Saudi Aramco TOTAL Refining & Petrochemical Company (SATORP)

Recovery of Delayed Coker Propylene At Turndown

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REFCOMM BAHRAIN
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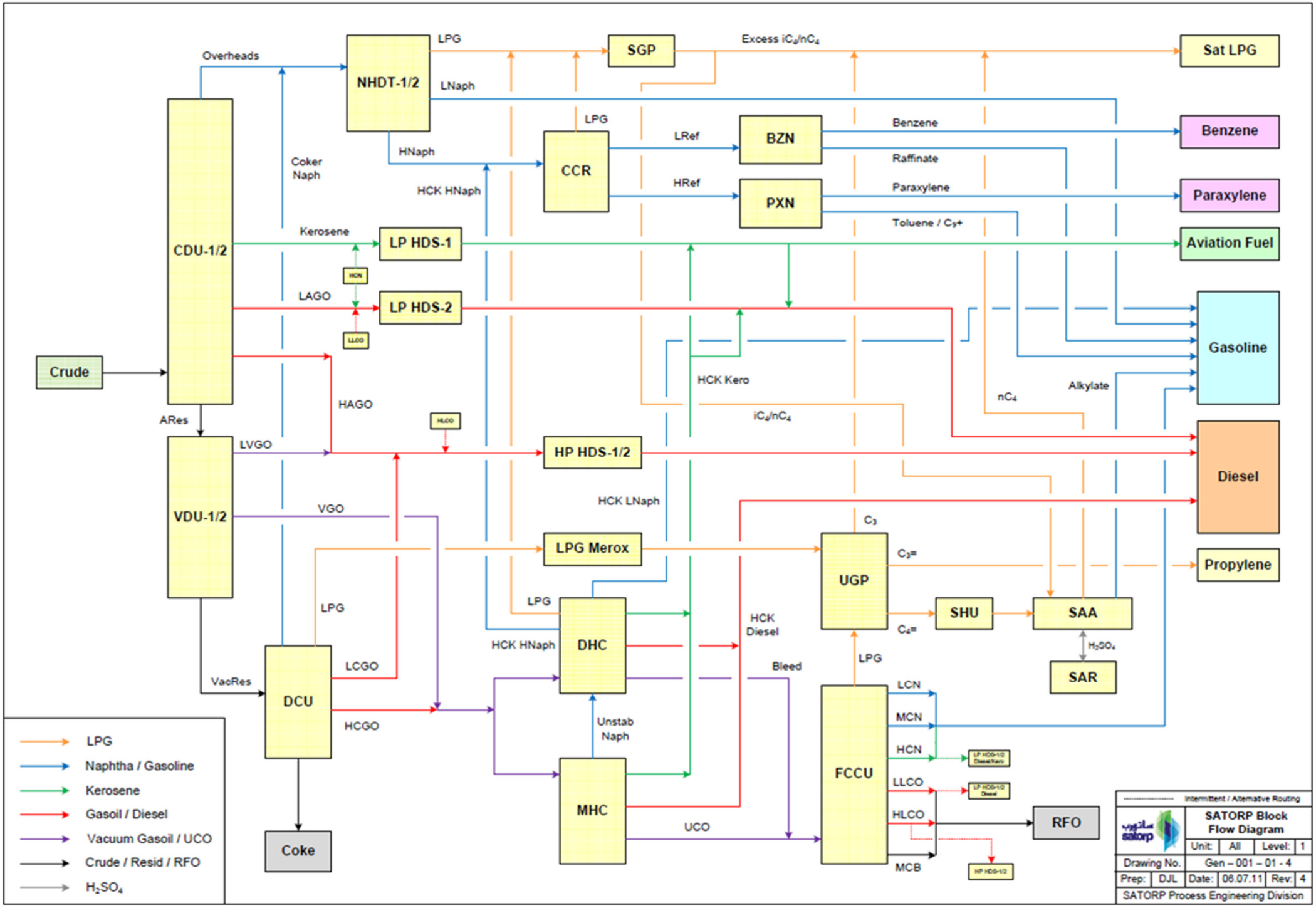
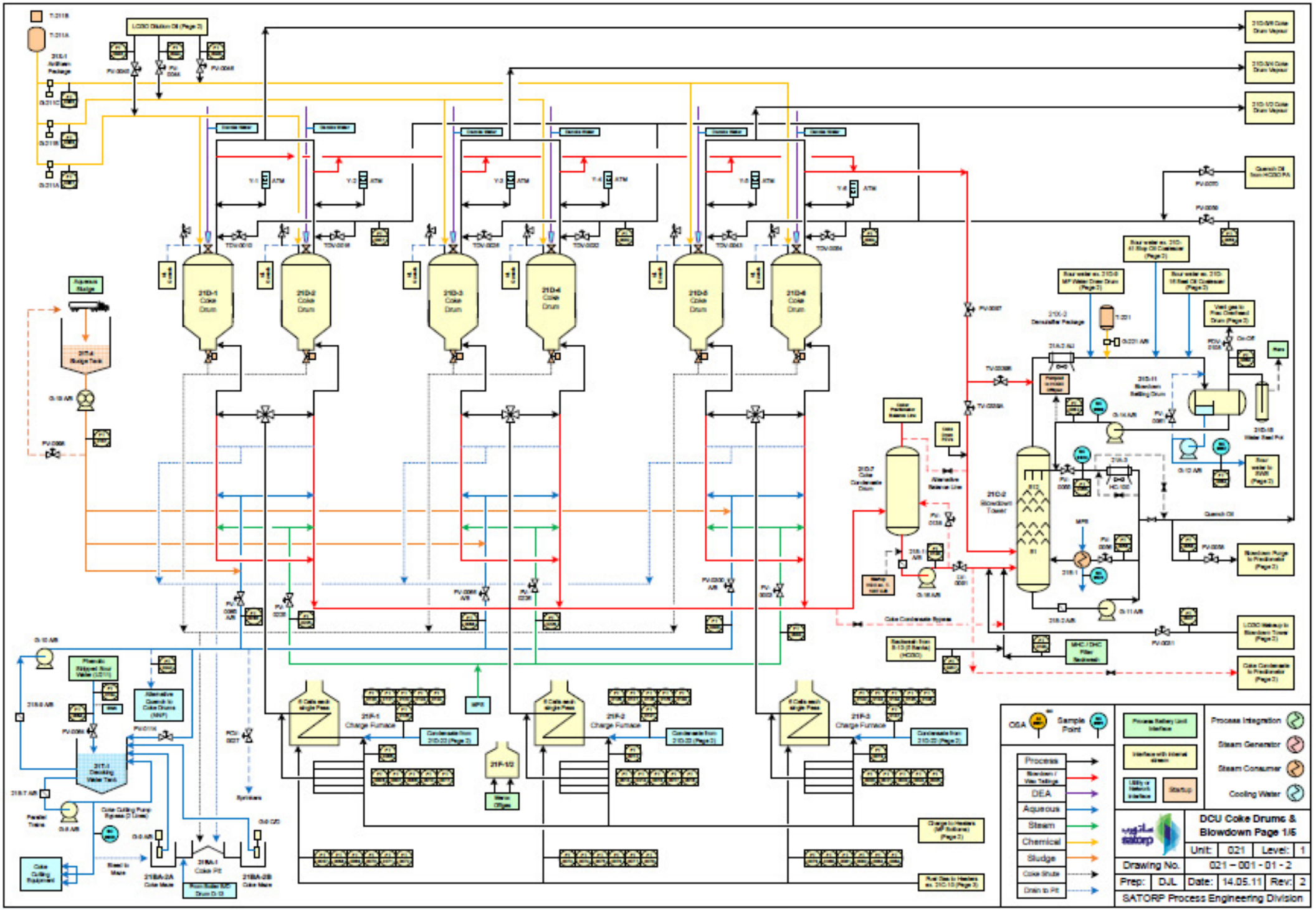
Outline:

- Satorp
- Delayed Coker Configuration & Basis of Design
- Re-Processing of Off-Spec LPG
- Observed Propylene Loss
- Analysis and Troubleshooting
- Recommendations
- Actions and Results
- Q & A


Overheads
NHDT-1/2
LPG
LNaph
SGP
Excess iC4/nC4
Sat LPG
CDU-1/2
Coker Naph
HNaph
HCK HNaph
CCR
LPG
LRef
BZN
Benzene
Raffinate
HRef
PXN
Paraxylene
Toluene / C9+
Benzene
Paraxylene
Kerosene
LP HDS-1
Aviation Fuel
HCN
LAGO
LP HDS-2
LLCO
Crude
HAGO
HCK Kero
nC4
Alkylate
Gasoline
ARes
HLCO
iC4/nC4
LVGO
HP HDS-1/2
Diesel
VDU-1/2
VGO
HCK LNaph
C3
LPG Merox
UGP
C3=
Propylene
LPG
DHC
HCK HNaph
HCK Diesel
C4=
SHU
SAA
H2SO4
SAR
VacRes
DCU
LCGO
HCGO
Bleed
LPG
LCN
MCN
HCN
FCCU
LLCO
HLCO
MCB
RFO
Unstab Naph
MHC
UCO
Coke
LP HDS-1/2 Diesel/Kero
LP HDS-1/2 Diesel
HP HDS-1/2
LPG
Naphtha / Gasoline
Kerosene
Gasoil / Diesel
Vacuum Gasoil / UCO
Crude / Resid / RFO
H2SO4
Intermittent / Alternative Routing
SATORP Block Flow Diagram
Unit: All Level: 1
Drawing No. Gen – 001 – 01 - 4
Prep: DJL Date: 06.07.11 Rev: 4
SATORP Process Engineering Division


21D-1 Coke Drum
21D-2 Coke Drum
21D-3 Coke Drum
21D-4 Coke Drum
21D-5 Coke Drum
21D-6 Coke Drum
21F-1 Charge Furnace
21F-2 Charge Furnace
21F-3 Charge Furnace
21F-1/2
21T-1 Cooling Water Tank
21T-4 Sludge Tank
21D-7 Coke Condensate Drum
21D-2 Blowdown Tower
21D-11 Blowdown Settling Drum
21D-10 Water Seal Pot
21BA-1 Coke Pit
21BA-2A Coke Mains
21BA-2B Coke Mains
Process
Blowdown / Wax Tailings
DEA
Aqueous
Steam
Chemical
Sludge
Coke Shute
Drain to Pit
Process Integration
Steam Generator
Steam Consumer
Cooling Water
DCU Coke Drums & Blowdown Page 1/6
Unit: 021 Level: 1
Drawing No. 021 – 001 - 01 - 2
Prep: DJL Date: 14.05.11 Rev: 2
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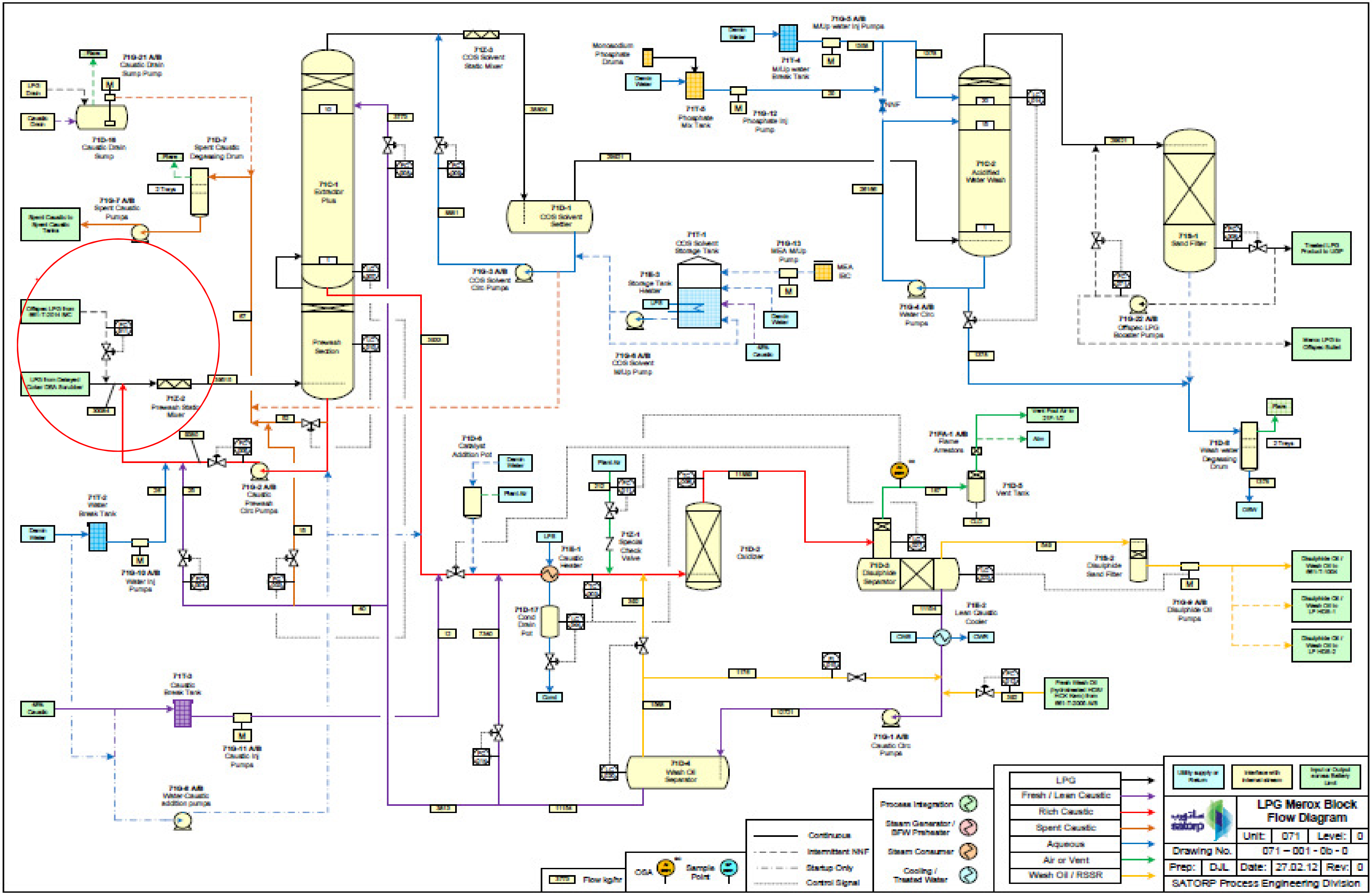
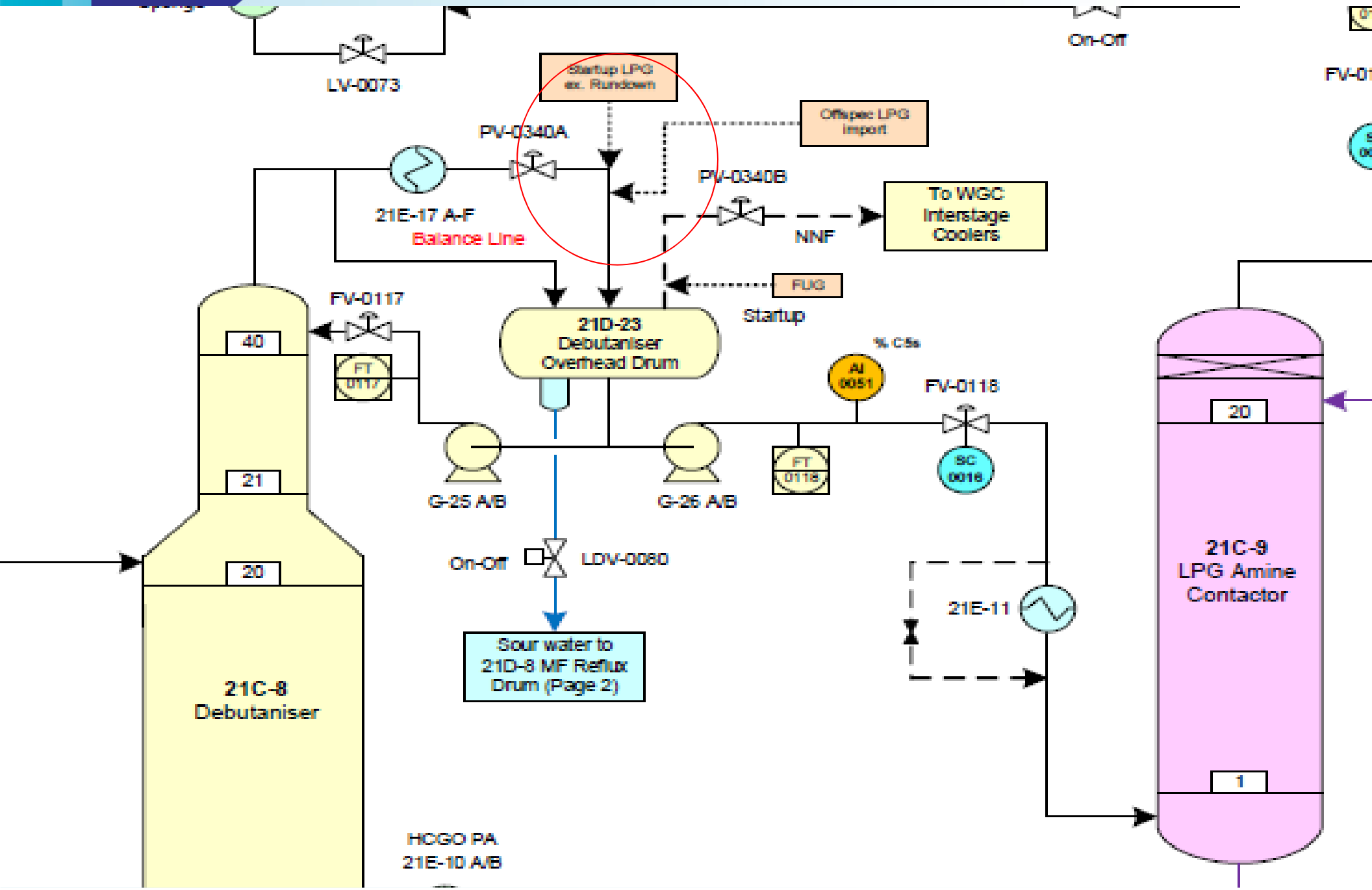
Re-Processing of Refinery Off-Spec LPG

- Through Merox Unit
- Through DCU (through HP receiver and Debut.

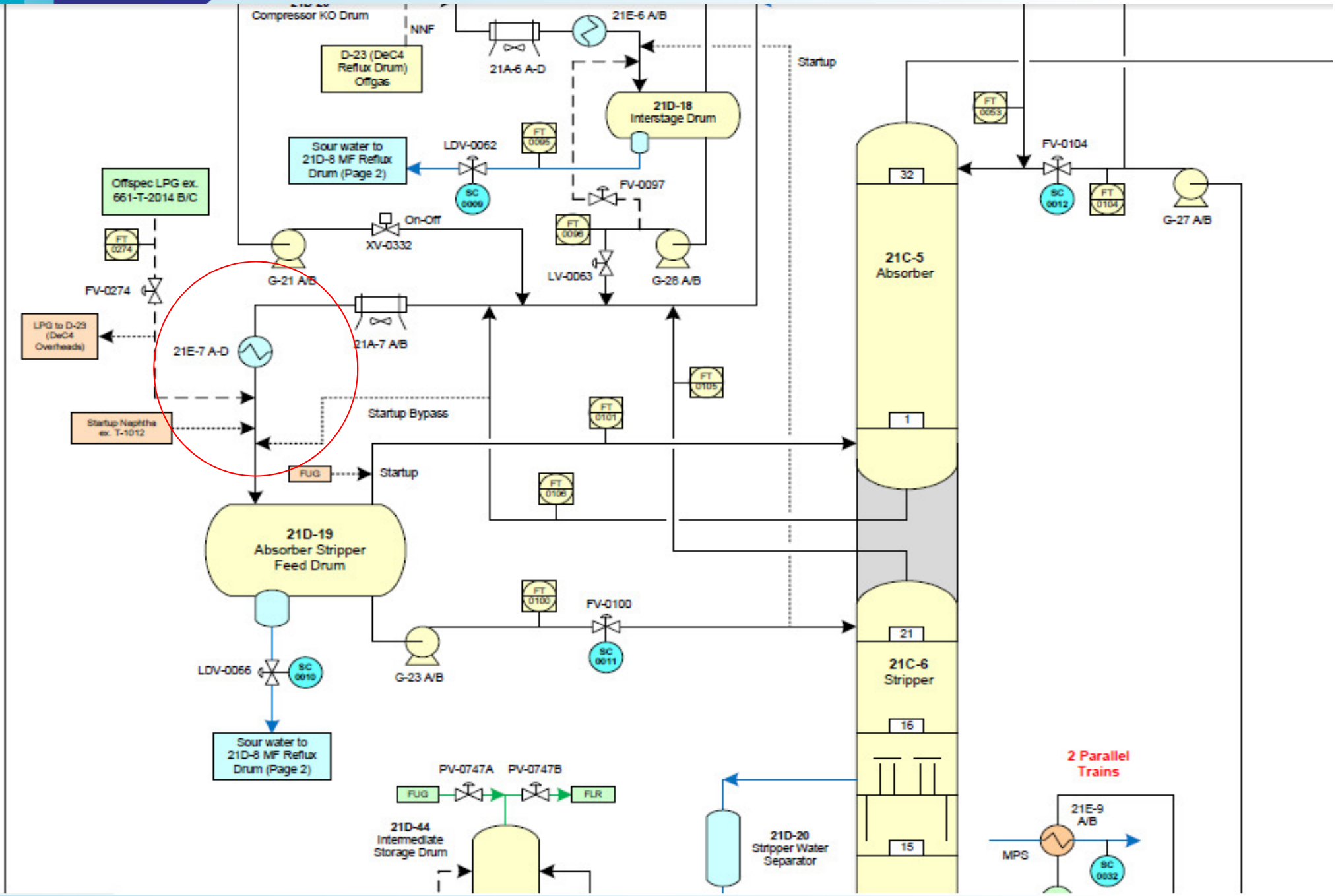
MEROX Unit


LPG
Fresh / Lean Caustic
Rich Caustic
Spent Caustic
Aqueous
Air or Vent
Wash Oil / RSSR
Continuous
Intermittent NNF
Startup Only
Control Signal
Process Integration
Steam Generator / BFW Preheater
Steam Consumer
Cooling / Treated Water
OSA
Sample Point
Flow kg/hr
LPG Merox Block Flow Diagram
Unit: 071
Level: 0
Drawing No. 071 – 001 – 0b – 0
Prep: DJL
Date: 27.02.12
Rev: 0
SATORP Process Engineering Division

DCU - Debut


On-Off
LV-0073
Startup LPG ex. Rundown
Off-spec LPG Import
PV-0340A
PV-0340B
21E-17 A-F
Balance Line
NNF
To WGC Interstage Coolers
FUG
Startup
FV-0117
21D-23 Debutaniser Overhead Drum
% C5s
AI 0051
FV-0118
FT 0117
FT 0118
SC 0016
G-25 A/B
G-26 A/B
40
21
20
On-Off
LDV-0080
Sour water to 21D-8 MF Reflux Drum (Page 2)
21E-11
21C-8 Debutaniser
HCGO PA
21E-10 A/B
20
21C-9 LPG Amine Contactor
1

DCU – HP Receiver

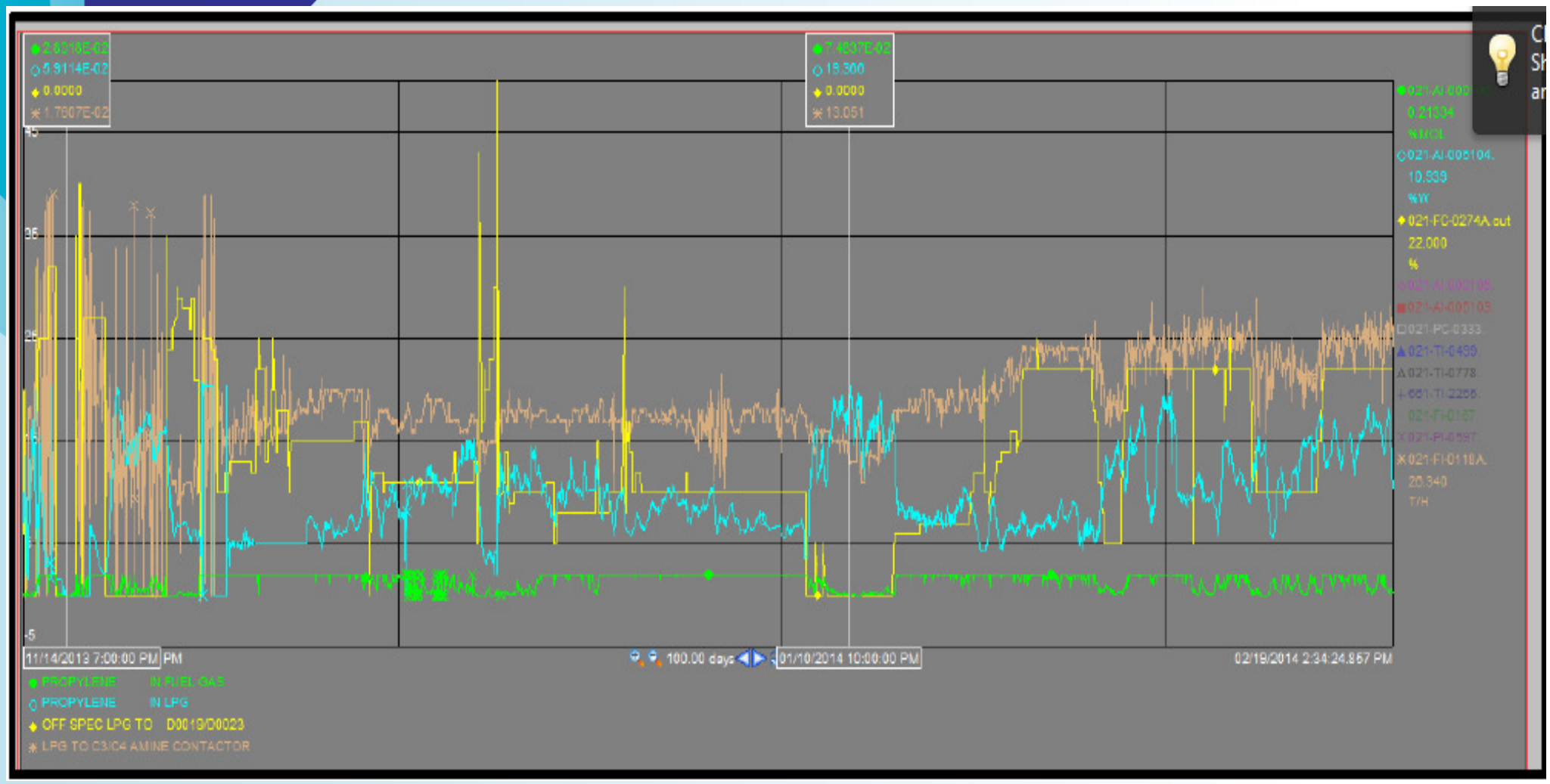


Observed Propylene Lost

1- Occasional Loss of Propylene Recovery

2- Propylene lost when off –Spec LPG is re-processed

3- Evaluation of Main Stripper Operation



Yellow: opening of off spec LPG valve to HP drum

Blue: propylene mole fraction in LPG

Green: propylene Mole fraction in FG

Light Orange: LPG Flow to R/D

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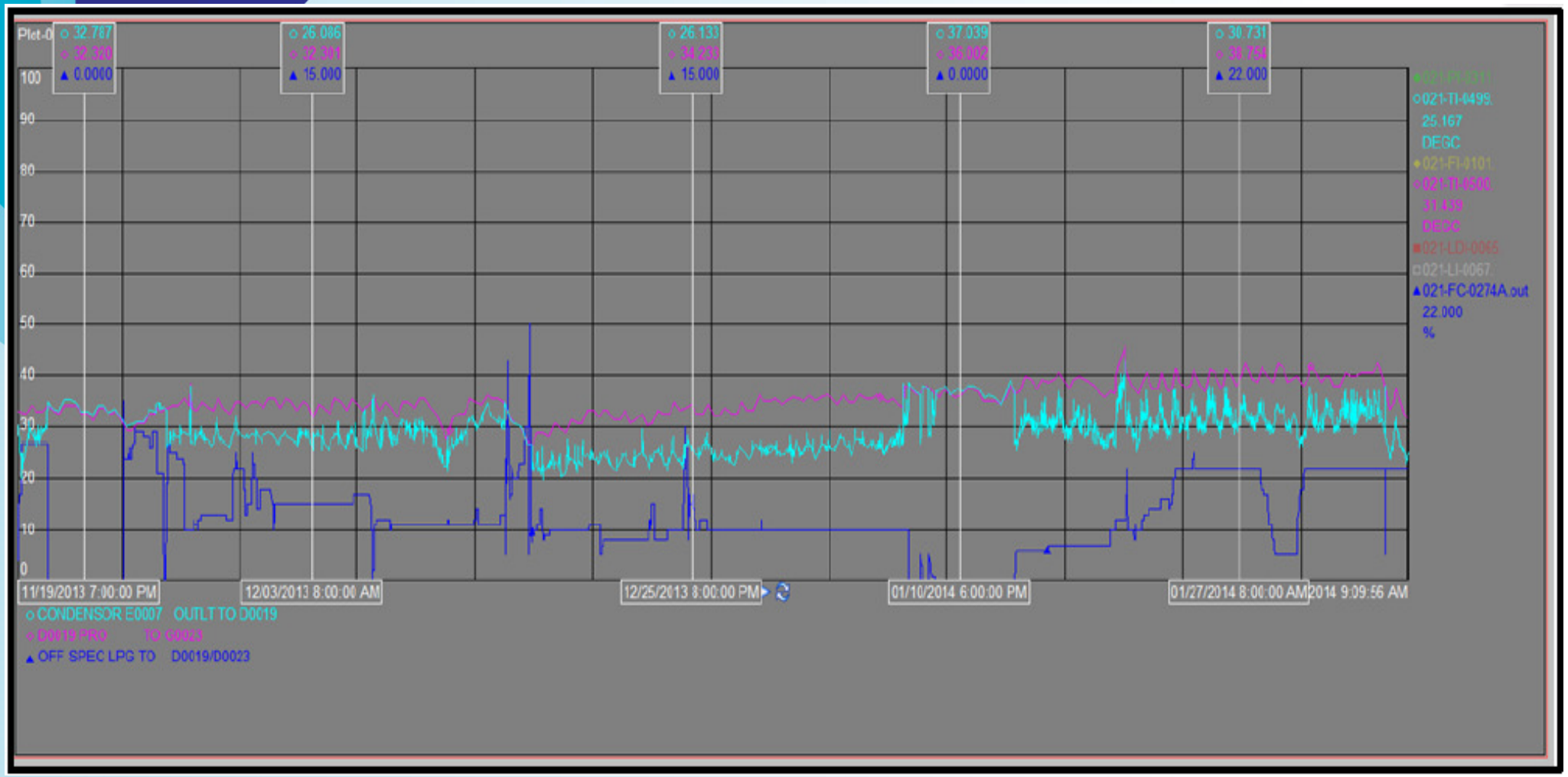

Dark Blue: opening of off spec LPG valve to HP drum

Light Blue: Temperature of HP drum vapor

Purple: Temperature of HP drum liquid

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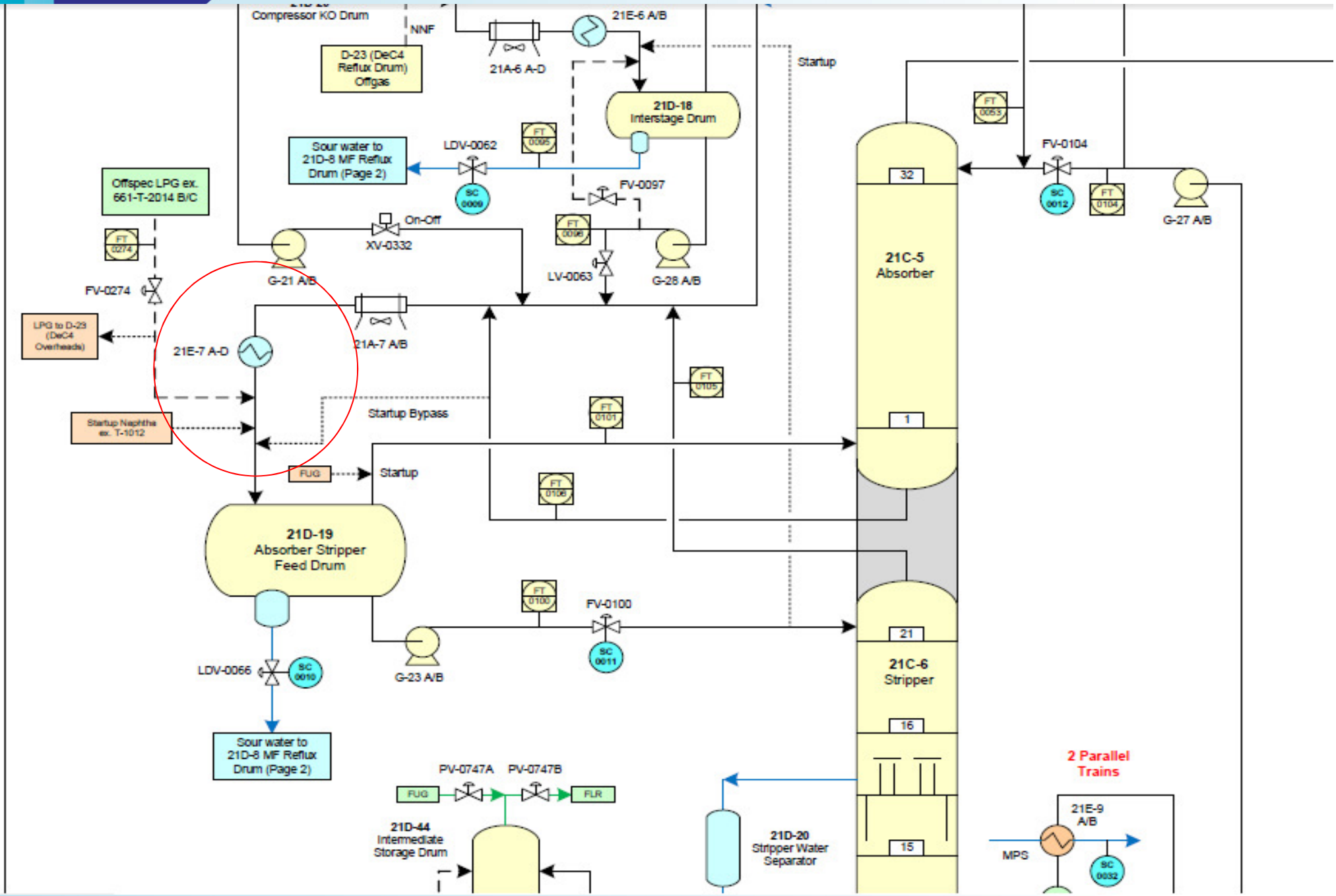
DCU – HP Receiver



Analysis and Troubleshooting

Simulation of the drum at:

Different quality of Off-Spec LPG:

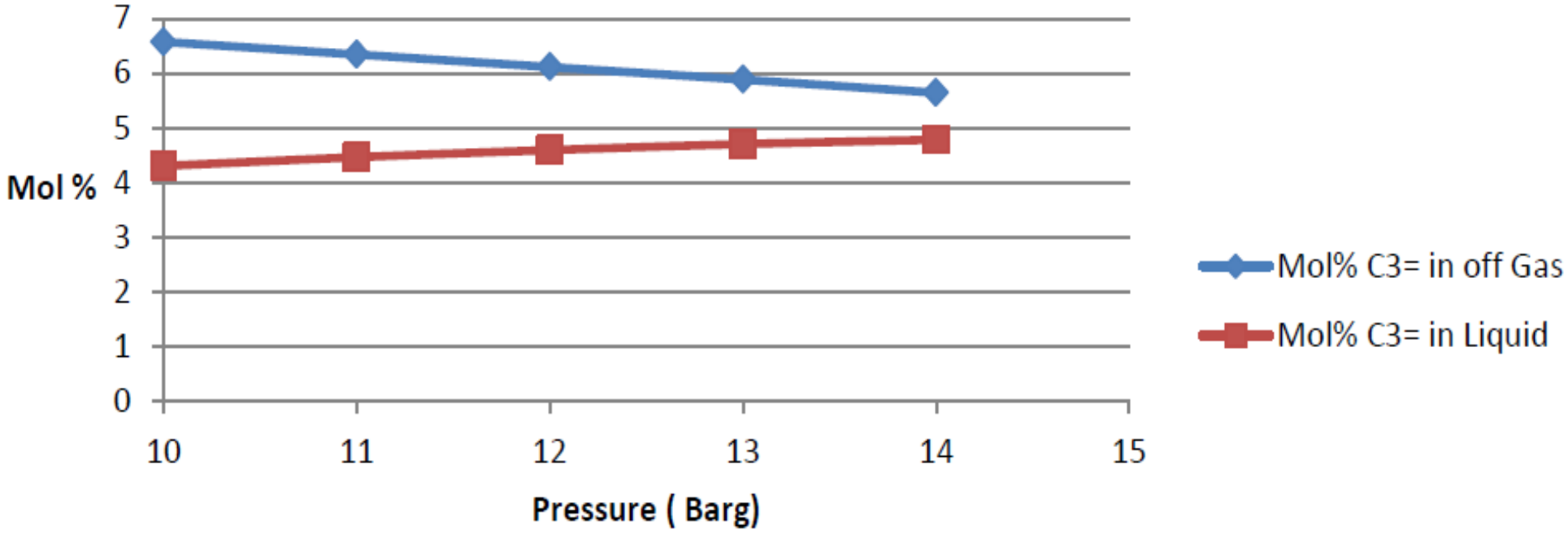
- Low Propylene content
- High propylene content
- Pure propylene

Different flows, 0 , 5 and 10 T/H

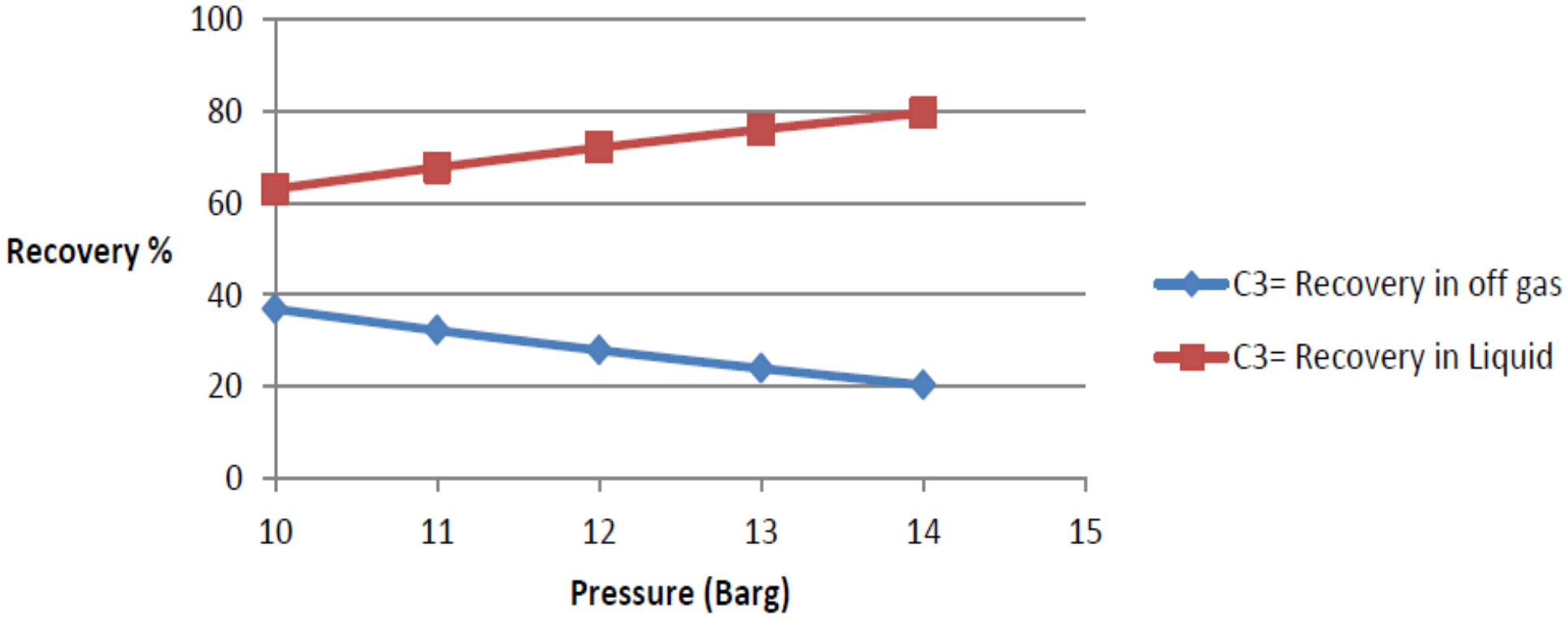
Different pressure:

- Actual Pressure , 12.5 barg
- H&M balance pressure 13.8 barg

C3= Mole % in 021-D-0019 Products



C3= Recovery in 021-D-0019 Products



Observed Propylene Lost

1- Occasional Loss of Propylene Recovery

2- Propylene lost when off –Spec LPG is re-processed

3- Evaluation of Main Stripper Operation

Main Stripper Operation

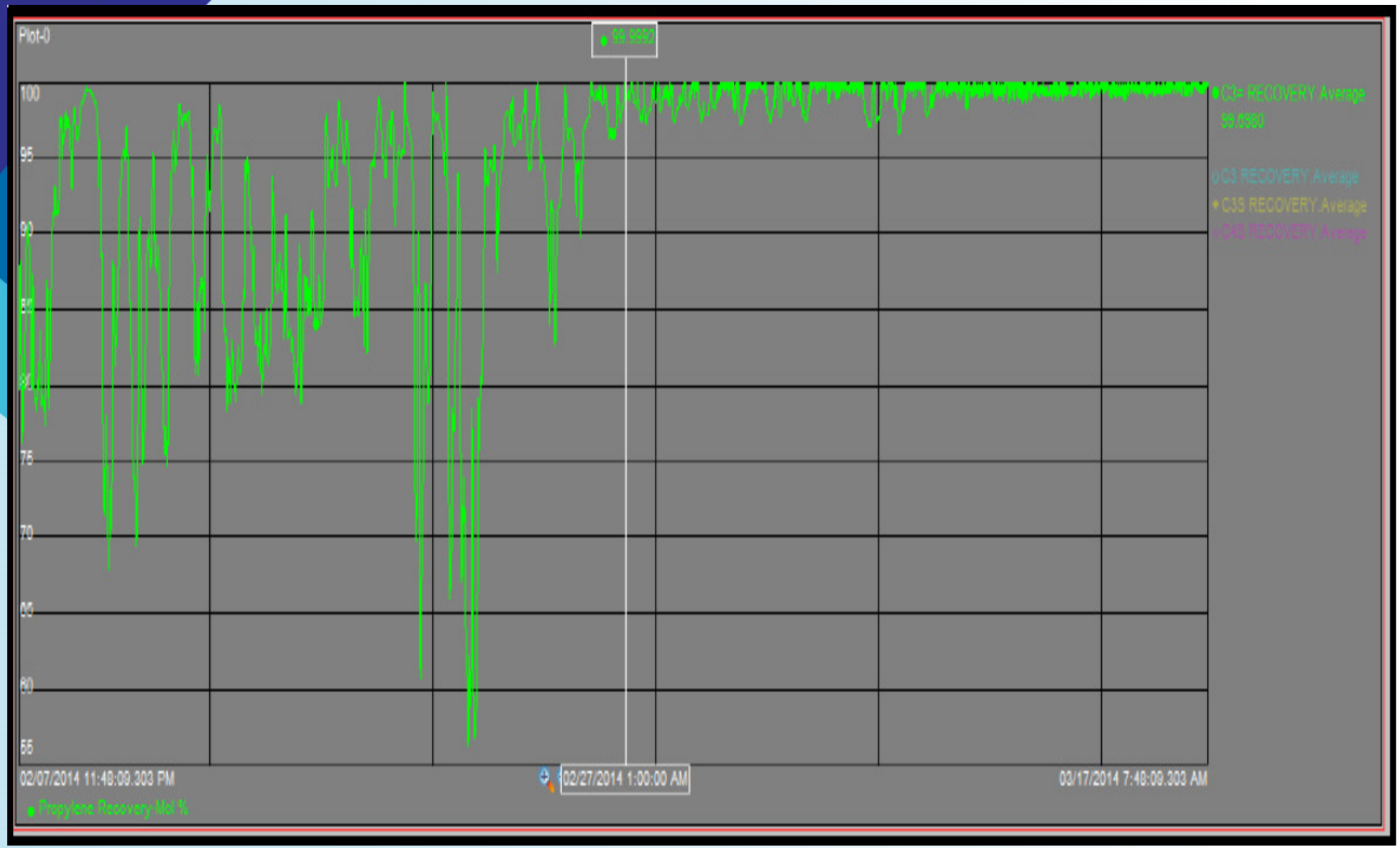
Bottom temperature relatively high

a- Undetectable C2 in Coker LPG (design 0.5 wt% max)

b- H2S in sour LPG is less than 0.1 wt%(design 6 – 7 wt%)

Actions and Results

- Gas plant pressure slightly increased
- Stripper bottom temperature reduced from 158 0C to 154 degC
- High Recovery achieved and propylene produced increased 250 %


Plot-0
100
95
90
85
80
75
70
65
60
55
C3= RECOVERY.Average
C3 RECOVERY.Average
C3S RECOVERY.Average
02/07/2014 11:48:09.303 PM
02/27/2014 1:00:00 AM
03/17/2014 7:48:09.303 AM
Propylene Recovery Mol %

Thank you

Q & A

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