P-08	Keywords	Y4	system or software	Z3/2	natural gas/oil	L	Technical Service

Toyo Engineering Corporation

High-efficiency Ethane & LPG Recovery Process

Features

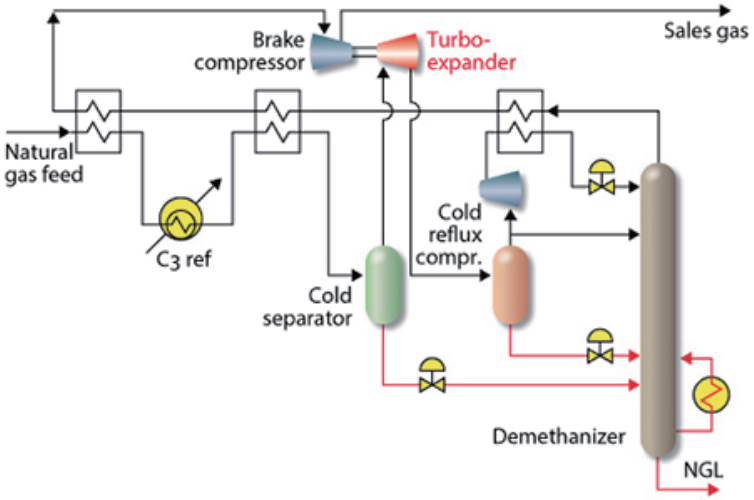
TOYO Engineering Corporation (TOYO) has developed COREFLUX (Cold Reflux), the new processes to extract Natural Gas Liquid (NGL) from natural gas and/or LNG utilizing a unique reflux enhancement method. The COREFLUX processes can achieve a high product recovery rate with a relatively low energy consumption.

1. COREFLUX®-C_2 (Cold Reflux Technology for C_2 recovery)
   COREFLUX®-C_2 is a very efficient and competitive process technology to obtain a high ethane recovery rate from natural gas, oil associated gas and off-gas from refinery plants.
   - High ethane recovery rate (>95%) with enhanced reflux,
   - Low compression power with an efficient use of a turbo expander
   - Easy modification from the conventional process
2. COREFLUX®-LNG Process (Cold Reflux Technology for LNG Processing)
   COREFLUX®-LNG is an efficient LNG processing technology to recover ethane and LPG from LNG. This technology can reduce the heating value of LNG at the LNG regasification terminal and utilize the recovered ethane and LPG as petrochemical feedstock.
   - High ethane recovery rate (>98%) with enhanced reflux,
   - Low energy consumption with an advanced cold heat integration, and
   - Simple flow scheme for easy operation and maintenance with reasonable initial investment cost.
3. COREFLUX®-LPG Process (Cold Reflux Technology for LPG Extraction)
   COREFLUX®-LPG is unique LNG processing technology to extract LPG from LNG. This technology can reduce the heating value of LNG at LNG regasification terminal and utilize the extracted LPG as petrochemical feedstock in the similar way with COREFLUX®-LNG.
   - High C3/C4 recovery rate (> 99.5%) with enhanced reflux
   - No vapor compression for reliquefaction of Demethanizer overhead
   - Low energy consumption with low operation pressure of Demethanizer

Basic Concept or Summary

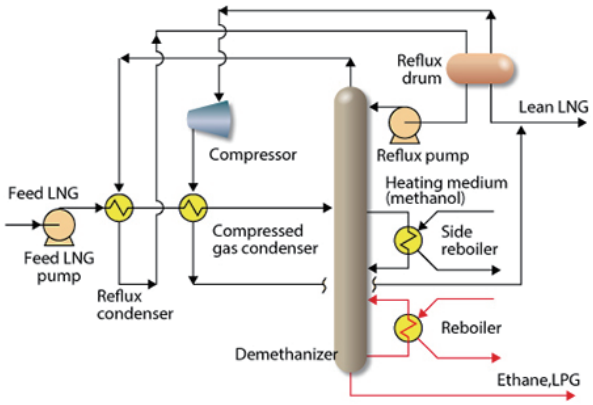
1. COREFLUX®-C_2 (Cold Reflux Technology for C_2 recovery)
   COREFLUX®-C_2 utilizes turbo expander to cool down the feed gas. However, unlike the conventional split vapor process, all of the feed gas is sent to the turbo expander to maximize the power recovery. To produce a methane rich reflux, a gas-liquid 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 have resulted in a lower total compression power for COREFLUX®-C_2 compared with the conventional processes.

COREFLUX®-C_2 Process Flow

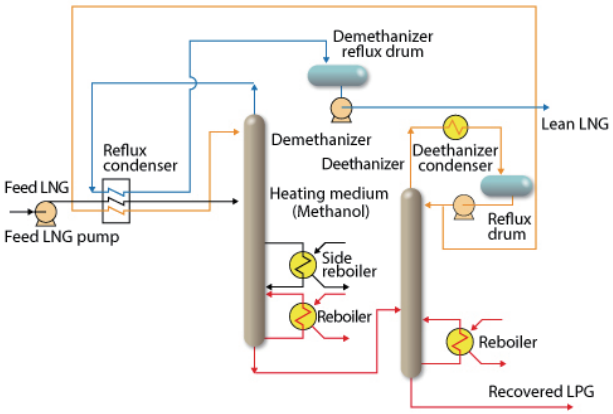


2. COREFLUX®-LNG Process (Cold Reflux Technology for LNG Processing)
   COREFLUX®-LNG involves a condenser in Demethanizer overhead, where the Demethanizer overhead vapor is partially condensed against the cold LNG feed stream. A part of condensed liquid from the condenser is returned to Demethanizer as reflux. This reflux contains more than 99 mol% of methane. This is the reason why COREFLUX®-LNG can achieve more than 98% of ethane recovery rate. 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.
3. COREFLUX®-LPG Process (Cold Reflux Technology for LPG Extraction)
   COREFLUX®-LPG is the two columns process, where a high propane recovery rate can be achieved with an ethane rich reflux recycled back from Deethanizer to Demethanizer. Overhead vapors from both Demethanizer and Deethanizer columns are fully condensed by feed LNG and cold heat recovery from Demethanizer. This unique reflux enhancement method enables total condensation of vapors without any overhead vapor compression at low operation pressure, which can maximize the separation efficiency of C_2 and C_3.

COREFLUX®-LNG Process Flow



COREFLUX®-LPG Process Flow



Effects or Remarks

1. COREFLUX®-C_2 (Cold Reflux Technology for C2 recovery)
   COREFLUX®-C_2 will achieve a high process performance for the following applications.
   - For high ethane recovery,
   - For relatively rich feed gas and
   - For revamp project to increase feed throughput and/or ethane recovery rate.
2. COREFLUX®-LNG Process (Cold Reflux Technology for LNG Processing)
   COREFLUX®-LNG will provide an additional value to LNG regasification terminal, i.e. an opportunity to sell petrochemical feedstock in addition to regasified natural gas, and thus, will improve the economics of LNG regasification terminal.
3. COREFLUX®-LPG Process (Cold Reflux Technology for LPG Extraction)
   COREFLUX®-LPG can be applied when LPG is sold as a product or supplied to petrochemical plant such as Propane Dehydrogenation (PDH) unit as the feedstock.

Installation in Practice or Schedule

Overseas

- In 2014, COREFLUX®-C_2 has been selected by State Concern “Turkmengas” for a 5 billion m^3 natural gas per annum NGL recovery facility located in Turkmenbashi, Turkmenistan.
- In 2006, COREFLUX®-LNG Process was selected for a large scale of C_2-C_4 extraction facility in Dahej, India (5 million tons per year of LNG processing capacity) by Oil and Natural Gas Corporation (ONGC).

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