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PROCESS DESIGN OF LPG RECOVERY AND SPLITTER UNITS

(PROJECT STANDARDS AND SPECIFICATIONS)

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SCOPE

This Project Standards and Specifications covers minimum process design requirements for LPG recovery & splitter Units. It should be expressed that only general process requirements are covered in this Standard and the Unit specific design conditions shall be determined based on the feed analysis and final product specifications during execution of the Unit conceptual design.

REFERENCES

Throughout this Standard the following dated and undated standards/codes are referred to. These referenced documents shall, to the extent specified herein, form a part of this standard. For dated references, the edition cited applies. The applicability of changes in dated references that occur after the cited date shall be mutually agreed upon by the Company and the Vendor. For undated references, the latest edition of the referenced documents (including any supplements and amendments) applies.

1. ASTM (American Society for Testing Of Materials)

   ASTM-D-2163
   ASTM-D-2420

2. GPSA (Gas Processors Suppliers Association)

   "Engineering Data Book", Vol. 2, Section 17-26, 1987

3. IP (Institute of Petroleum, London)

   IP 10 (A) July, 1985 "Petroleum Measurement Manual", Part 10, "Meter Proving"

DEFINITIONS AND TERMINOLOGY

Absorption - Is a process, which the liquid (absorbent) flows countercurrent to a gas stream for the purpose of removing one or more constituents (absorbate) from that gas.

Lean Oil (Absorbent) - Is usually those hydrocarbons which have molecular mass of about 100-180 and maximum final boiling point of 160°C (e.g., Naphtha).

Liquefied Petroleum Gas (LP-Gas or LPG) - Any material having a vapor pressure not exceeding that allowed for commercial propane composed predominantly of the following hydrocarbons, either by themselves or as a

mixtures: propane, propylene, butane (normal butane or isobutane) and butylenes including butylenes isomers, as a by-product in petroleum refining or natural gasoline manufacture.

Reid Vapor Pressure (RVP) - Is the Pressure of the vapor in equilibrium with liquid at 37.8°C (100°F).

SYMBOLS AND ABBREVIATIONS

SYMBOL/ABBREVIATION	DESCRIPTION
APC	Advanced Process Control.
LPG	Liquefied Petroleum Gas.
PFD	Process Flow Diagram.
RVP	Reid Vapor Pressure.

UNITS

This Standard is based on International System of Units (SI) except where otherwise specified.

BASIC DESIGN REQUIREMENTS

1. Process configuration of the LPG recovery Units shall be established based on the following factors and submitted for Company's approval:
   - feed composition;
   - upstream Unit process configurations;
   - ultimate product consumption;
   - product specifications;
   - minimum C_3, C_4 and C_5 (if any) recovery.
2. Unless otherwise specified, economical study shall be practiced to justify provision of the absorption/stripping lean oil system if required by the minimum product recovery specification as instructed by the project scope of the work for minimum C_3 recovery. The final process configuration shall be approved by the Company. For C_4 and C_5 the following requirements should be considered.
   - Minimum C_4 recovery: 98 (vol. %).
   - Minimum C_5 recovery: 99.5 (vol. %).

3. The Unit product minimum specifications shall be as follows, unless otherwise specified in the project specification. The specifications of finished LPG product shall be as outlined in Appendix A of this Standard.

	C_3	C_4	C_5
C_2 (vol. %)	0.3 (max.)	---	---
C_3 (vol. %)	Balance	0.2 (max.)	---
C_4 (vol. %)	3.5 (max.)	Balance	1 (max.)
C_5 (vol. %)	---	1 (max.)	Balance
H_2S (ASTM D-2420)	Negative	Negative	Negative

4. If required by the feed compositions, and product specifications, treating facilities shall be provided.
5. The Unit design throughput shall be based on the sum of maximum flow rates of various feed streams to the Unit when the upstream Units are operating at their design capacities.
6. C_3 and C_4 products must be manufactured separately and each stream must be suitable for LPG blending as per LPG specification shown in Appendix A.
7. Drying facilities for C_3 product shall be provided.
8. Feed surge drum shall be provided to receive all feed streams into the LPG recovery Unit.
9. Unless otherwise specified, the Unit turndown capacity should be 60% of design throughput, without loss of efficiency in fractionation while meeting the product specifications.
10. The Unit design capacity shall be determined based on the Licenser's information on the upstream Licensed Process Units and shall take into consideration the variations resulted in the relevant process Units.
11. One cooler shall be supplied to cool the feed gas from the crude distillation overhead compressor (if any).
12. The following design notes shall be taken into consideration if LPG caustic treating section to be supplied as per feed and product specifications.
    - Caustic dissolving facilities shall be included if supply of the caustic outside of the Unit battery limit is not feasible.

- Caustic regeneration facilities shall be provided, if economically are justified.
- Spent caustic degassing and storage shall be provided.

13. Safety considerations shall be fully complied.
14. Special attention shall be made to the flexibility and ease of operations, equipment interchangeability and optimization.
15. Maximum energy conservation shall be applied.
16. Kettle type reboilers shall be provided to maintain the bottom temperature of the following towers:
    - deethanizer;
    - depropanizer;
    - propane dryer;
    - debutanizer.

FRACTIONATION AND SYSTEM CONFIGURATION

General

1. Stabilization tower shall be used where a natural gasoline or stable liquid to be produced [see Fig. 1(a)].
2. The two-tower system shown in Fig. 1(b) is most commonly used to produce an LPG mixture in the overhead and a natural gasoline product as the bottoms. In this system, the deethanizer must remove all methane, ethane and other constituents not suitable in the two product streams from the second tower. Any material that enters the second tower must necessarily leave in one of the product streams.
3. The three-tower system shown in Fig. 1(c) most commonly produces commercial propane, commercial butane and natural gasoline as products. In this system also, the deethanizer must work properly to remove all constituents that cannot be sold in one of the three products. The sequence of fractionation following the deethanizer may be varied. In the second tower, an LPG mixture could be produced overhead with natural gasoline produced as bottoms. The third tower would then split the LPG into commercial propane overhead and commercial butane as bottoms. This sequence is favored sometimes where the market situation is variable and a market for LPG only exists during a portion of the year. During this period, the third tower would be shut down and not operated.