NGL 회수공정

2020년 2월 11일(화)

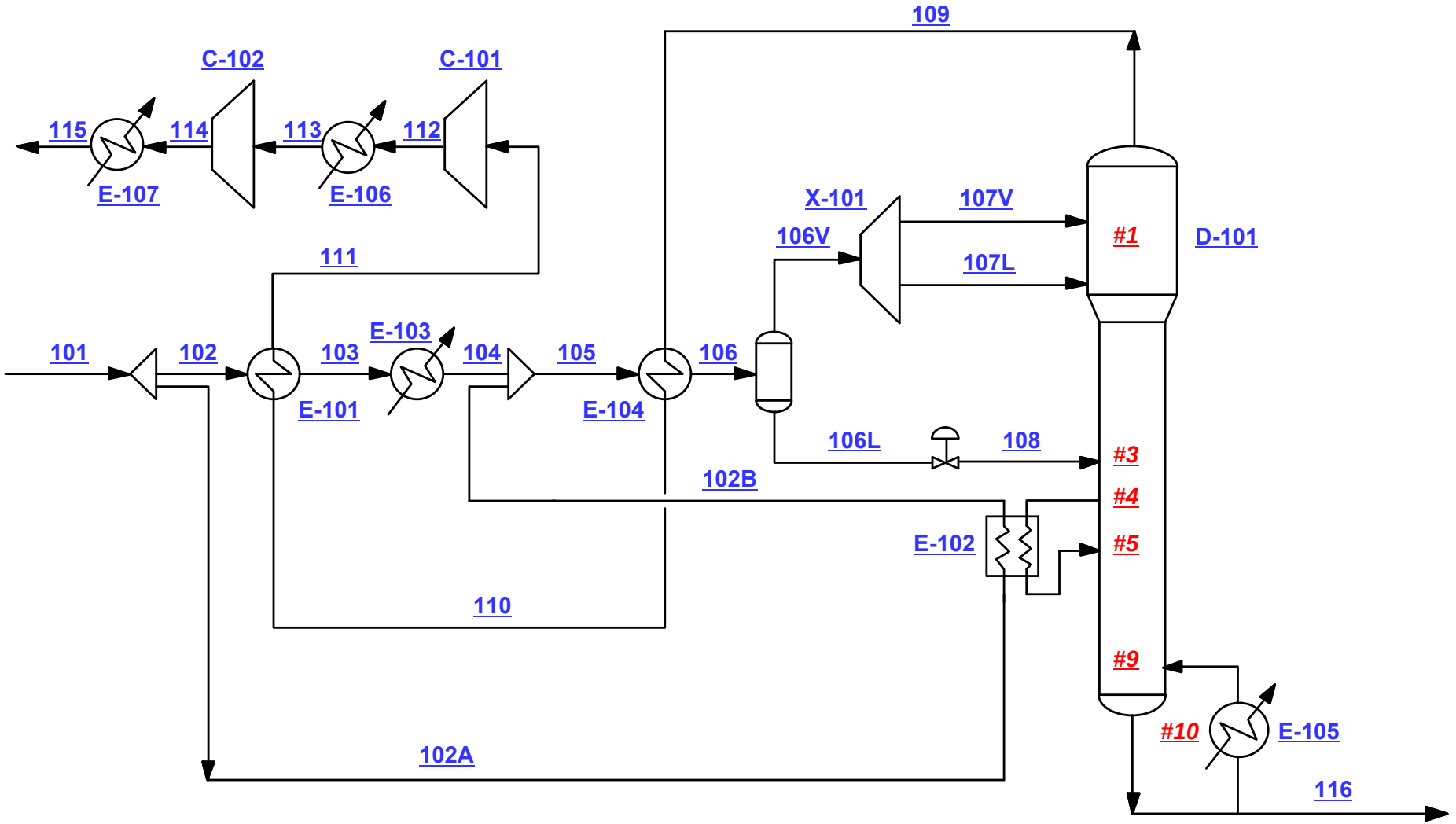
공주대학교 공과대학 화학공학부

조 정 호

목차

1 공정 설명

NGL 회수공정의 공정 개요도:



공정 설명:

- Gas is dehydrated usually by molecular sieve.
- Gas is partially chilled by back-exchange with residue gas.
- Gas is further chilled by refrigeration system
- Gas is further chilled demethanizer overhead gas.
- Extremely low temperature stream is obtained by letting-down the pressure using turbo-expander.
- Ethane & heaviers are obtained by further fractionations.

2 원료 조건 및 제품 사양

원료 조건:

Contents	Value
Pressure (bar)	70
Temperature (°C)	45
Flow Rate (kg/hr)	625,000

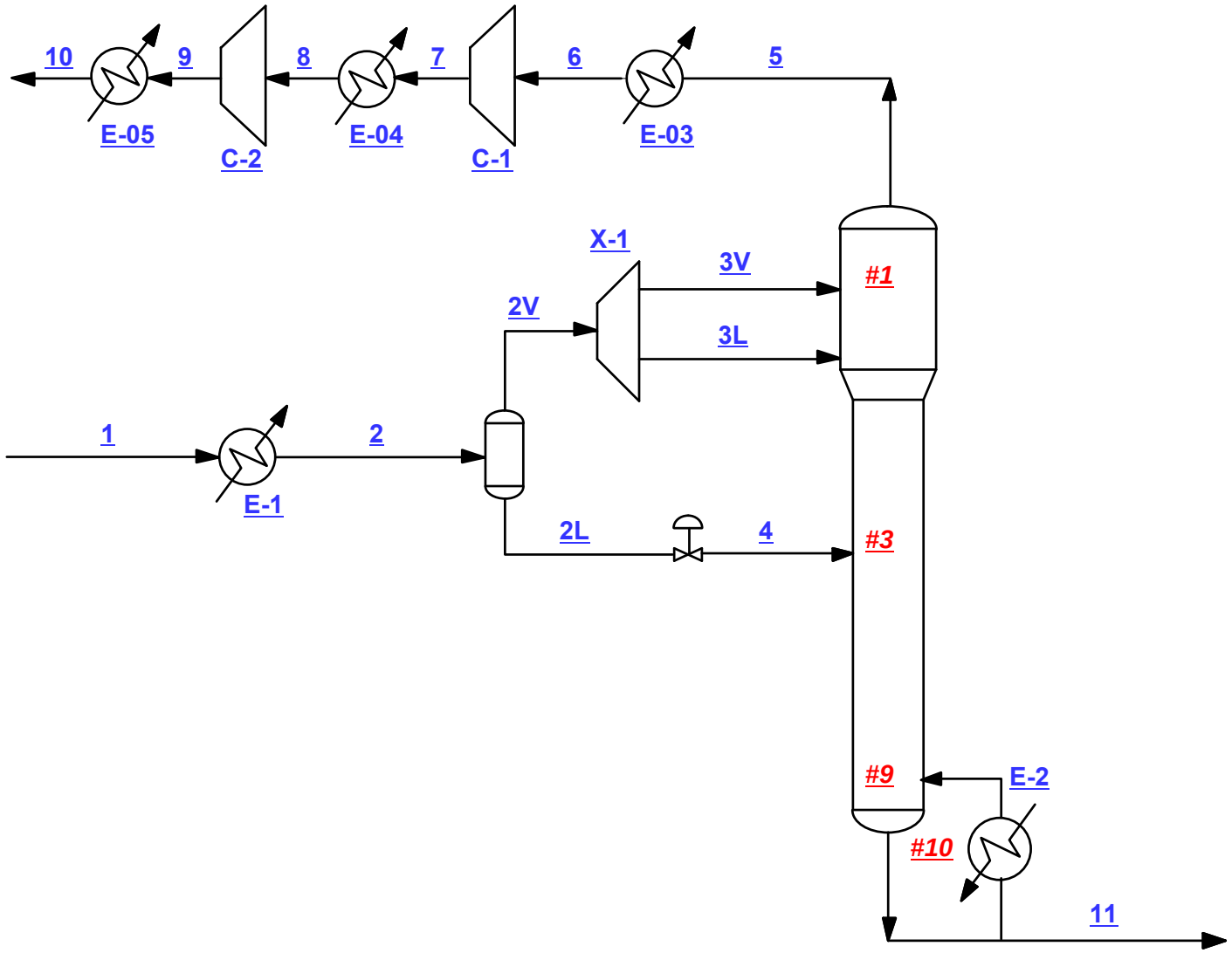
Component	Mole%
Nitrogen	0.22
Methane	91.33
Ethane	5.36
Propane	2.14
I-Butane	0.46
N-Butane	0.47
I-Pentane	0.01
N-Pentane	0.01
Total	**100**

제품 사양:

- C1/C2 molar ratio: 0.0119
  - Methane molar flow divided by ethane molar flow at demethanizer bottom stream
- Ethane recovery at DeC1 column bottom: 75%
  - 75% or higher ethane recovery ratio at demethanizer bottom stream is required.

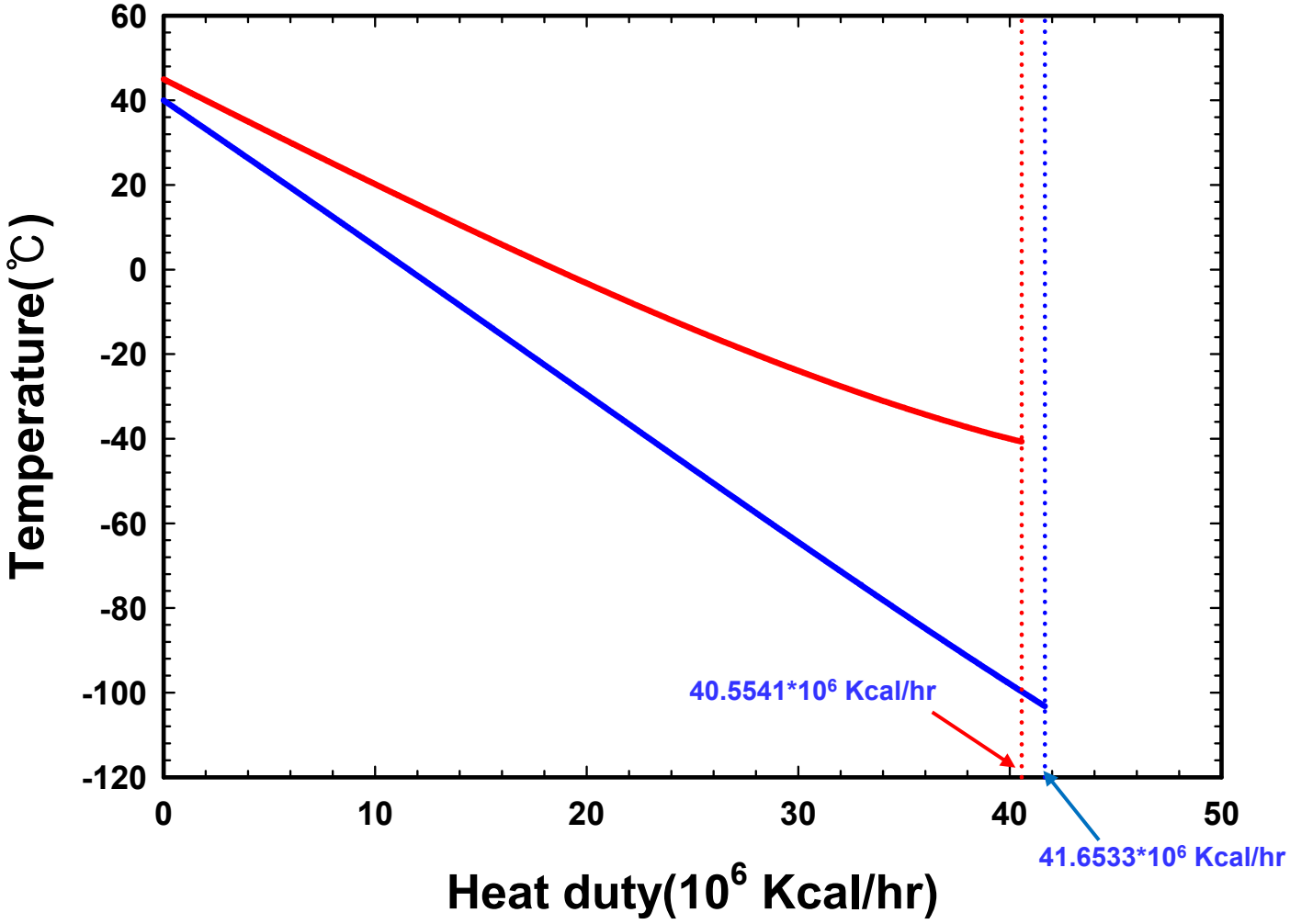
3 운전압력 최적화

탈메탄탑:



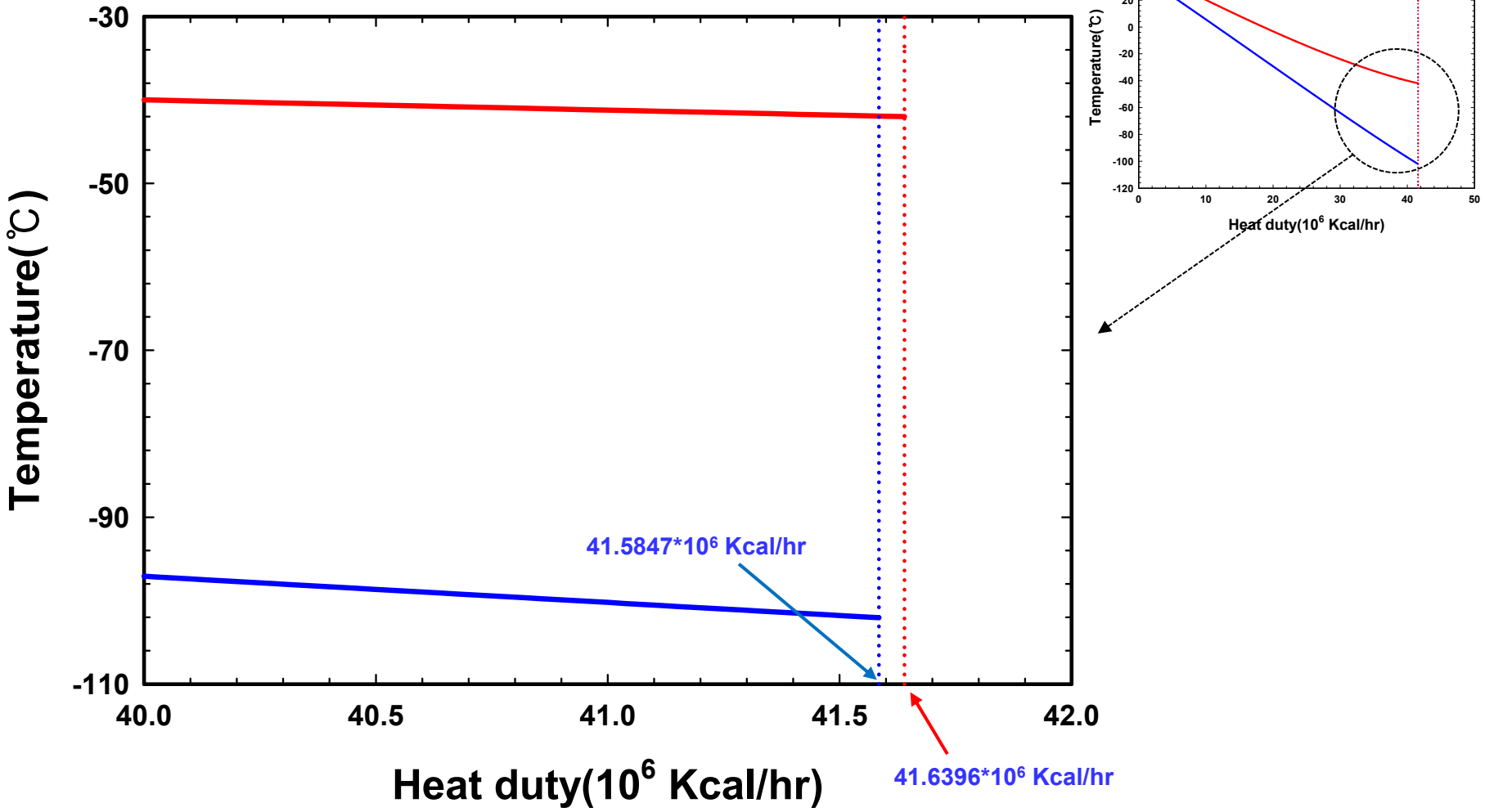
운전압력이 13 bar일 때:

Residue gas를 통해 회수하는 냉열이 천연가스의 온도를 낮추기 위한 냉열보다 크므로
프로판을 이용한 냉동 사이클 불필요



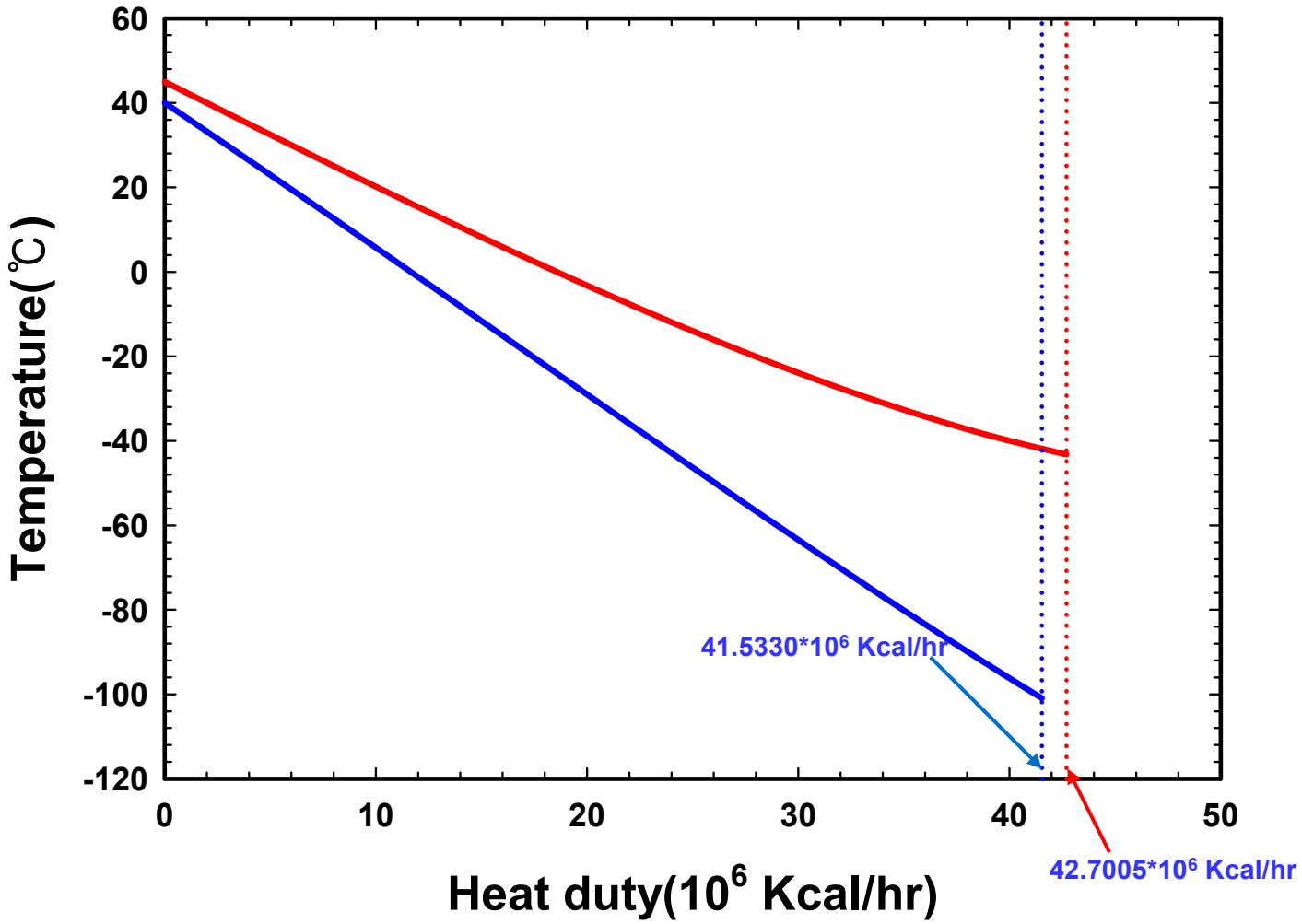
운전압력이 14 bar일 때:

Residue gas를 통해 회수하는 냉열이 천연가스의 온도를 낮추기 위한 냉열보다 작으므로
14bar 부터는 프로판을 이용한 냉동 사이클 필요



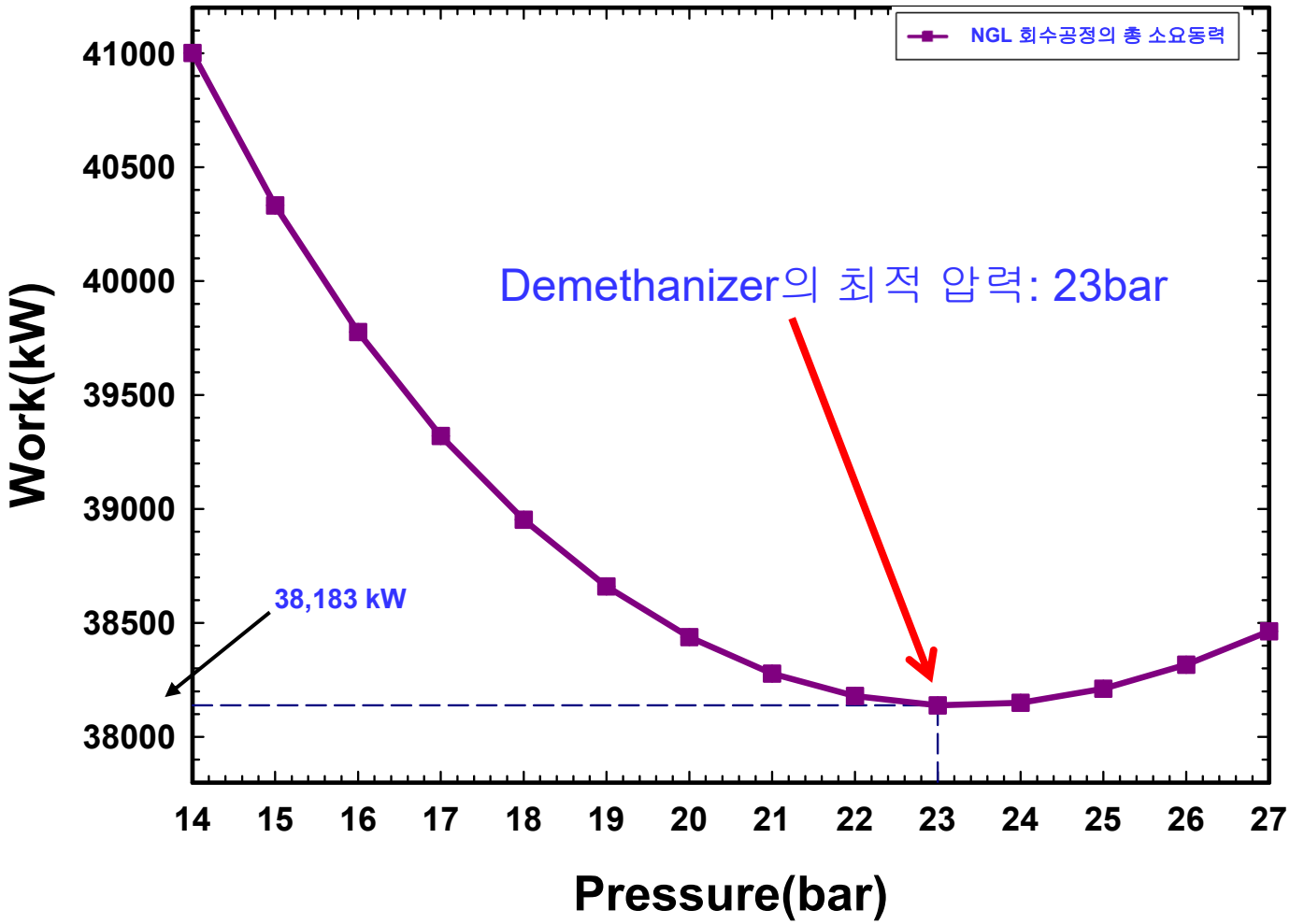
운전압력이 15 bar일 때:

Residue gas를 통해 회수하는 냉열이 천연가스의 온도를 낮추기 위한 냉열보다 크므로
프로판을 이용한 냉동 사이클 불필요



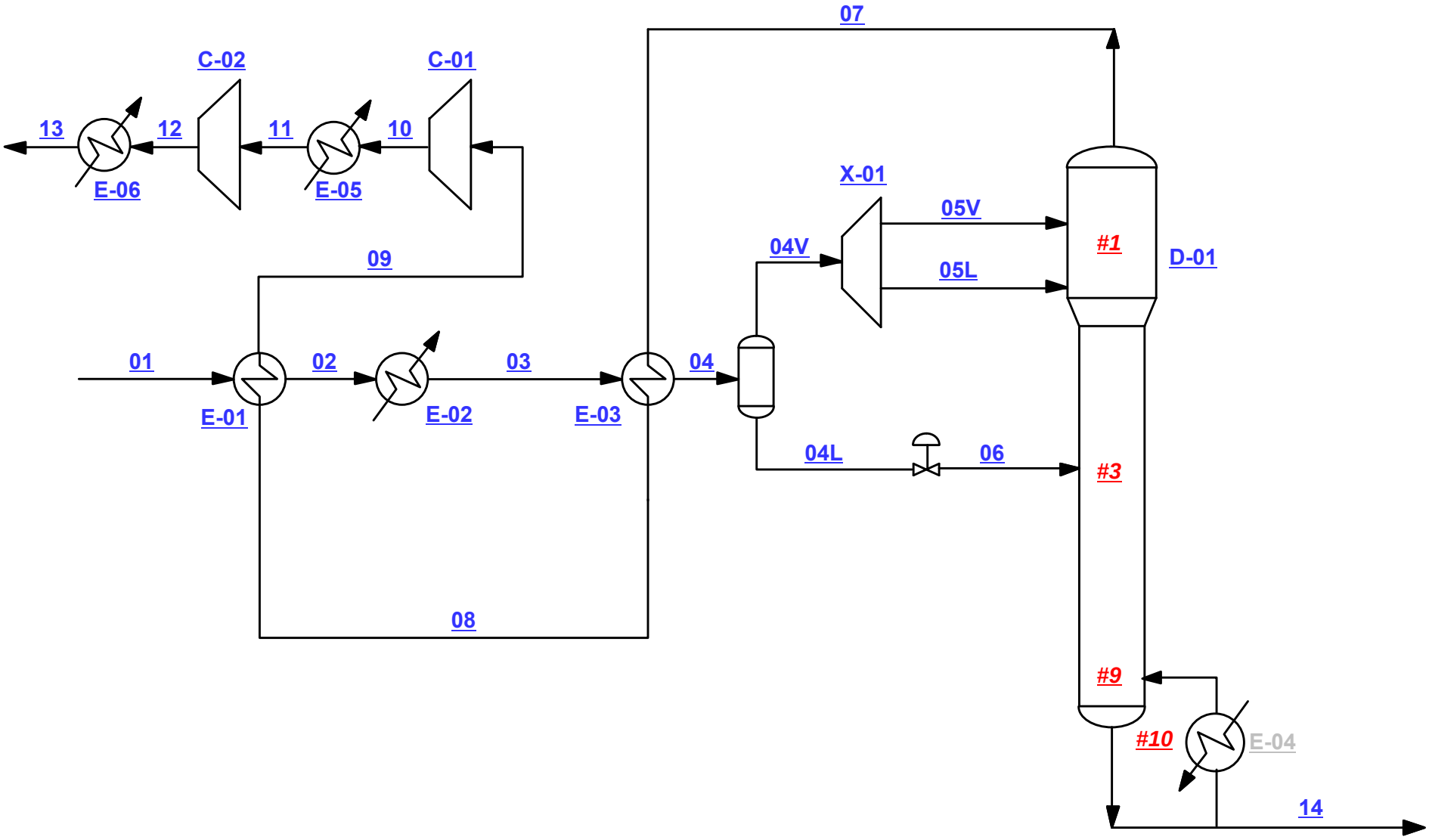
온도에 따른 소요 동력의 변화:

탈메탄탑의 압력이 23 bar일 때
NGL 회수공정에 필요한 총 소요동력이 최소

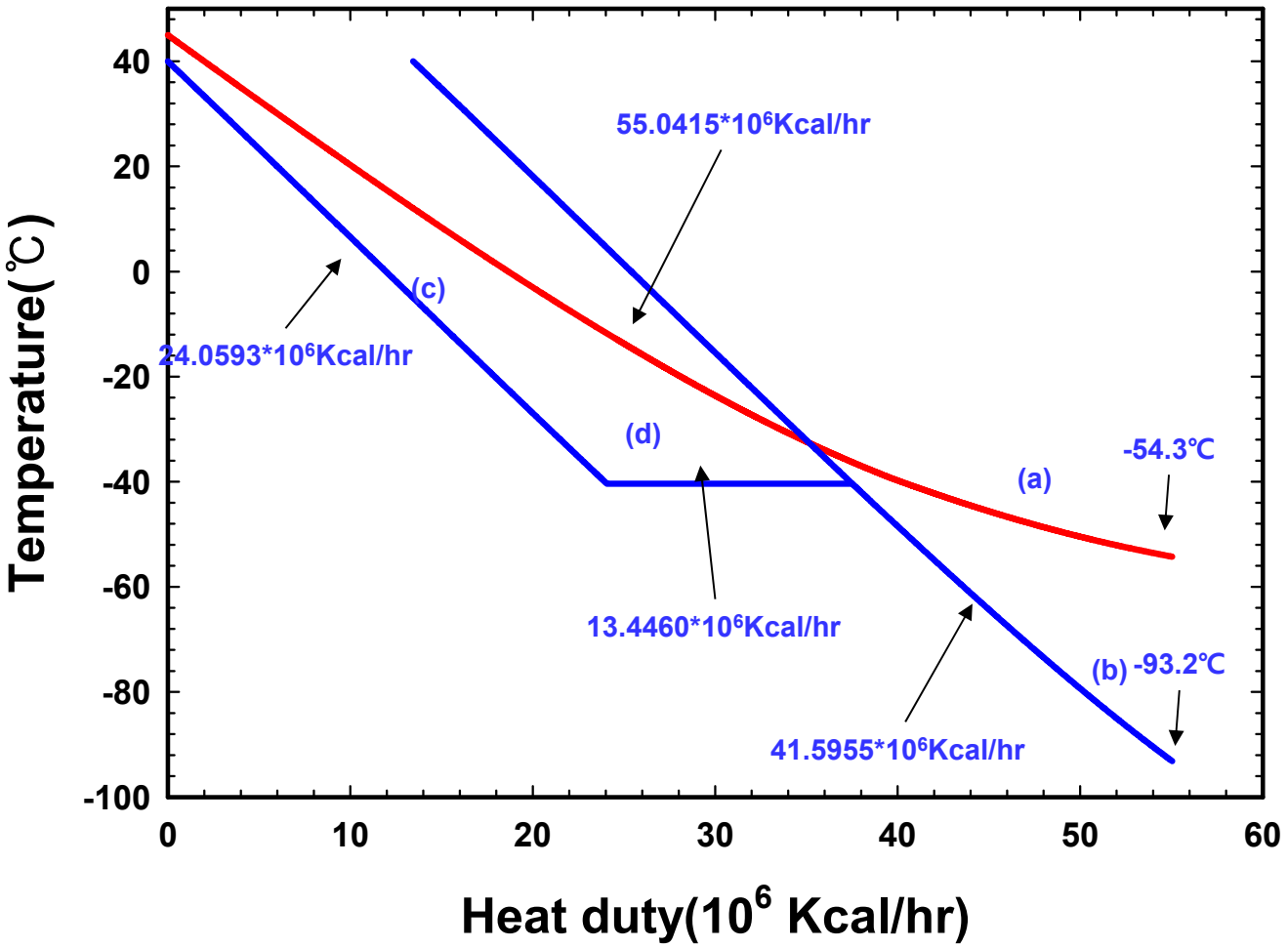


4 Side Reboiler와 열교환을 하지 않는 경우

NGL 회수공정 개요도:


07
C-02
C-01
13
12
11
10
E-06
E-05
X-01
05V
04V
05L
#1
D-01
09
01
02
03
04
E-01
E-02
E-03
04L
06
#3
08
#9
#10
E-04
14

Heating and Cooling Curves:

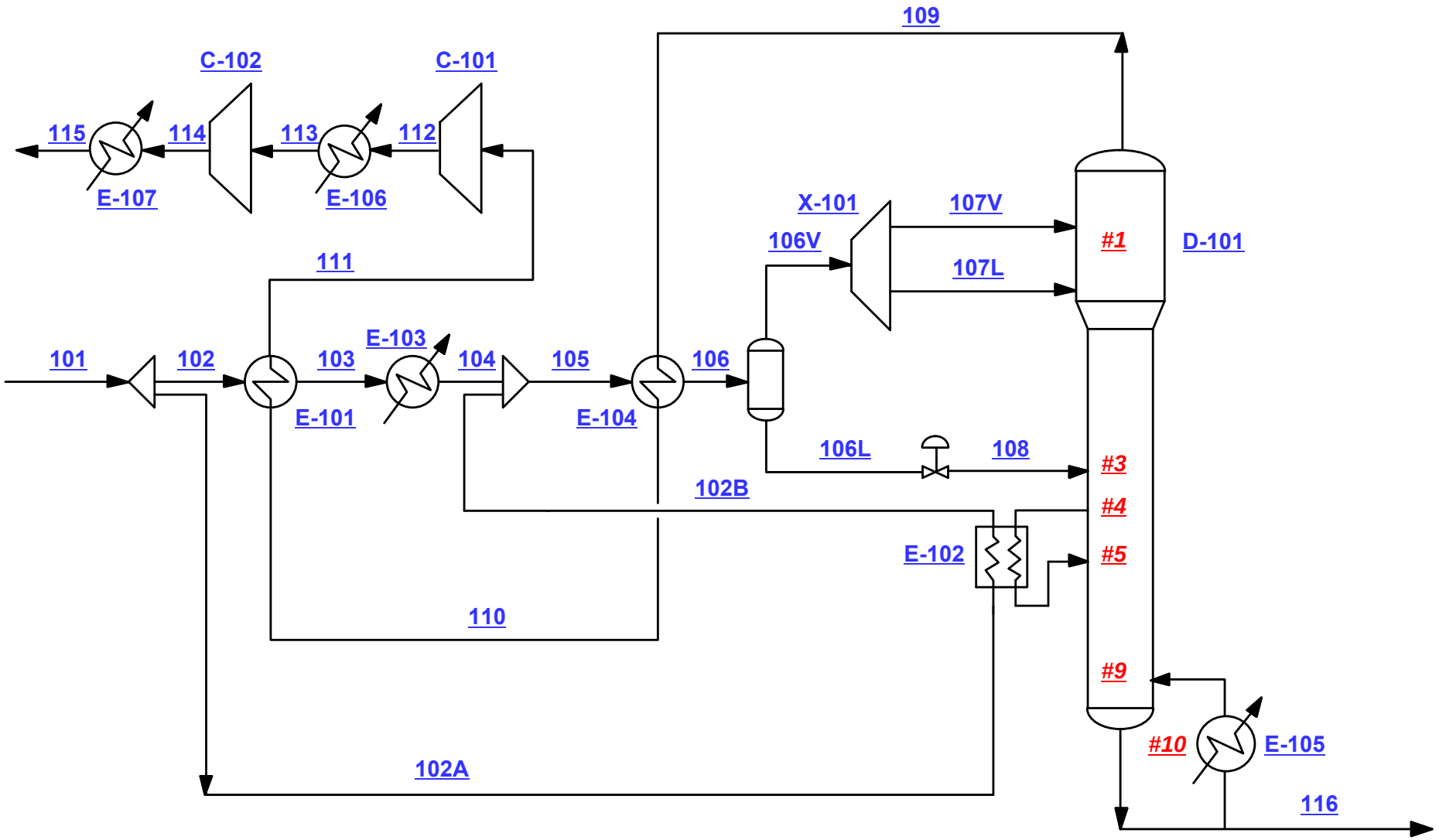


전산모사 결과 요약:

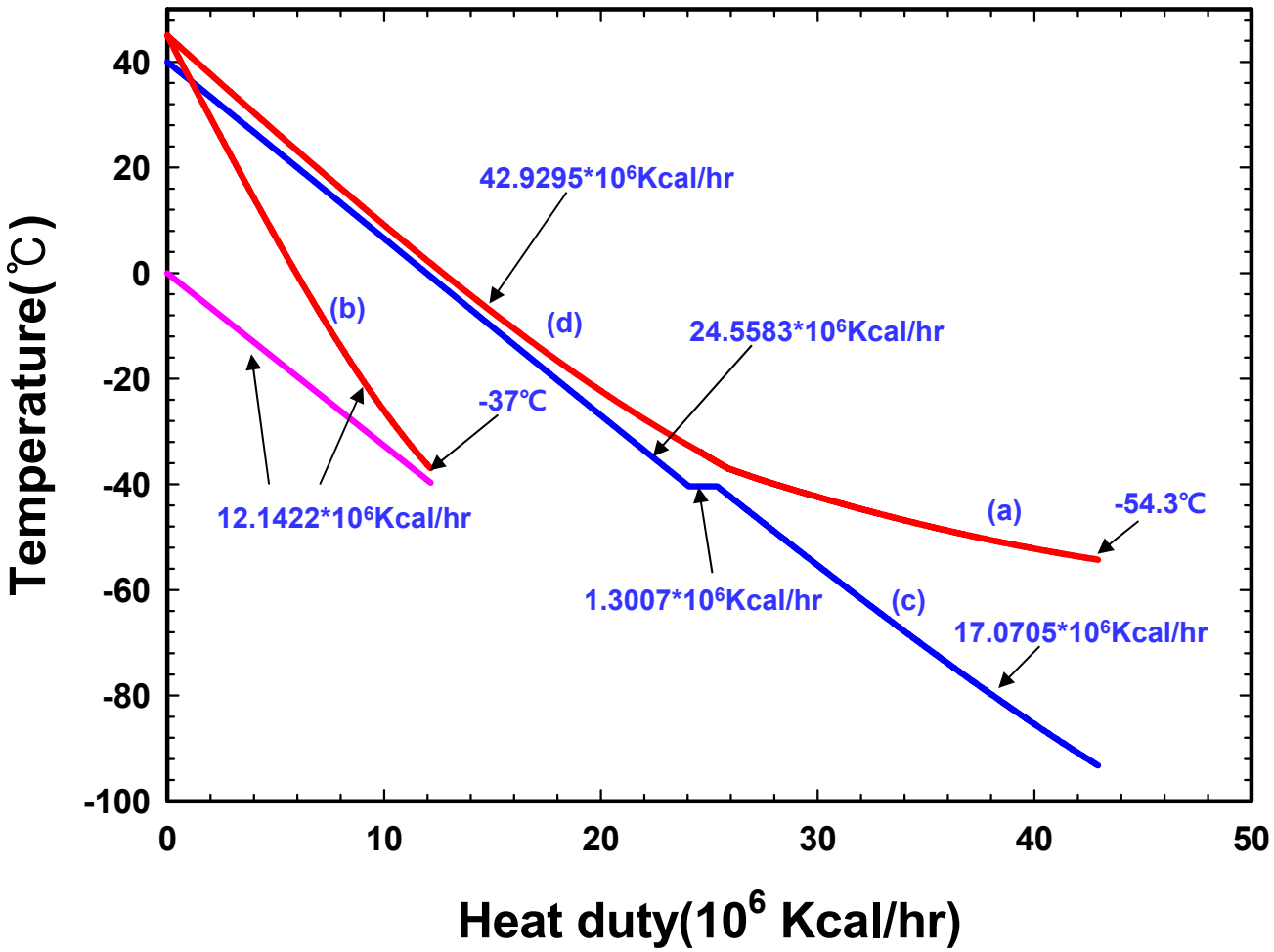
항목	결과
E-01 Heat duty(10^6 Kcal/hr)	24.5599
E-02 Heat duty(10^6 Kcal/hr)	13.4466
E-03 Heat duty(10^6 Kcal/hr)	17.0356
E-04 Heat duty(10^6 Kcal/hr)	14.1168
E-05 Heat duty(10^6 Kcal/hr)	5.9015
E-06 Heat duty(10^6 Kcal/hr)	29.9462
04번 스트림 온도(℃)	-54.3
X-01 동력(kW)	7,605
C-01 동력(kW)	7,605
C-02 동력(kW)	28,603

5 Side Reboiler와 열교환을 하는 경우

NGL 회수공정 개요도:


109
C-102
C-101
115
114
113
112
E-107
E-106
X-101
107V
106V
#1
D-101
107L
111
E-103
101
102
103
104
105
106
E-101
E-104
106L
108
#3
102B
#4
E-102
#5
110
#9
#10
E-105
102A
116

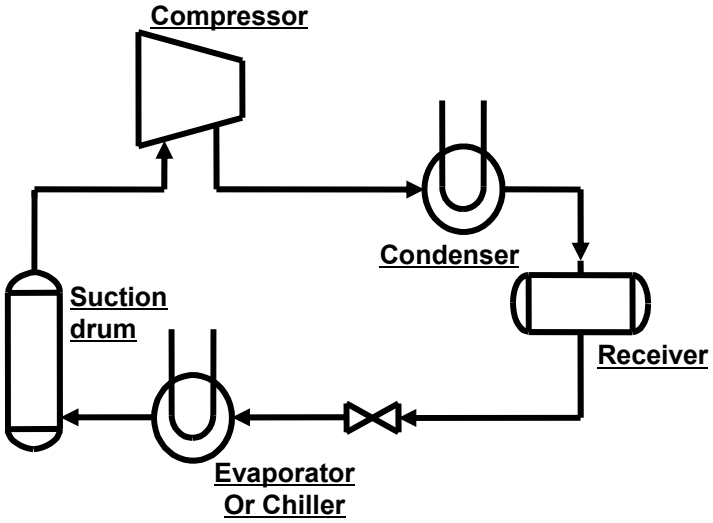
Heating and Cooling Curves:

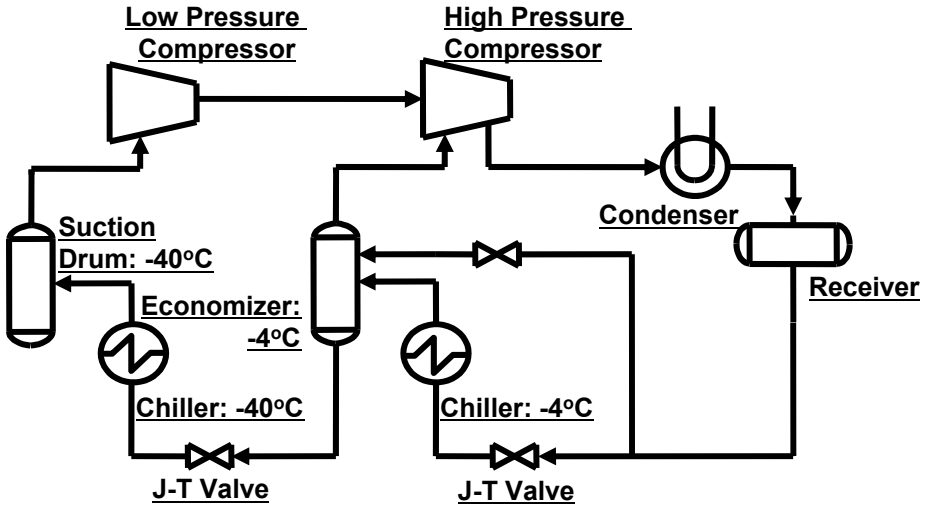


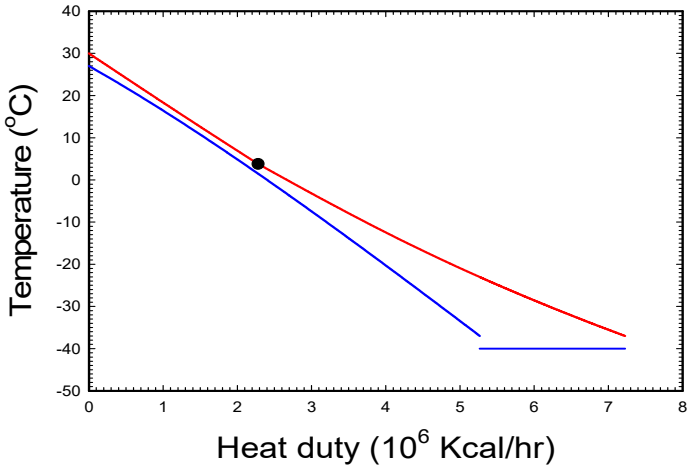
전산모사 결과 요약:

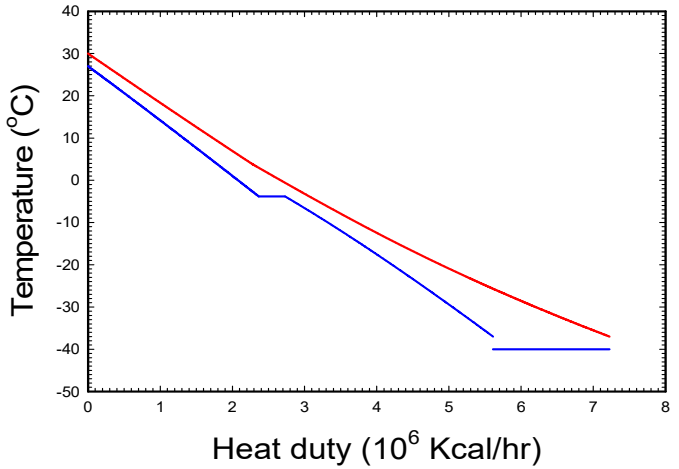
항목	결과
E-101 Heat duty(10^6 Kcal/hr)	24.5583
E-102 Heat duty(10^6 Kcal/hr)	12.1422
E-103 Heat duty(10^6 Kcal/hr)	1.3007
E-104 Heat duty(10^6 Kcal/hr)	17.0705
E-105 Heat duty(10^6 Kcal/hr)	2.6605
E-106 Heat duty(10^6 Kcal/hr)	5.6996
E-107 Heat duty(10^6 Kcal/hr)	30.1835
106번 스트림 온도(℃)	-54.3
X-101 동력(kW)	7,401
C-101 동력(kW)	7,401
C-102 동력(kW)	28,850

1단과 2단 냉동 사이클의 비교:









THANK YOU