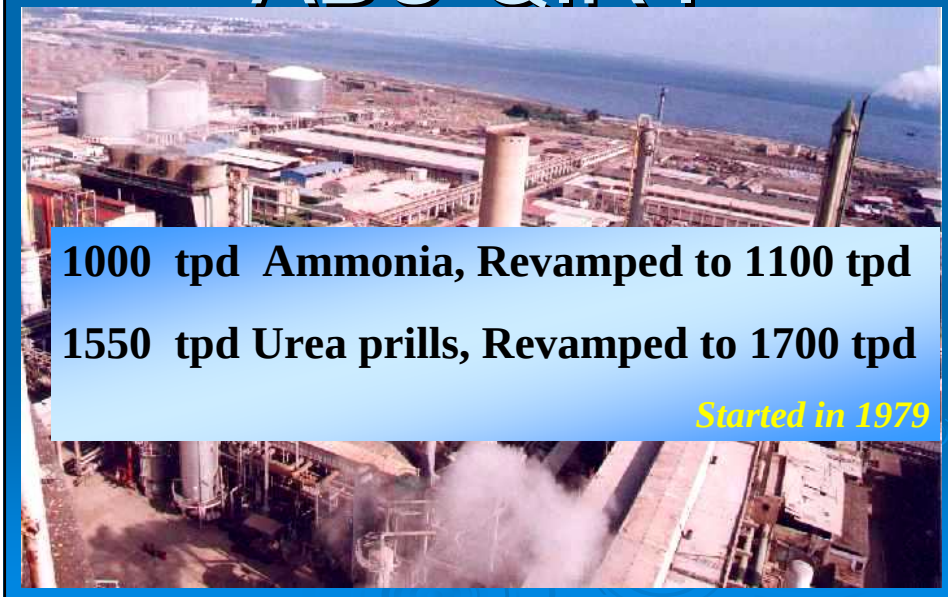
Abu Qir Fertilizers

And Chemical Industries Co.

Alexandria - Egypt

ABU QIR I

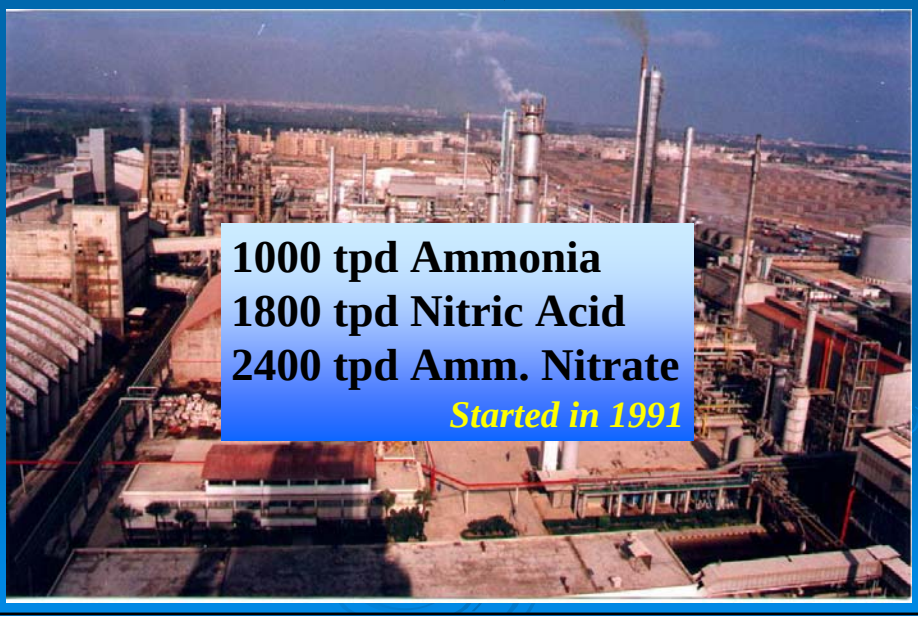


1000 tpd Ammonia, Revamped to 1100 tpd

1550 tpd Urea prills, Revamped to 1700 tpd

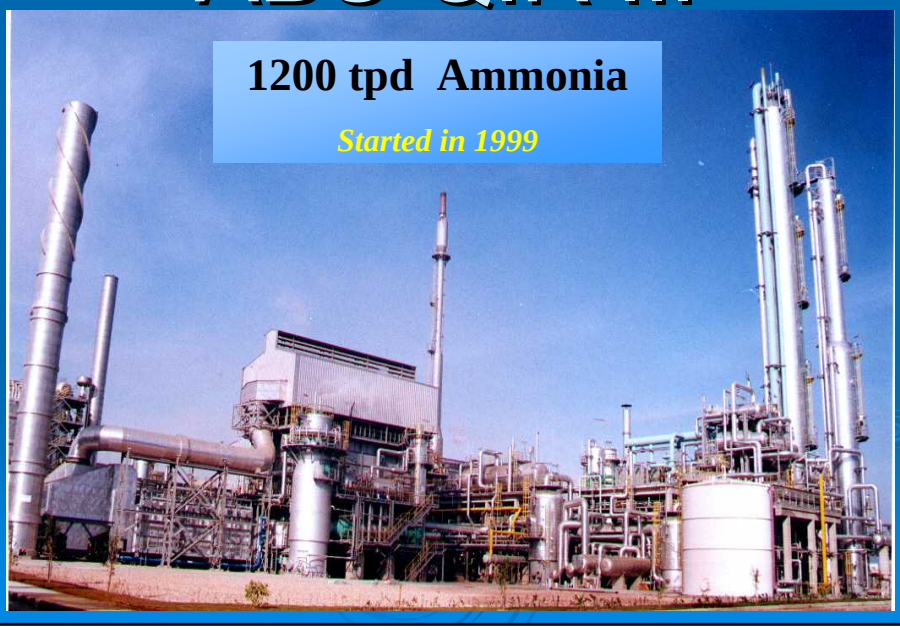
Started in 1979

ABU QIR II



1000 tpd Ammonia
1800 tpd Nitric Acid
2400 tpd Amm. Nitrate
Started in 1991

ABU QIR III



1200 tpd Ammonia
Started in 1999

1750 tpd Urea granules

Started in 1999

Marine Line

- December 1990
- 100,000 t/year
- Liquid Ammonia

Washing of Methanator Catalyst (Ammonia Plant III)

Prepared By:

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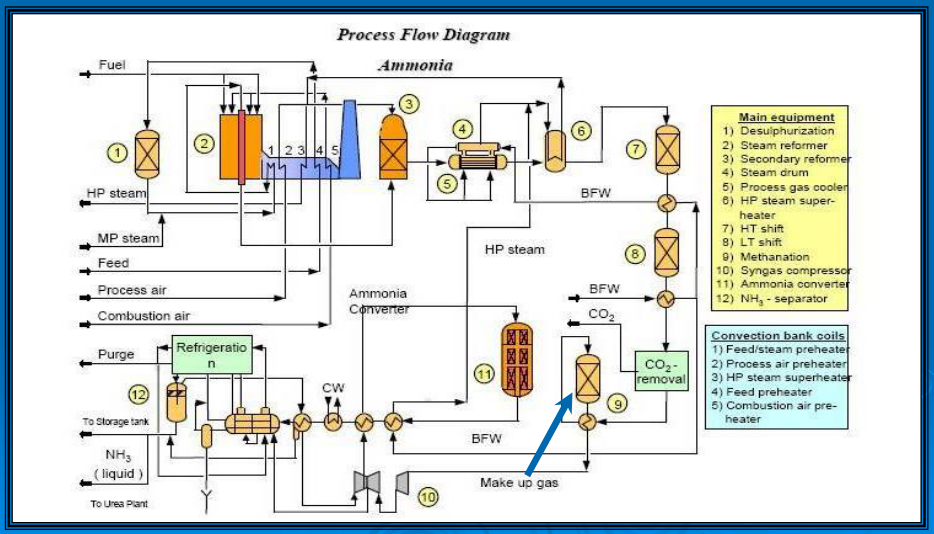
ABU-QIR FERTILIZERS CO.&
CHEMICALS INDESTRIES.

Alexandria – Egypt.

Abstract

This paper describes the washing of methanator catalyst at ammonia plant III. It also describes the comparison between before washing and after washing, the method of washing and put the reactor in operation after washing.

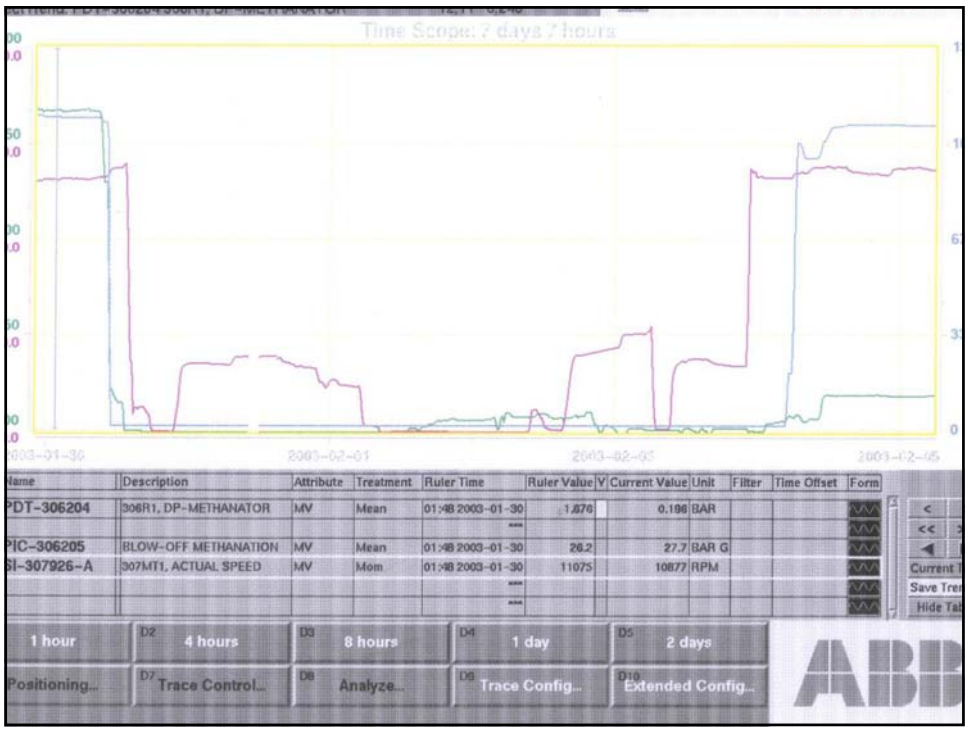
Ammonia Plant III



Introduction

- After the ammonia plant shut down at October 2002, the pressure drop across the absorber tower in carbon dioxide removal unit increased to about (0.6-0.7) bar attributed to the presence of organic matter in the benfield solution that led to severe foaming in the solution system so that big amount of solution was separated in the separator 305F002 after the absorber tower, considerable amount of solution entrainment reached to the methanator reactor catalyst with process gas.

- It was observed that the pressure drop across the methanator reactor increased gradually during 3 weeks to about 1 bar , then suddenly to 1.6 bar at 21-11-2002 (before plant shut down ,the pressure drop was 0.22 bar). of course ,the power of the synthesis gas compressor turbine was increased to maintain the ammonia plant load " fig.1 ".The calculated and measured (ΔT) across the reactor before washing were 25^{o}C &29^{o}C respectively. It was decided to wash the methanator reactor catalyst in the plant shut down 30th January, 2003.



Preparation Work

- A special blind was prepared to be put at the reactor outlet, this blind containing 4 nozzles, each of 0.5 inch to introduce water for washing and nitrogen for bubbling (Fig.2).

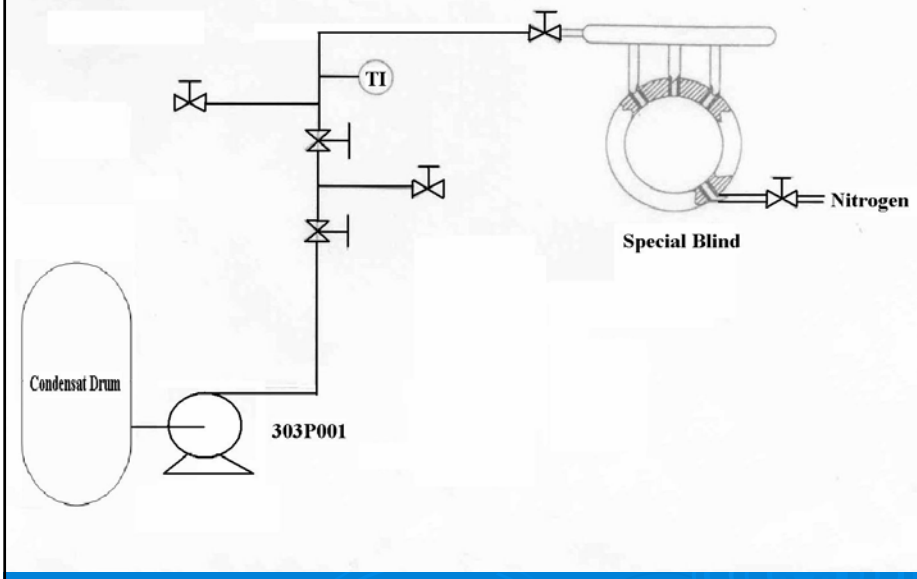
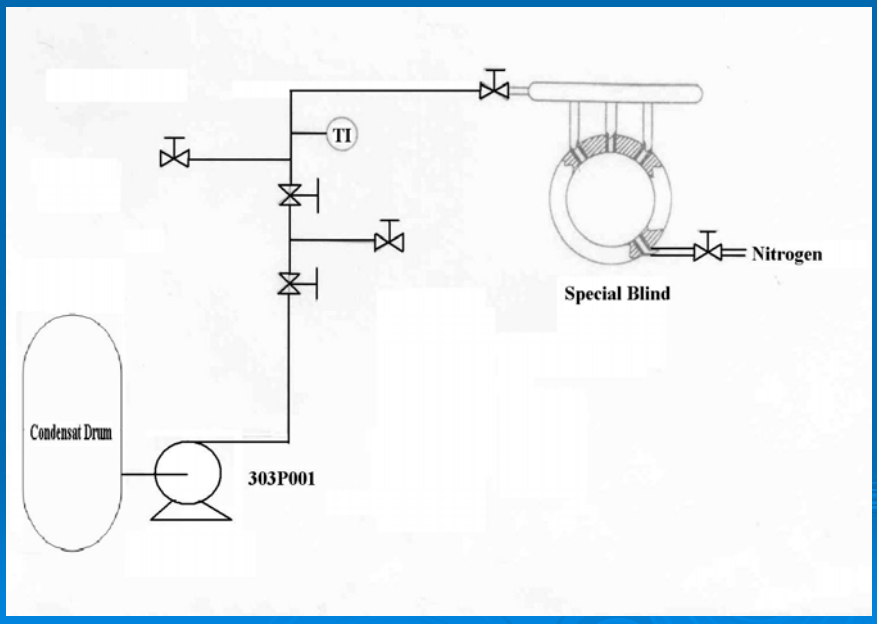

TI
Nitrogen
Special Blind
Condensat Drum
303P001

Fig.2

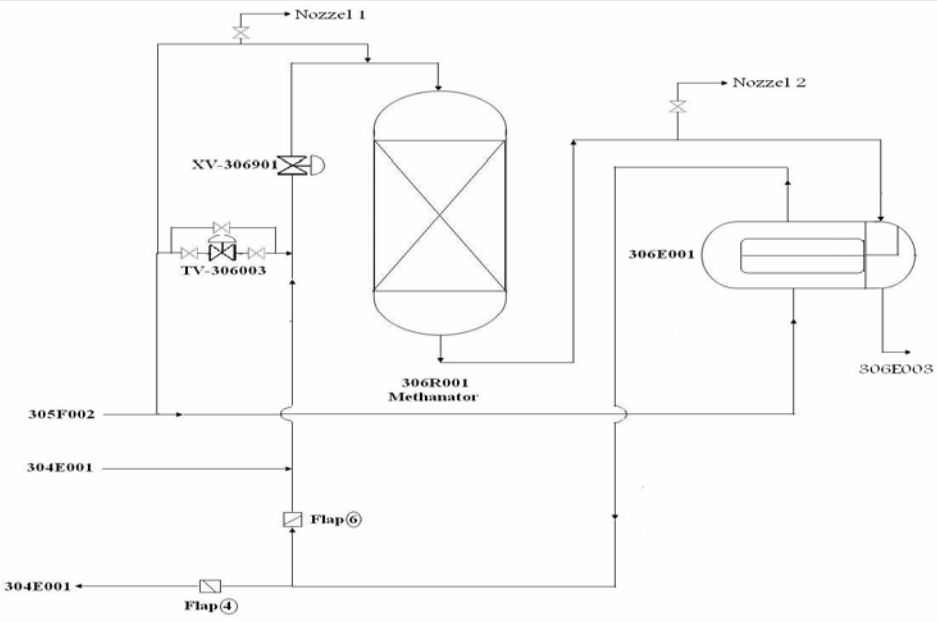

TI
Nitrogen
Special Blind
Condensat Drum
303P001

- A blind flange was prepared to be put on the top of the reactor containing line " 2 inch " with a manual valve to direct the washing water and another line “ 1 inch “ with manual valve for nitrogen facility after washing.

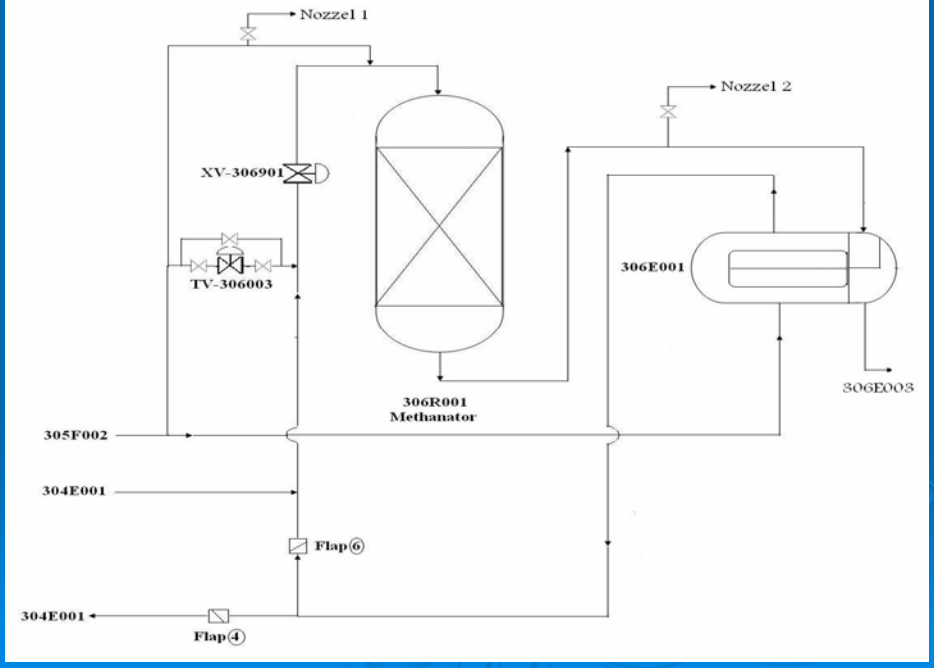
- A special line was erected from the discharge line of the condensate pump 303P001 A/B to introduce condensate to the reactor through special blind. This line contains a temperature indicator and special connection to introduce hydrazine if needed.

- Tow nitrogen connections were erected

  to nozzles 1 & 2. "Fig. 3".



- Fig.3



Cooling Down of Methanator Reactor

- In 30th January 2003 after the synthesis gas compressor was stopped. The cooling down of the methanator reactor was stared using the process gas as follows :

- Open the TV-306003 gradually to 100%.
- Open flab no.4 completely.
- Close flab no.6 completely.
- Open the by-pass of TV-306003 completely.

The time for Cooling down of the methanator reactor catalyst is 4 hours "Fig. 4".

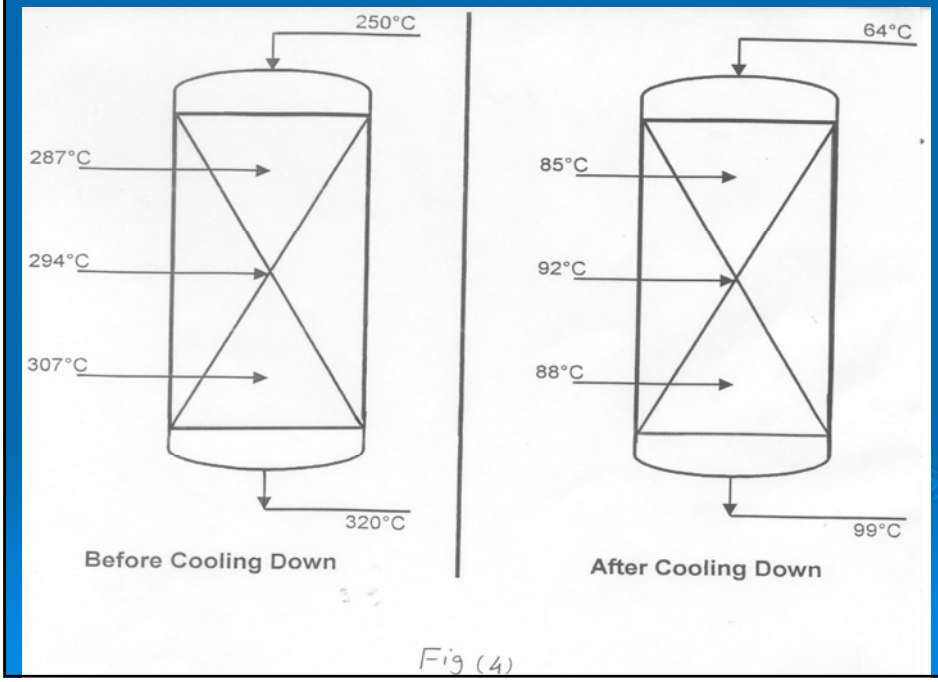


Fig (4)

Purging of the Methanator Reactor:

- After the cooling down of the methanator reactor catalyst to 85 ^{o}C, the reactor was depressurized to about 2 bar, the nitrogen was opened from nozzle 1 and vented through PV-306205 several times until gas outlet methanator became hydrogen free.

Dismantling the Elbow at Methanator Reactor Inlet:

- Nitrogen was opened from nozzle 1, then the elbow at the reactor inlet was both dismantled and removed, and the prepared blind flange was erected on the top of the reactor.

Erection of the Special Blind at the Methanator Reactor Outlet:

- Nitrogen was opened from the upper nitrogen connection and nozzle 2, then the exit flange of the reactor was dismantled and special blind was erected.

Washing of the Methanator Catalyst:

- Condesate water from pumps 303P001 A/B with the following specification was used for washing;

Temperature	80 °C
Pressure	9 bar
pH	9-9.2
N_2H_4	>0.1

- The condensate water was opened to the special blind through 3 nozzles until the methanator reactor was filled and an over flow appeared from the prepared line on the top of the methanator reactor.

- An analysis was handled when the first over flow took place. It resulted in (K+ as K_2CO_3 =7.2 g/l . This analysis was handled every 30 minutes to detect the % of K+ as K_2CO_3 in the washing water. [Table 1].

- After 6 hours of washing , analysis of (K+ as K_2CO_3) in the washing water reached (0.2 g/l) and remaind constant for another 2 hours.

- At the end of washing , bubbling with nitrogen was handled for 30 minutes to dissolve any remaining carbonate in the catalyst.
- At the end (K as K_2CO_3) reached (0.15 g/l).

Emptying the Methanator reactor from Washing Water

- Nitrogen was opened from the top of the methanator to replace the water inside the reactor which was drained through the special blind nozzles.
- Methanator reactor was purged with nitrogen several times.

- Nitrogen was introduced from the nozzle at the special blind and the upper flange was dismantled and the original elbow was erected in the presence of nitrogen flow.
- Nitrogen was opened from the methanator inlet (nozzle 1) and the special blind was removed.
- Nitrogen was opened to the reactor from top to bottom to repel the remaining water in the catalyst bed.

Drying and Heating up of the Methanator Reactor

- The catalyst bed temperature was 25 °C, so it was heated up slowly by using the process gas via PV- 306205. A lot of water was separated un the heat exchanger 306E003 separator , which was directed to the sewer.

- The temperature was kept at 120 °C for about 1 hour for drying purposes.

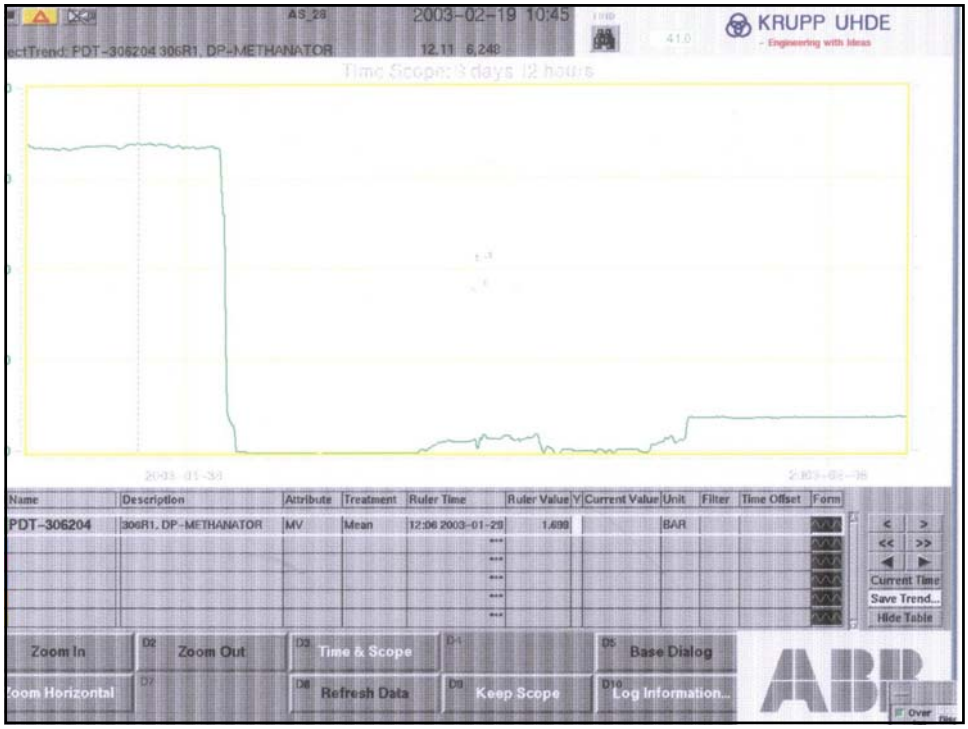
- It took 7 hours until the catalyst bed temperature reached 300 °C.

- After reaching 300 ^{o}C , the methanator reactor reached (0.18 bar).

- Temperature difference calculated and measured were 32 ^{o}C & 35 ^{o}C respectively.

Conclusion

- Pressure drop across the methanator reactor was reduced from (1.8 bar) to (0.18 bar) after successful washing for the catalyst bed and the catalyst regained its original activity and the power of synthesis gas compressor decreased.


AS_28
2003-02-19 10:45
KRUPP UHDE
- Engineering with Ideas
ectTrend: PDT-306204 306R1, DP-METHANATOR
12,11 6,248
Time Scope: 3 days 12 hours
Name
Description
Attribute
Treatment
Ruler Time
Ruler Value
Y
Current Value
Unit
Filter
Time Offset
Form
PDT-306204
306R1, DP-METHANATOR
MV
Mean
12:06 2003-01-29
1,699
BAR
Current Time
Save Trend...
Hide Table
Zoom In
D2 Zoom Out
D3 Time & Scope
D5 Base Dialog
oom Horizontal
D8 Refresh Data
D9 Keep Scope
D10 Log Information...


AS_28
2003-02-27 14:08
KRUPP UHDE
- Engineering with Ideas
ectTrend: TIC-306003 GCV TO 306R001
12,11 62,62
Time Scope: 7 hours 31 minutes
500
375
250
125
0
Name
Description
Attribute
Treatment
Ruler Time
Ruler Value
Current Value
Unit
Filter
Time Offset
Form
TIC-306003
GCV TO 306R001
MV
Mom
10:54 2003-01-30
250,8
300,4
C
TT-306004A-T
306R1, METHANATOR
MV
Mom
10:54 2003-01-30
287
326
C
TT-306004B-T
306R1, METHANATOR
MV
Mom
10:54 2003-01-30
294
328
C
TT-306004C-T
306R1, METHANATOR
MV
Mean
10:54 2003-01-30
307
324
C
TT-306006
306R1, METH. OUTLET
MV
Mom
10:54 2003-01-30
320
330
C
FV-306003
GCV TO 306R001
OUT
Mean
10:54 2003-01-30
0,0
18,0
%
Current Time
Save Trend...
Hide Table
Zoom In
D2 Zoom Out
D3 Time & Scope
D5 Base Dialog


FIC-310406 STMH TO 310E004
MV < L2 13:17:06
ectTrend: TT-306004A-T 306R1, METHANATOR
12,14 6,176
KRUPP UHDE
Engineering with Ideas
Time Scope: 9 hours 22 minutes
Name | Description | Attribute | Treatment | Ruler Time | Ruler Value | Current Value | Unit | Filter | Time Offset | Form
TT-306004A-T | 306R1, METHANATOR | MV | Mom | 23:35 2003-02-03 | 39 | 339 | C
TT-306004B-T | 306R1, METHANATOR | MV | Mom | 23:30 2003-02-03 | 26 | 342 | C
TT-306004C-T | 306R1, METHANATOR | MV | Mean | 23:35 2003-02-03 | 27 | 334 | C
PV-306205 | BLOW-OFF METHANATION | OUT | Mom | 23:35 2003-02-03 | 10,0 | 0,2 | % | 0,99
LV-306501 | GAS COOLER 306E003 | OUT | Mom | 23:35 2003-02-03 | 0,4 | 48,9 | % | 0,99
PV-305201 | BLOW-OFF CO2-REMOVAL | OUT | Mean | 23:35 2003-02-03 | 41,4 | 0,0 | %
Zoom In
D2 Zoom Out
D3 Time & Scope
D5 Base Dialog
D8 Refresh Data
D8 Keep Scope
D10 Log Information


AS_28
2003-02-04 13:16
FIC-310406 STMH TO 310E004
MV < L2 13:16:06
ectTrend: TT-306004A-T 306R1, METHANATOR
12,14 6,176
KRUPP UHDE
Engineering with Ideas
Time Scope: 9 hours 22 minutes
Name | Description | Attribute | Treatment | Ruler Time | Ruler Value | Current Value | Unit | Filter | Time Offset | Form
TT-306004A-T | 306R1, METHANATOR | MV | Mom | 02:44 | 132 | 339 | C
TT-306004B-T | 306R1, METHANATOR | MV | Mom | 02:42 | 98 | 342 | C
TT-306004C-T | 306R1, METHANATOR | MV | Mean | 02:44 | 95 | 334 | C
PV-306205 | BLOW-OFF METHANATION | OUT | Mom | 02:44 | 70,0 | 0,2 | % | 0,99
LV-306501 | GAS COOLER 306E003 | OUT | Mom | 02:44 | 56,3 | 48,9 | % | 0,99
PV-305201 | BLOW-OFF CO2-REMOVAL | OUT | Mean | 02:44 | 31,5 | 0,0 | %

Thanks

With my best wishes

Eng. Yasser Abdelmonem Ahmed