

HAMBURG COMPLEX
-HAMBURG REFRIGERATION UNIT-
1.0 GENERAL

1.01 REFRIGERATION UNIT

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Purpose

The Shell Canada Hamburg Refrigeration Unit was added to existing Hamburg processing facilities to efficiently remove condensate from the rich gas production from the South Hamburg and East Hamburg fields. The Hamburg Refrigeration Unit is owned and operated wholly by Shell. The field production facilities and gas/condensate produced from the wells is owned by Shell and by others.

The Hamburg Refrigeration Unit is designed to process 1000 E³m³/d of gas and to recover 180 m³/d of condensate at an inlet gas pressure of 6500 kPa(g).

At an inlet pressure of 5000 kPa(g), the Hamburg Refrigeration Unit can process 700 E³m³/d of gas.

Key Performance Objectives

Four key plant performance objectives are shown below as an introduction to the Hamburg Refrigeration Operator Training System. This manual is referred to as the Hamburg Refrigeration OTS or as the Hamburg Refrigeration Operating Manual (HROM). The key plant performance objectives are:

- Maximize plant availability
- Maximize condensate production
- Minimize plant operating costs
- Maximize plant reliability

Plant Availability

Maintaining plant availability is keeping the plant in operation for as many days per year as possible. Shutdowns of the Hamburg Refrigeration Plant cause a loss of revenue because of the time required to bring the plant and wells back on-stream.

The gathering system pipelines from the South Hamburg and East Hamburg wells slope upward from the wells to the Plant. Extended shutdowns allow the pipelines to cool which condense hydrocarbons in the pipeline. Water and condensate flow backward toward the wells. When the wells are started, the liquids slug to the Hamburg inlet separator. These condensed liquids can also increase the back pressure on the wellsite chokes to make the wells more difficult to start.

Keep plant shutdowns short, whenever possible.

Condensate Production

A significant part of the revenue generated by the Hamburg Refrigeration Unit comes from the sale of condensate. Maximizing condensate production can be done by keeping the following principles in mind:-

- Minimize the plant inlet temperature within allowable limits to avoid hydrate formation.

- Maintain the process design temperature at 172°C at the outlet of the condensate stabilizer reboiler(TIC-3501).
- Maintain the low temperature separator temperature a minus 14°C.

Plant Operating Costs

Contrary to the last objective, another operating objective is to reduce plant operating costs to a minimum.

The three key pieces of equipment in the Hamburg Refrigeration Unit, in terms of high operating cost, are the refrigeration compressor, the sales gas/overhead compressor and the hot oil heater.

To reduce the cost of electric power used by the compressors, maintain a low temperature from the stabilizer overhead condenser to reduce recycle rates.

To reduce the operating cost of the hot oil heater, pinch the manual globe valves on the heating glycol system to reduce utility glycol heating loads.

Plant Reliability

A fourth objective is to maintain high reliability in the plant. Many of the decisions regarding reliability are already made as part of the plant design and engineering. However there are activities which can help the reliability of the Hamburg Refrigeration Unit:

- change filters in the glycol regeneration building when the pressure drop shows that they are plugging off.
Maintain the lube oil systems for the propane refrigeration compressor and the sales gas/overhead compressor.
- Maintain the hot oil temperature below 290°C to prevent oil flashing and oil breakdown.

- Overview** This section briefly describes the different systems which make up the Hamburg Refrigeration Unit. Each system is described in detail in the sections of this manual.
- Residue Gas System** Refer to HROM 1.0
- Gas from the inlet separator passes through a series of heat exchangers to chill the gas to -14°C . Hydrocarbon liquids condense from the gas to meet Nova hydrocarbon dew point specifications.
- Gas Compression** The Hamburg Refrigeration Unit has been designed for an inlet operating pressure of 6500 kPa(g). Residue gas from the low temperature separator meets Nova sales gas specifications. This gas is compressed in the sales gas compressor to approximately 8400 kPa(g).
- At reduced plant inlet pressure of 5000 kPa(g), the load on the compressor motor increases. To achieve the maximum plant throughput of $700 \text{ E}^3\text{m}^3/\text{d}$ at 5000 kPa(g) inlet, the Nova sales gas pressure must be less than 7500 kPa(g).
- Overhead gas from the condensate stabilizer is compressed in two stages and recycled to the inlet of the refrigeration exchangers. The overhead gas compressor is on a common compressor frame with the sales gas compressor. The sales gas/overhead compressor is a four throw reciprocating compressor with a single speed electric motor drive.
- Glycol Injection** Ethylene glycol/water mixture is injected into the tube sheet of all of the refrigeration exchangers. Water which condenses in these exchangers is absorbed into the glycol/water.
- Cold glycol/water removed from the low temperature separator is regenerated in a direct fired glycol reboiler. Steam from the reboiler is vented. Regenerated glycol/water is pumped back to the glycol injection nozzles.
- Propane Refrigeration** Condensate is recovered from the inlet gas stream by propane refrigeration. Propane is boiled in the propane chiller to cool the inlet gas to -14°C . The cold gas and condensate is separated in the low temperature separator. Gas from the low temperature separator meets Nova sales gas specifications for hydrocarbon dew point and water content.
- Condensate System** Warm condensate from the inlet separator and cold condensate from the low temperature separator mix in the condensate stabilizer feed drum. The condensate stabilizer is a 30-tray tower with a hot oil heated reboiler and an aerial cooler overhead condenser.

Gas from the stabilizer feed drum and stabilizer reflux drum is recycled to the refrigeration exchangers with the overhead gas compressor. Stabilized condensate from the reboiler flows to the condensate storage tanks.

Hot Oil Heating System Heat for the condensate stabilizer reboiler and for the glycol heat medium system is produced in the hot oil heater. The hot oil heater is a direct fired heater which burns gas from the wet fuel gas system.

Glycol Heating System Glycol/water is used as a heat medium system for the Hamburg Refrigeration Unit. The glycol heating system is a closed loop system which takes heat from the hot oil heating system. The glycol heating system is separate from the glycol injection system.