulfur.
Elemental sulfur is not normally present; but if it is present at a sufficient level, the sample will fail the corrosion test method.
Note C: In case of dispute, ASTM D1267 is the referee method for vapor pressure.
Note D: GPA 2177 and GPA 2186 are suitable methods when the fluid does not contain olefins.
Note E: ASTM D2158 remains the referee method. If ASTM D7756 is used, the maximum is 350 mg/kg.
Note F: There may be suitable electronic test methods as a potential alternative to determine moisture content.

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The Liquefied Petroleum Gas (LPG) Specification Table (Fig. 2-1) has been adopted as GPA Midstream Standard 2140. [1]

These are "official" industry standards, representing a broad industry consensus for minimum quality products. Producers, purchasers, or pipeline companies may adopt variations of these specifications.

The gas plant designer and operator, as well as purchasers, will also be concerned with specifications for other plant products, including residue gas, raw mix streams, ethane, propane, ethane-propane mixes, normal butane, iso-butane, and plant condensate. Although there are no "official" industry specifications for these products, GPA Midstream's Analysis, Test Methods and Product Specifications Committee (Analysis Committee) developed a new set of product specifications for use in the natural gas industry. These specifications would be used to establish consistent, minimum specifications across the industry. Fig 2-2 (adapted from GPA Midstream Standard 2108)[2] shows fractionation grade product specifications for the following products:

- Fractionation Ethane,
- Fractionation Ethane/Propane (E/P) Mix,
- Fractionation Propane,
- Fractionation Iso-butane,
- Fractionation Normal Butane,
- Fractionation Natural Gasoline.

Fig. 2-2
GPA 2108-20 Fractionation Grade Product Specifications[2]

Product characteristic	Test Methods (2)	Fractionation Ethane	Fractionation Ethane/Propane	Fractionation Propane	Fractionation Iso-butane	Fractionation Normal Butane	Fractionation Natural Gasoline
ANALYSIS:							
Liquid Volume percent (LV%)							
Methane	GPA 2177 or ASTM D2163	3.0 LV% max.	1.5 LV% max.				
Ethane	GPA 2177 or ASTM D2163	95.0 LV% min.	75 LV% / 82 LV%				
Ethylene	ASTM D2163	1.0 LV% max.	1.5 LV% max.				
Propylene	ASTM D2163		1.0 LV% max.	5.0 LV% max.			
Propane	GPA 2177 or ASTM D2163	3.5 LV% max.	11.5 LV% / 25 LV%	90.0 LV% min.	3.0 LV% max.	0.5 LV% max.(1)	
Butane & Heavier	GPA 2177 or ASTM D2163		0.8 LV% max.	2.5 LV% max.			
Iso-butane	GPA 2177 or ASTM D2163				95.0 LV% min.	5.0 LV% max	
Normal Butane	GPA 2177 or ASTM D2163				5.0 LV% max.	95.0 LV% min.	6.0 LV% max. (4)
Pentanes	GPA 2177 or ASTM D2163					1.5 LV% max.	
Carbon Dioxide and other nonhydrocarbons not specifically listed.	GPA 2177	1000 ppmw max.	1000 ppmw max.				
Total Volatile sulfur, parts per million by weight (ppmw)	ASTM D6667 or ASTM D5623 or GPA 2199(5)	30 ppmw max.	30 ppmw max.	123 ppmw max. (3)	93 ppmw max.	93 ppmw max.	1000 ppmw max.
Water content	VISUAL	No Free Water	No Free Water	No Free Water	No Free Water	No Free Water	No Free Water
Vapor Pressure at 100 °F	ASTM D323 or ASTM D1267 or ASTM D2598 or ASTM D6897			208 psig max.	70 psig max.	50 psig max.	14 psi. max. (RVP)
VOLATILE RESIDUE:							
Temperature @ 95 % Evaporation	ASTM D1837			-37 °F max.	+16 °F max.	+36 °F max.	
Distillation End Point	ASTM D86						375 °F max.
RESIDUAL MATTER:							
Residue on evaporation of 100 ml, max.	ASTM D2158			0.05 ml			
Oil Stain Observation				Pass			
Corrosion, Copper Strip, max.	ASTM D1838 or ASTM D130(6)	No. 1	No. 1	No. 1	No. 1	No. 1	No. 1
Hydrogen Sulfide	ASTM D2420			Pass			
Doctor Test	ASTM D4952						Negative
Color, Saybolt Number	ASTM D156 or ASTM D6045						+25 min.
Oxygenates, Total	ASTM D7423					50.0 max.	

Note 1. Propane and lighter are 0.50 liquid volume percent (LV%) max.
Note 2. Test methods listed are typical. Equivalent or mutually agreeable methods may also be utilized.
Note 3. The 123 parts per million by weight (ppmw) sulfur specification includes sulfur from compounds used for stenching purposes.
Note 4. Butanes and lighter.
Note 5. Does not include elemental sulfur.
Note 6. ASTM D130 is to be used for natural gasoline only.

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Likewise, there are no industry standard specifications for ethane or ethane/propane (E/P) mixes. However, the GPA Midstream Analysis Committee has provided a summary of quality criteria in industry use as shown in Fig. 2-3.

FIG. 2-3
Representative Quality Criteria for Ethane Streams

	Weight Percent		
	Low	High	Common
High-Ethane Raw Streams			
Methane and Lighter	1.0	5.0	1.0
Ethane	Remainder	Remainder	Remainder
Propane	Remainder	Remainder	Remainder
Isobutane & Heavier	Remainder	Remainder	Remainder
Contaminant Maximums (ppmw)*:			
Hydrogen Sulfide	No. 1 Strip	50 ppmw	No. 1 Strip
Carbon Dioxide	100 ppmw	3,500 ppmw	500 ppmw
Sulfur	5 ppmw	200 ppmw	200 ppmw
Oxygen	300 ppmw	–	–
Moisture	75 ppmw	No free	No free
Ethane-Propane Mixes			
Methane and Lighter	0.6	1.0	0.6
Ethane	20	80	50
Propane	20	80	50
Isobutane & Heavier	0.2	4.5	4.5
Contaminant Maximums (ppmw)*:			
Hydrogen Sulfide	No. 1 Strip	No. 1 Strip	No. 1 Strip
Carbon Dioxide	500 ppmw	3,000 ppmw	500 ppmw
Sulfur	5 ppmw	143 ppmw	100 ppmw
Oxygen	500 ppmw	1,000 ppmw	1,000 ppmw
Moisture	10 ppmw	No free	50 ppmw
High-Purity Ethane			
Methane and Lighter	1.5	2.5	2.5
Ethane	90.0	96.0	90.0
Propane	6.0	15.0	6.0
Isobutane & Heavier	0.5	3.0	2.0
Contaminant Maximums (ppmw)*:			
Hydrogen Sulfide	6 ppmw	10 ppmw	10 ppmw
Carbon Dioxide	10 ppmw	5,000 ppmw	10 ppmw
Sulfur	5 ppmw	70 ppmw	50 ppmw
Oxygen	5 ppmw	5 ppmw	5 ppmw
Moisture	13 ppmw	No free	76 ppmw
*parts per million by weight (ppmw)			

Quality specifications for natural gas have historically been individually negotiated and prescribed in contracts between purchasers or pipeline companies and the producer or processor. Specification parameters for pipeline quality natural gas may include heating value, composition, contaminants, water content, and hydrocarbon dew point. Specification limits for these parameters may vary widely depending on the pipeline system, climatological conditions, end use, and other factors. Example pipeline quality gas specification parameters are shown in Fig. 2-4.

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FIG. 2-4
Example Pipeline Quality Natural Gas

	Minimum	Maximum
Major and Minor Components, mol%		
Methane	75	–
Ethane	–	10
Propane	–	5
Butanes	–	2
Pentanes and heavier	–	0.5
Nitrogen and other inerts	–	3
Carbon Dioxide	–	2-3
Total Diluent Gases	–	4-5
Trace Components		
Hydrogen sulfide	–	0.25-0.3 gr/100 scf
Mercaptan sulfur	–	–
Total sulfur	–	5-20 gr/100 scf
Water vapor	–	4.0-7.0 lb/mmcf
Oxygen	–	1.0%
Other Characteristics Heating value, Btu/scf-gross saturated	950	1150

Liquids: Free of liquid water and hydrocarbons at delivery temperature and pressure.
Solids: Free of particulates in amounts deleterious to transmission and utilization equipment. (3-15 microns, max.)

LPG SPECIFICATION PARAMETERS

International LPG specifications, from ISO 9162, are shown in Fig. 2-5.[4]

FIG. 2-5
Specifications for Liquefied Petroleum Gases - Table adapted from ISO 9162-2013[4]

Characteristics	Method of Test	Commercial Propane ISO-F-LP	Commercial Butane ISO-F-LB
Gauge vapor pressure at 104 °F, psig, max.	ISO 4256[2)] or ISO 8973	225[1)]	75[1)]
Volatility			
Ethane (C_2) hydrocarbons	ISO 7941	Report value[3)]	
Butane (C_4) hydrocarbons, mole percent (mol%), max.	ISO 7941	7,5[1)]	
Pentane (C_5) hydrocarbons, mol%, max.	ISO 7941	0,2[1)]	2,5[1)]
Unsaturated hydrocarbons, mole percent (mol%)	ISO 7941	Report value[4)]	Report value[4)]
Dienes, mol%, max.	ISO 7941	0.5[1)]	0.5[1)]
Evaporation residue parts per million by weight (ppmw)	EN15470[6]/EN15471[6]/EN16423	60	60
Corrosiveness to copper, max.	ISO 6251	1	1
Sulfur, mg/kg, max.	ASTM D6667	50[1)]	50[1)]
Hydrogen sulfide	ISO 8819	Pass	Pass
Free water content		None[5)]	None[5)]

1) Certain national standards and/or regulations can prescribe other limits.
2) In case of dispute about the vapor pressure, ISO 4256 shall prevail.
3) Physical limitations of transport and storage facilities shall be considered for refrigerated transport; a common limit is 2.0 mole percent (mol%) maximum.
4) Certain national standards or commercial agreements (particularly in the Asia-Pacific region) may prescribe a limitation on unsaturated hydrocarbons. Limitations should be confirmed on a case-by-case basis.
5) The presence of water shall be determined by visual inspection. For shipments of refrigerated liquefied petroleum gases at their atmospheric boiling point, it is essential that the water content is below the saturation level at this temperature as determined by a method agreed between the buyer and the seller.
6) In case of dispute about the evaporation residue, EN 15470 and EN 15471 shall prevail.

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