

COREFLUX[®]

Enhanced NGL/LPG Recovery



The solution for NGL/LPG extraction from Natural Gas and LNG with high product recovery rate and low energy consumption

COREFLUX[®] Concept

Toyo Engineering Corporation (TOYO) has developed COREFLUX[®] (Cold Reflux) technology to extract Natural Gas Liquids (NGL), ethane and Liquefied Petroleum Gas (LPG) from Natural Gas/Liquefied Natural Gas (LNG) using a reflux enhancement method. Our unique processes are known as COREFLUX[®]-C₂ for NGL recovery from Natural Gas, COREFLUX[®]-LNG for ethane and LPG recovery from LNG and COREFLUX[®]-LPG for LPG recovery from LNG.

Key features of COREFLUX[®]-C₂/LNG concept are ;

- ▶ Simple flow scheme- lower CAPEX
- ▶ High ethane recovery rates
- ▶ Low total energy consumption with advanced cold heat integration and lower OPEX compared to conventional NGL extraction process

COREFLUX[®]-C₂ Features & Applications

COREFLUX[®]-C₂ is a highly efficient and competitive process technology with a deep NGL recovery from Natural Gas, oil associated gas and off-gas from refinery plants. This proprietary process suits following applications ;

- ▶ High ethane recovery requirement
- ▶ Rich feed gas
- ▶ Increased throughput or enhanced C₂ recovery

COREFLUX[®]-C₂ recovers more than 95% of ethane from feed natural gas at less compression power compared to the conventional split vapor process. Easy modification from the conventional process to COREFLUX[®]-C₂ is also applicable. NGL recovered will be utilized for petrochemical feedstock and contribute to feasibility of gas processing complex.

COREFLUX[®]-C₂ Process Configuration

Process configuration of COREFLUX[®]-C₂ is shown in Fig-1. Turbo expander cools down the feed gas similar to the conventional split vapor process, however in COREFLUX[®]-C₂, all feed gases are sent to the turbo expander to maximize the power recovery. To produce a methane rich reflux, a gas-liquid separator is provided at the outlet of the turbo expander. The methane rich vapor

from the separator is recompressed by a compressor and totally condensed against the cold stream from demethanizer overhead. The condensed liquid contains high concentration of methane and works as an effective reflux. Maximum power recovery at the turbo expander and the methane rich reflux lowers total compression power by 20% compared to the conventional processes.

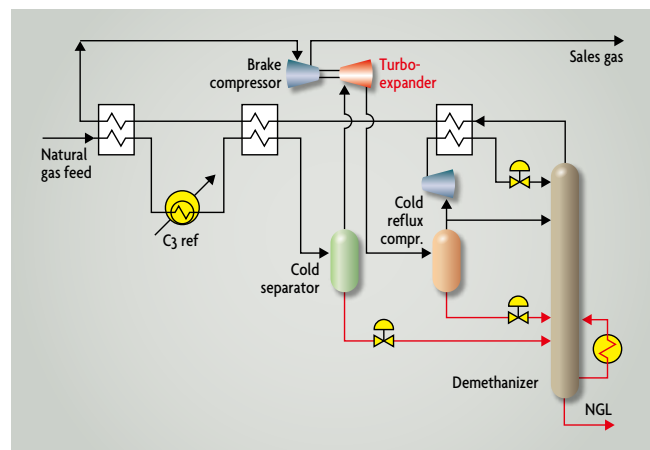


Fig-1 : Flow scheme of COREFLUX[®]-C₂

COREFLUX[®]-LNG Features & Applications

COREFLUX[®]-LNG is an efficient LNG processing technology to recover ethane and LPG from LNG. Process features in COREFLUX[®]-LNG include ;

- ▶ High ethane recovery rate (> 98%) with enhanced reflux
- ▶ Low energy consumption with cold heat integration
- ▶ Simple flow scheme for easy operation and maintenance with low initial investment

COREFLUX[®]-LNG Process Configuration

Process configuration of COREFLUX[®]-LNG is shown in Fig-2. Process feature in COREFLUX[®]-LNG is in demethanizer overhead condenser system, where the overhead vapor is partially condensed against the cold LNG feed stream in the conventional process. In COREFLUX[®]-LNG, a part of condensed liquid from the condenser is returned to demethanizer as reflux. This reflux

contains more than 99 mole% of methane, and this methane rich reflux enables more than 98% of ethane recovery rate at demethanizer. The remaining vapor from the condenser is compressed with an overhead compressor before being fully condensed against the feed LNG. For energy conservation, a methanol heating medium, suitable for cold heat transfer, is applied.

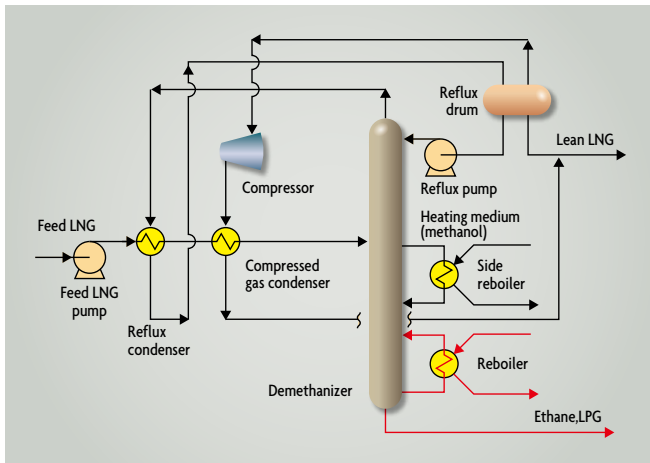


Fig.-2: Flow scheme of COREFLUX®-LNG

COREFLUX®-LPG Features & Applications

COREFLUX®-LPG is unique LNG processing technology to extract LPG from LNG, where process configuration is further simplified from COREFLUX®-LNG. Process features in COREFLUX®-LPG include:

- ▶ High C₃/C₄ recovery rate (> 99.5%) with enhanced reflux
- ▶ No external refrigerant for cryogenic fractionation
- ▶ No vapor compression for reliquefaction of demethanizer overhead

COREFLUX®-LPG Process Configuration

Process configuration of COREFLUX®-LPG is shown in Fig.-3. A high Propane recovery rate can be achieved when an ethane rich reflux is fed to the overhead of demethanizer. This is unique process and first time to use subcooled ethane reflux to enhance LPG recovery in LNG processing.

Process feature in COREFLUX®-LPG is overhead vapor in both columns is fully condensed by feed LNG and heat recovery from demethanizer. This reflux contains more than 99 mole% of ethane to ensure less LPG leakage and enable more than 99.5% of propane recovery rate in whole process. All products can be sent out in liquid phase to ensure no further compression becomes required.

Applications of COREFLUX®-LNG/LPG

Extracting ethane and LPG at the LNG regasification terminal is an effective method to meet the heating value specifications with downstream gas pipelines requirements. COREFLUX®-LNG/

LPG provides additional profit to LNG regasification terminals, i.e., an opportunity to sell petrochemical feedstock and improve terminal complex feasibility as depicted in Fig.-4. COREFLUX®-LNG/ LPG is applicable to regasification terminals where:

- ▶ Higher heating value LNG importing
- ▶ Lower heating value Natural Gas to end users
- ▶ Ethane and LPG demand as petrochemical feedstock

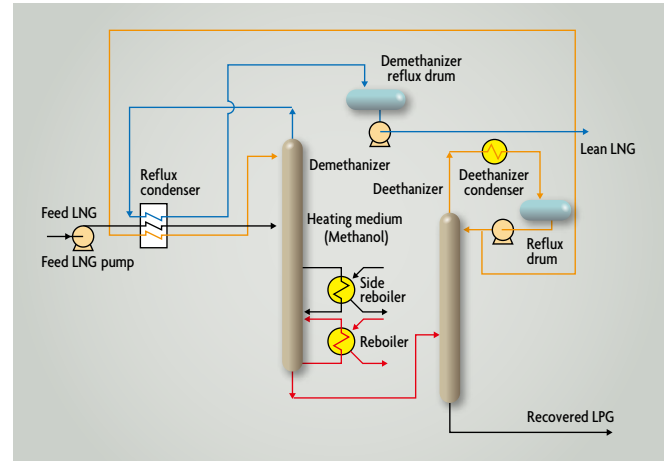


Fig.-3: COREFLUX®-LPG Process Flow Diagram (Patent pending)

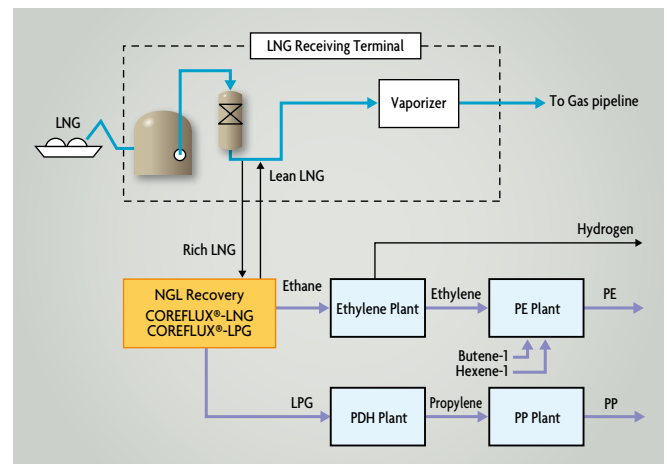


Fig.-4: COREFLUX®-LNG/LPG integration with petrochemical plants

Commercially Proven Process

COREFLUX®-LNG has been selected by Oil and Natural Gas Corporation Ltd (ONGC) for a 5 million tons LNG per annum C₂/C₃/C₄ extraction facility located in Dahej, India. The plant has been in commercial operation successfully since 2015.

COREFLUX®-C₂ has also been selected by State Concern “Turkmengas” for a 5 billion m³ natural gas per annum NGL extraction facility located in Turkmenbashi, Turkmenistan. Turkmengas awarded TOYO as EP contractor for gas processing, ethylene and polyethylene construction project. This plant is scheduled to be completed in 2018.



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