


Switching between

Pyrolysis Furnaces

cracking and decoking


Menno VAN DER BIJ - Deputy Manager Instrumentation Department

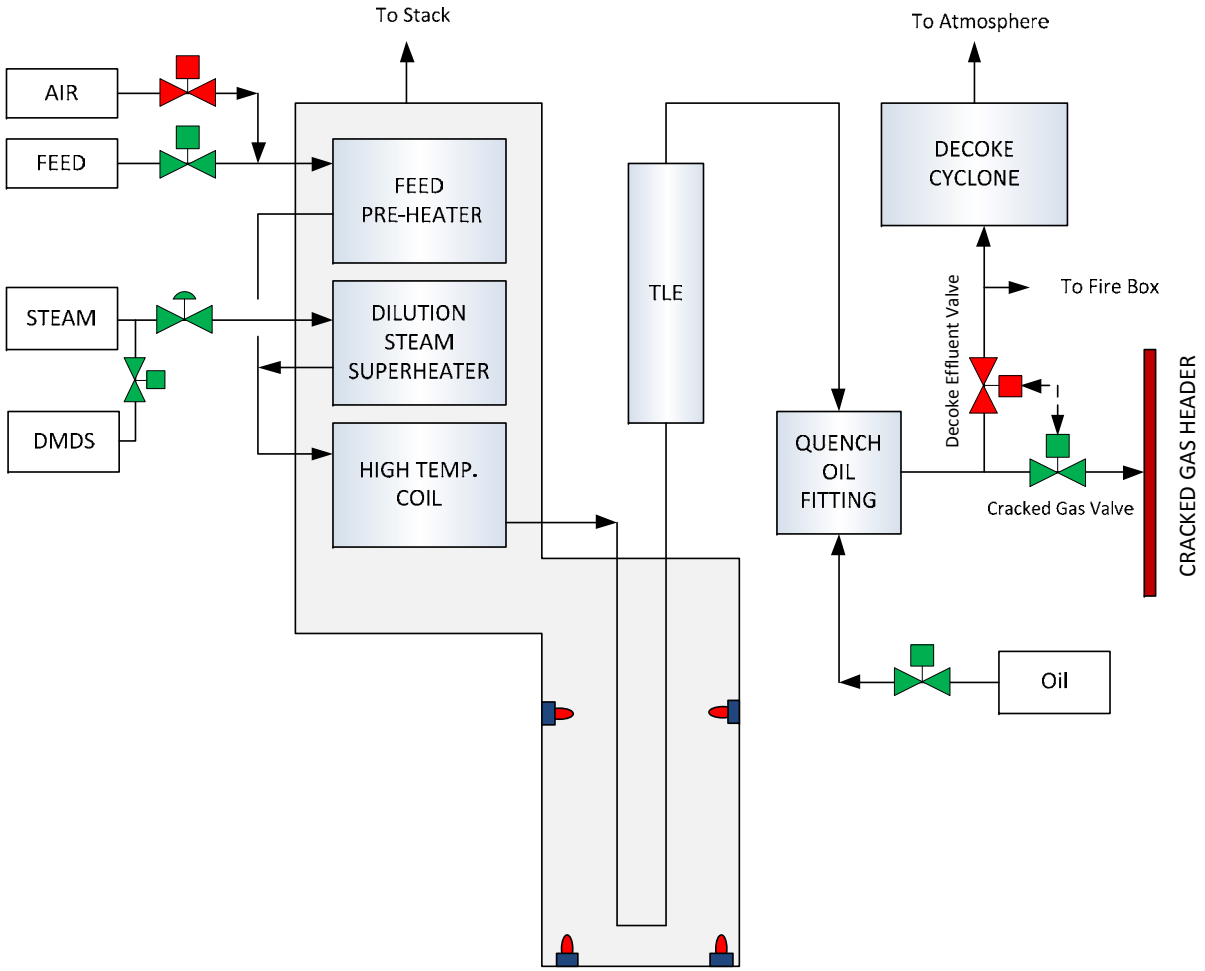
32th Annual European AIChE / Delta Process Academy Seminar

'Safe start-up of chemical plants' October 11th, 2016, Domein Martinus / Halle - Zoersel

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS

Netherlands / Belgium Section

Switching between cracking and decoking
Introduction



Cracking furnace in CRACKING mode of operation

Switching between cracking and decoking
Possible Hazards

While in CRACKING mode:

- Cracked gas leaking through decoke valve(s) to atmosphere
- Decoke air routed to furnace, mixing with HC
- High temperature downstream QOF in case of quench oil failure
- Backflow of cracked gas from header to cracking furnace in case of multiple radiant coil failure
- Low temperature downstream QOF due to failure of the emergency water back-up

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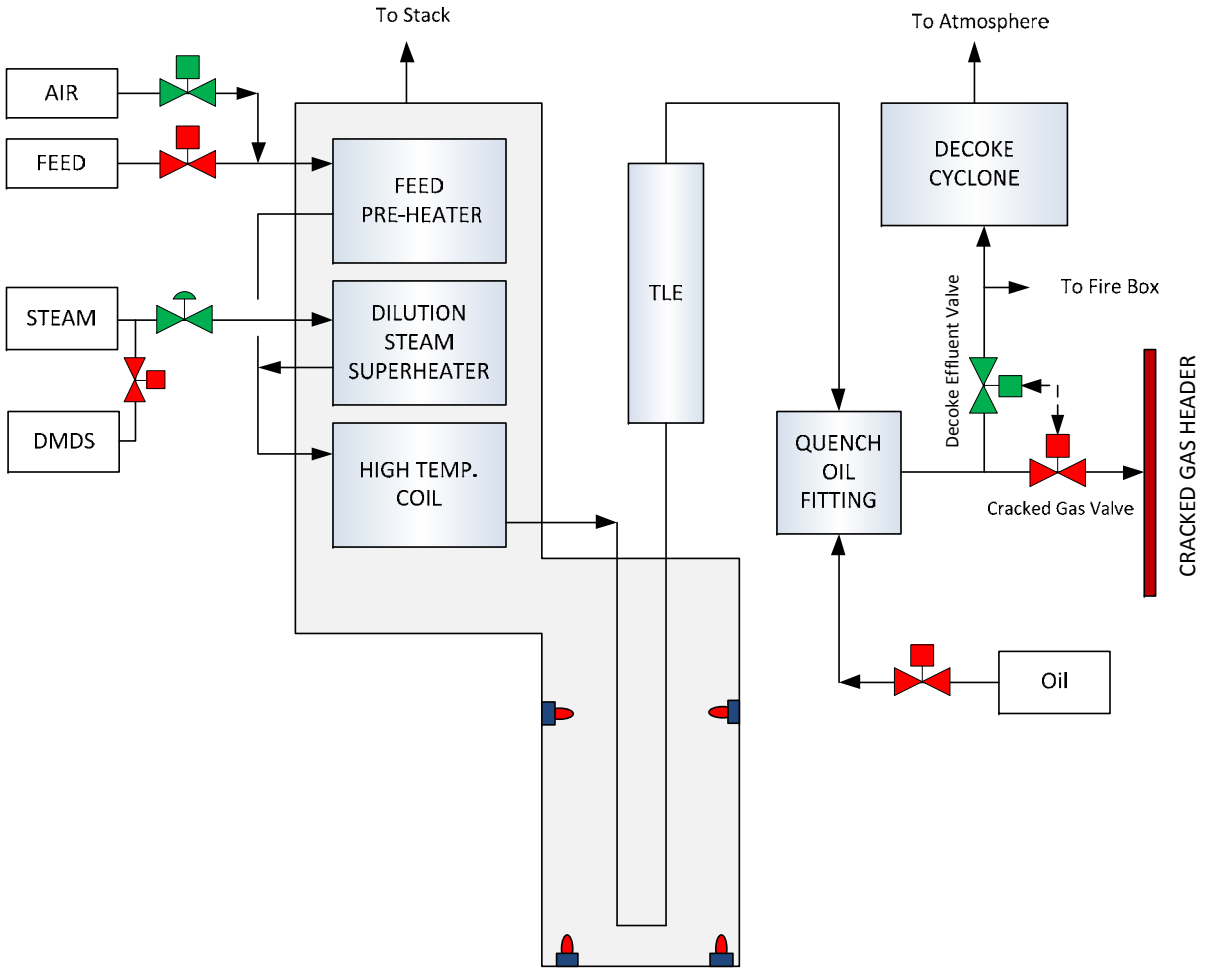
Switching between cracking and decoking
Introduction



Cracking furnace in DECOKING mode of operation

Switching between cracking and decoking
Possible Hazards

While in DECOKING mode (open connection to atmosphere):

- Cracked gas leaking through cracked gas valve(s) to atmosphere
- Hydrocarbon feed routed to furnace, mixing with decoke air
- DMDS connected to atmosphere
- Quench oil connected to atmosphere
- Decoke effluent routed to cracked gas analyzer

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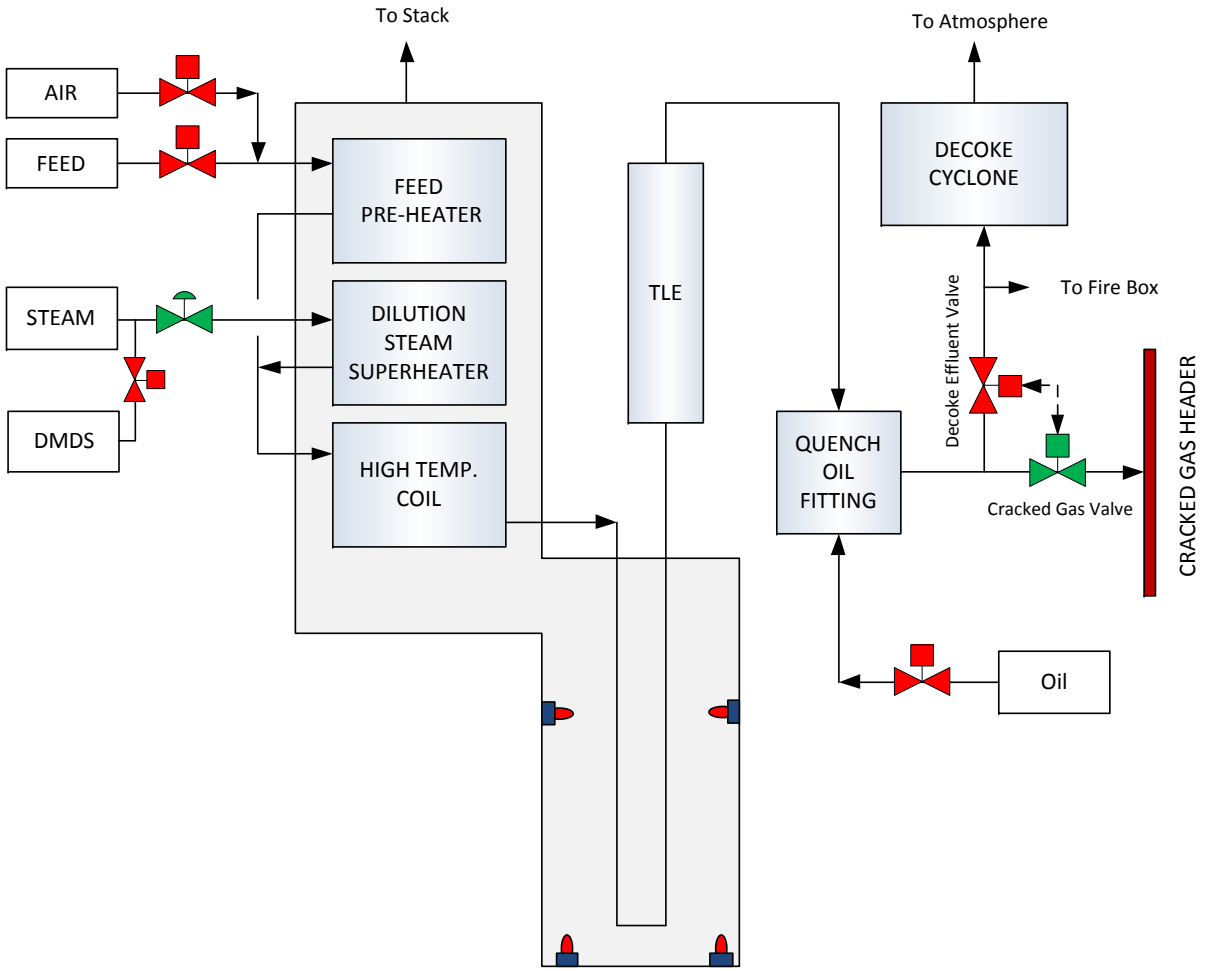
Switching between cracking and decoking
Introduction



Cracking furnace in HOT STANDBY mode of operation

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Switching between cracking and decoking
Pre-conditions for change-over

- Hydrocarbon feed lines isolated
- Decoke air line isolated
- DMDS line isolated
- Quench oil line isolated
- Decoke air and HC feed lines purged with steam

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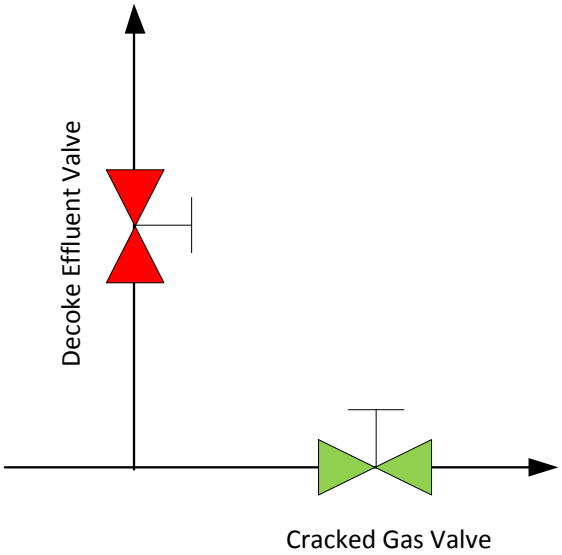
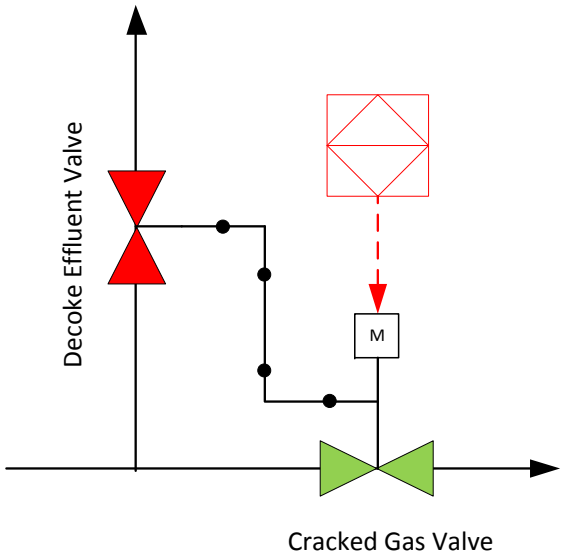
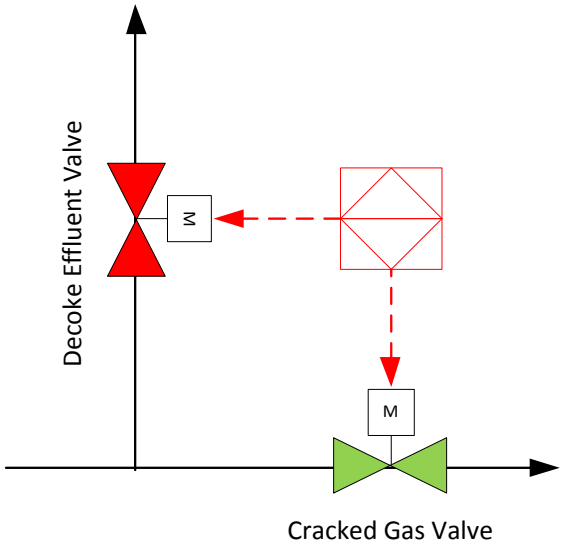
Switching between cracking and decoking
History



Individual operated valves



Mechanically linked valves
With 1 electric motor



Electrically linked valves

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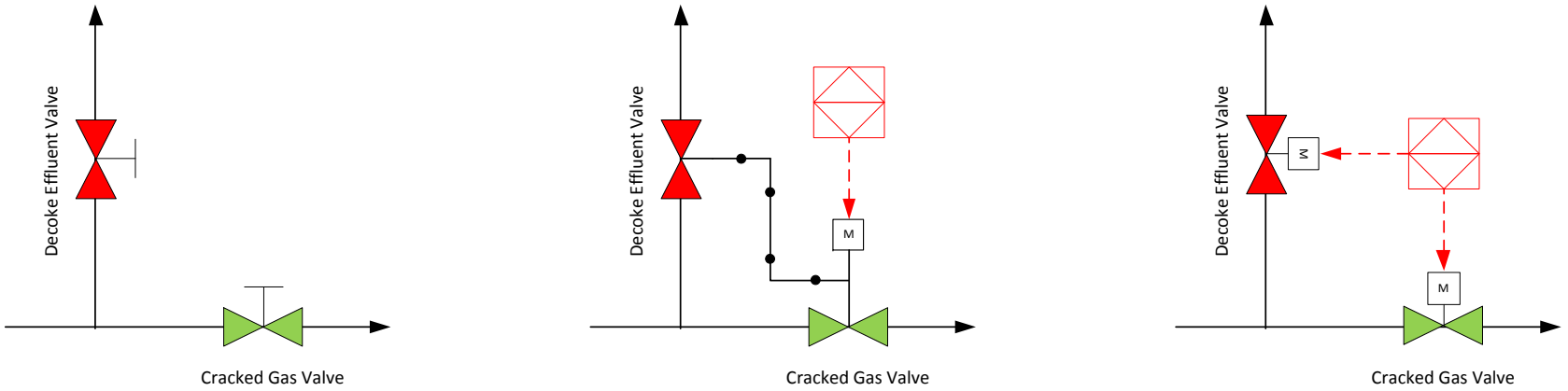
Switching between cracking and decoking
Possible Hazards

During TRANSFER from cracking mode to decoking mode

- Overpressure due to simultaneously (partial) closed decoke and cracked gas valve(s)
- Backflow of cracked gas to atmosphere while both valves are open



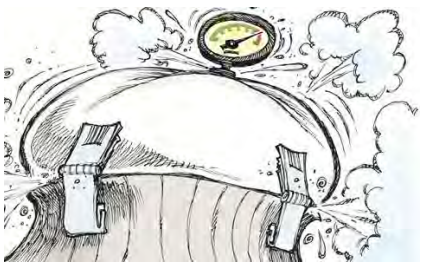
Overpressure is possible in all 3 configurations

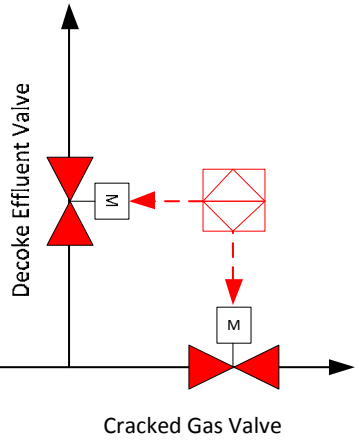
Switching between cracking and decoking
Safety Instrumented System requirements

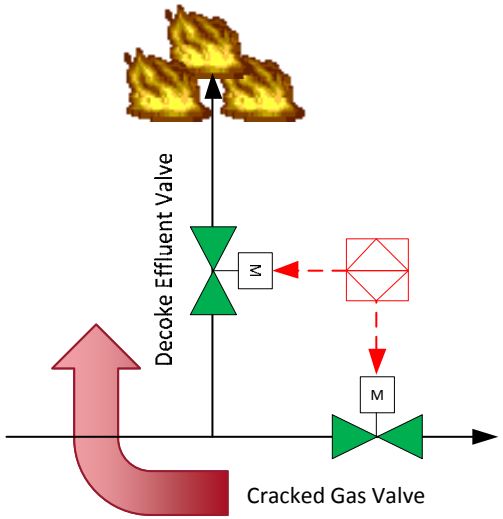
During TRANSFER from cracking mode to decoking mode

PREVENT

- Overpressure due to simultaneously (partial) closed decoke and cracked gas valve(s)
- Backflow of cracked gas to atmosphere



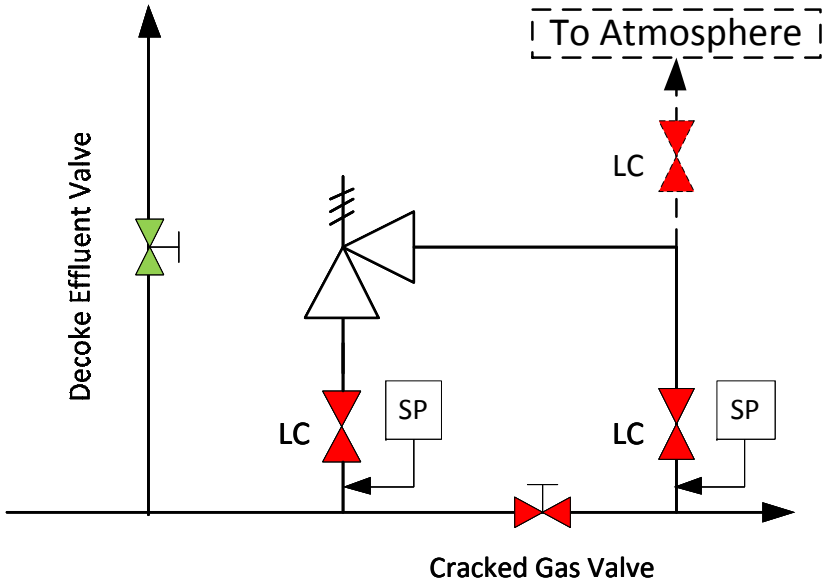


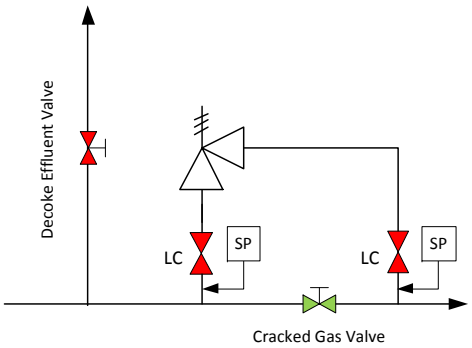


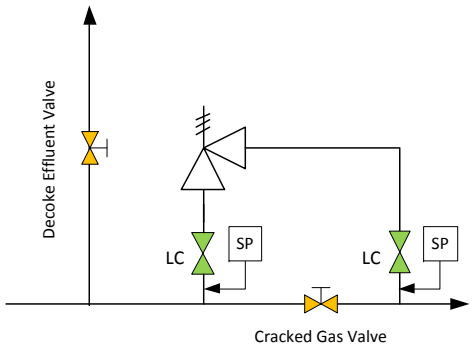
Switching between cracking and decoking
Safety valve for overpressure protection

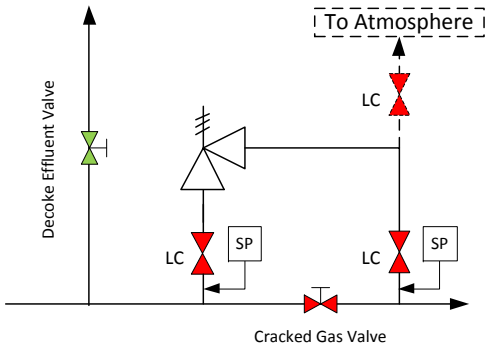
SP = Steam Purge

LC = Locked Closed

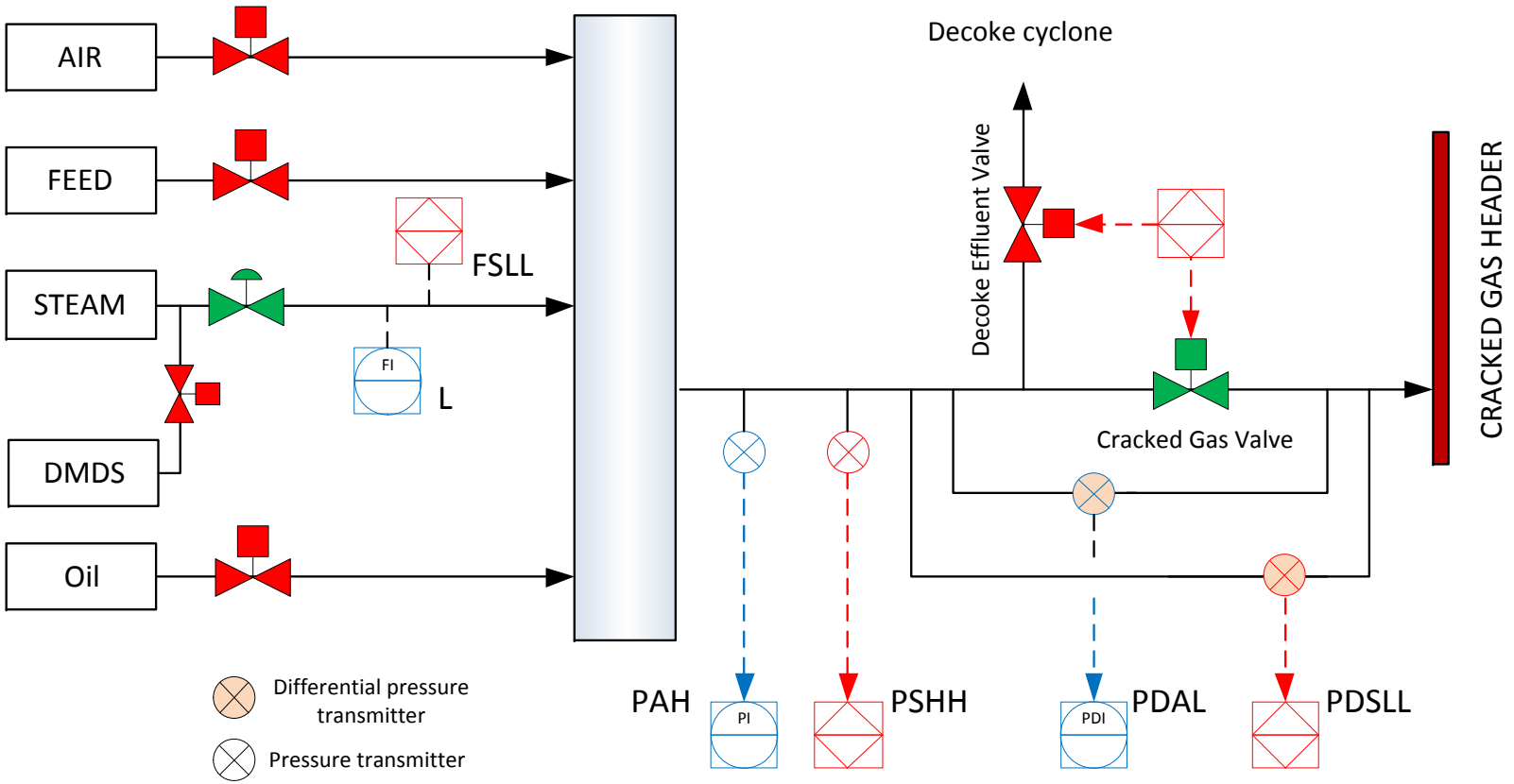






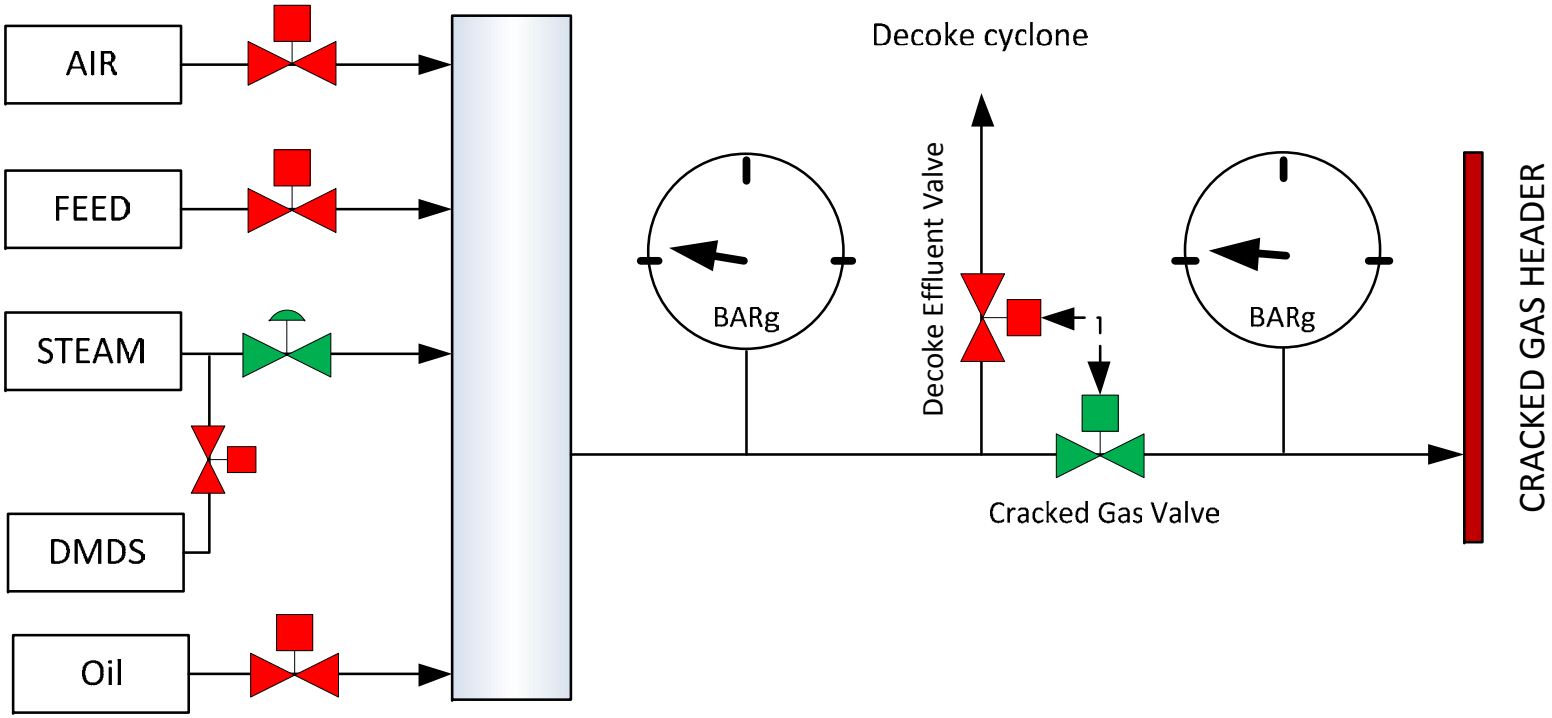


Switching between cracking and decoking
Conceptual design



Note: Switch-over can be manually from local panel or DCS or fully automatic through the safeguarding system

Switching between cracking and decoking
Conceptual design



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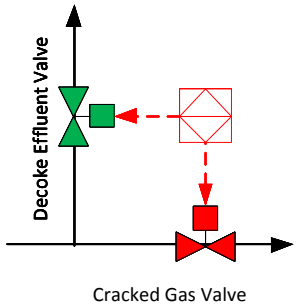
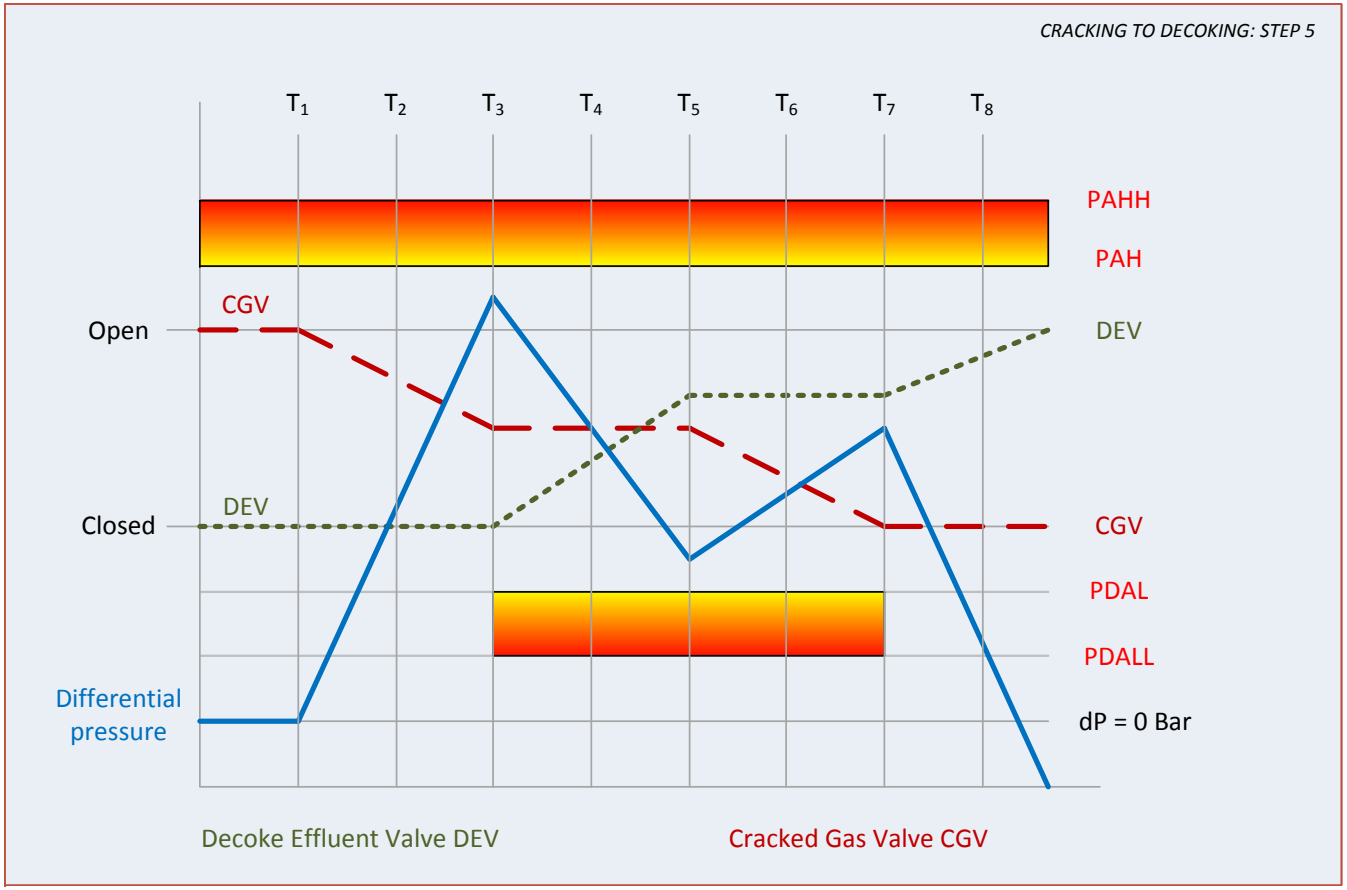
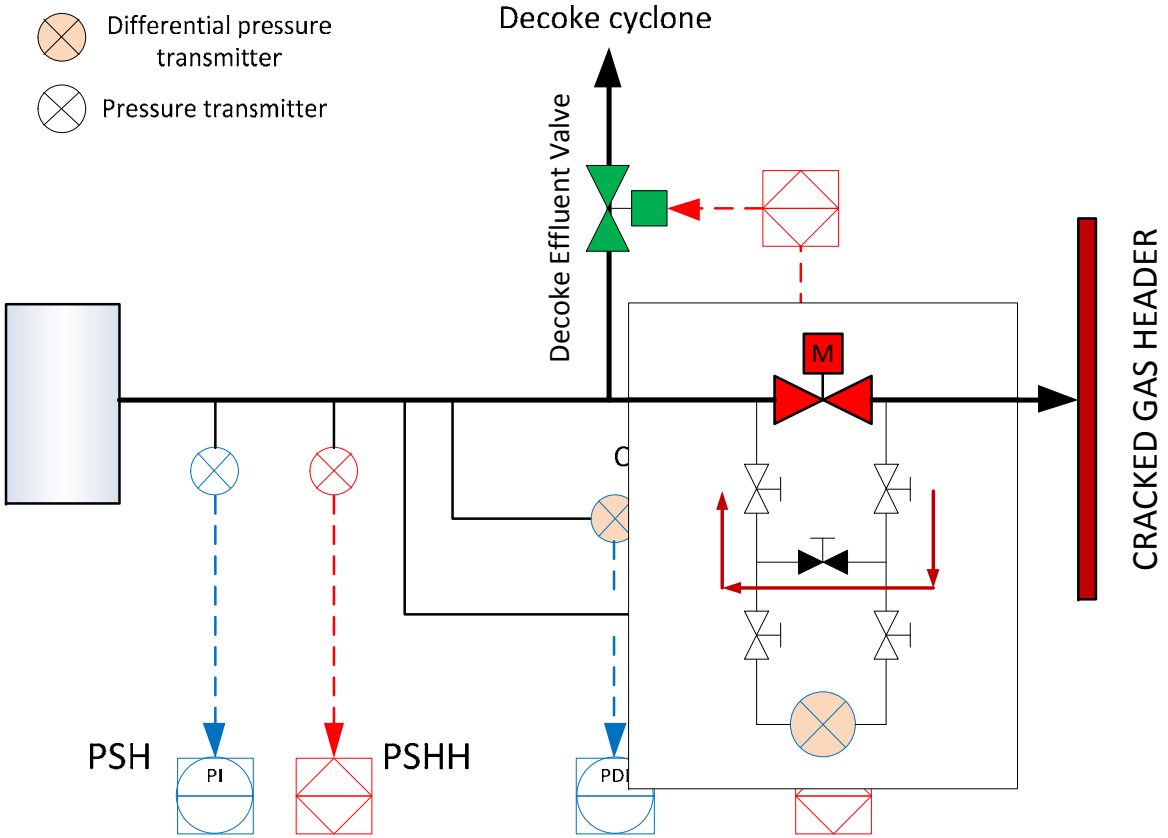
Switching between cracking and decoking
Pressure profile

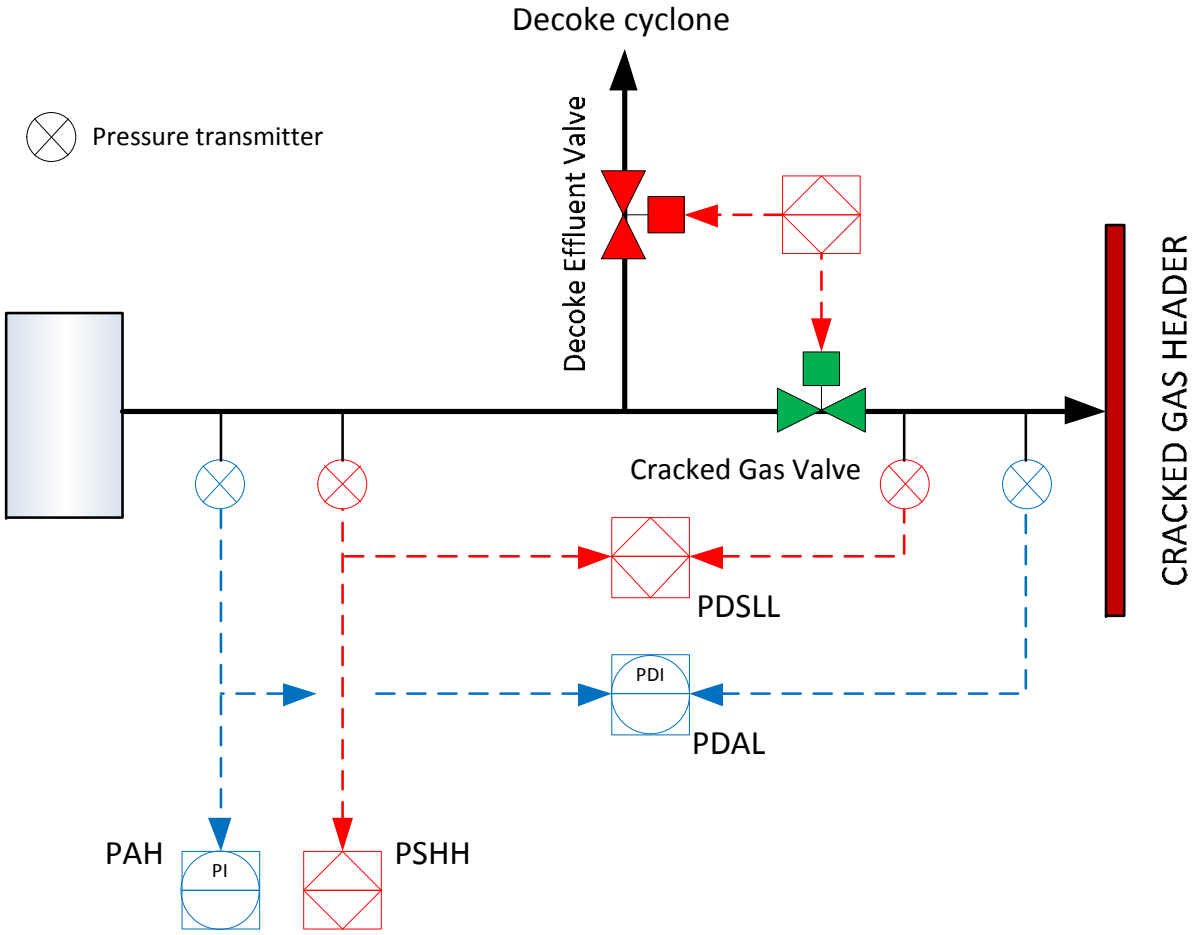




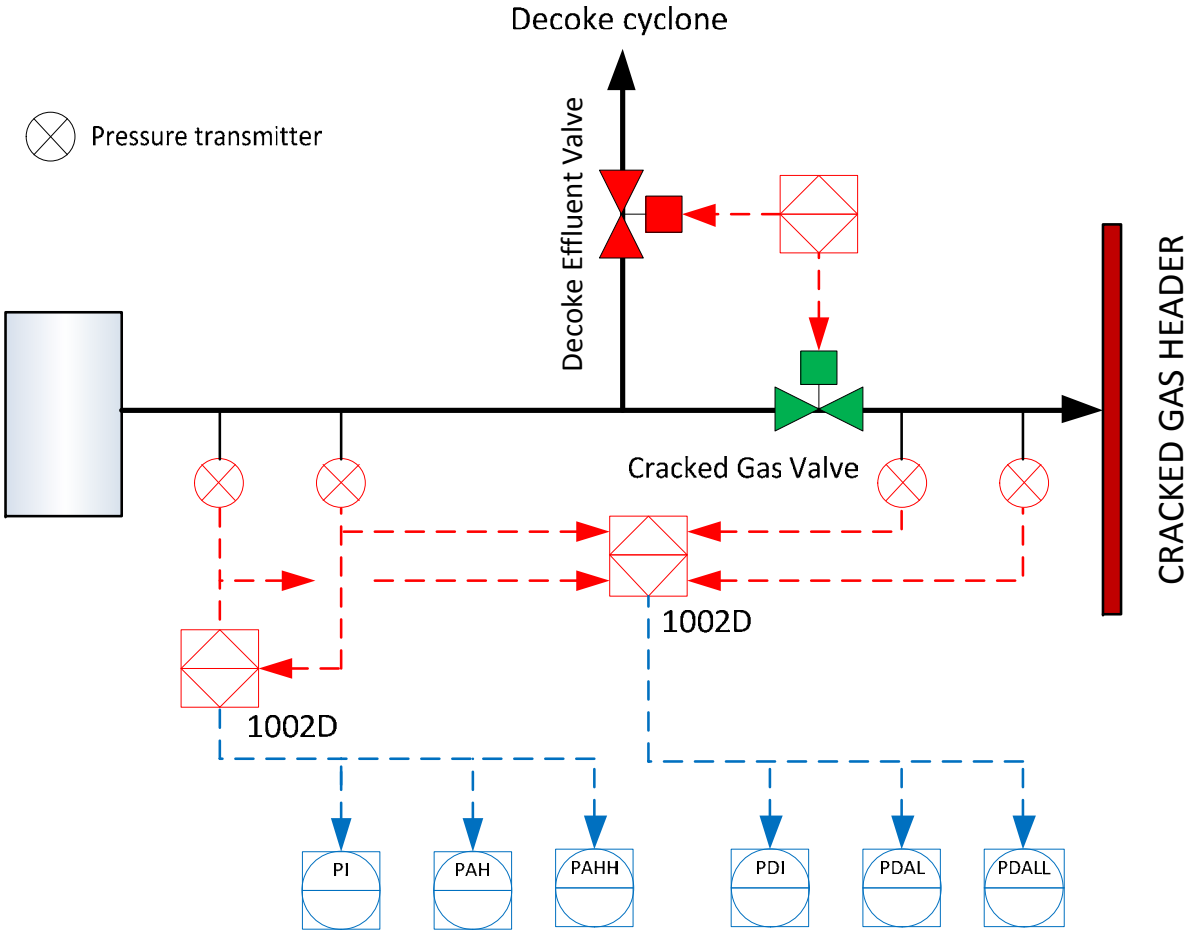
Switching between cracking and decoking
Conceptual design



Switching between cracking and decoking
Differential pressure transmitters replaced



Switching between cracking and decoking
Improved reliability Safety Integrity Level



Switching between cracking and decoking
Emergency isolation

Closing the cracked gas valve after a multiple coil rupture

- Initiate furnace total shutdown:
  - > Close feed and DMDS valves
  - > Close decoke air valve
  - > Close fuel gas valves
- Close quench oil valve (if applicable)
- Overpressure protection remains active
- Steam purge of HC and decoke air lines bypassed

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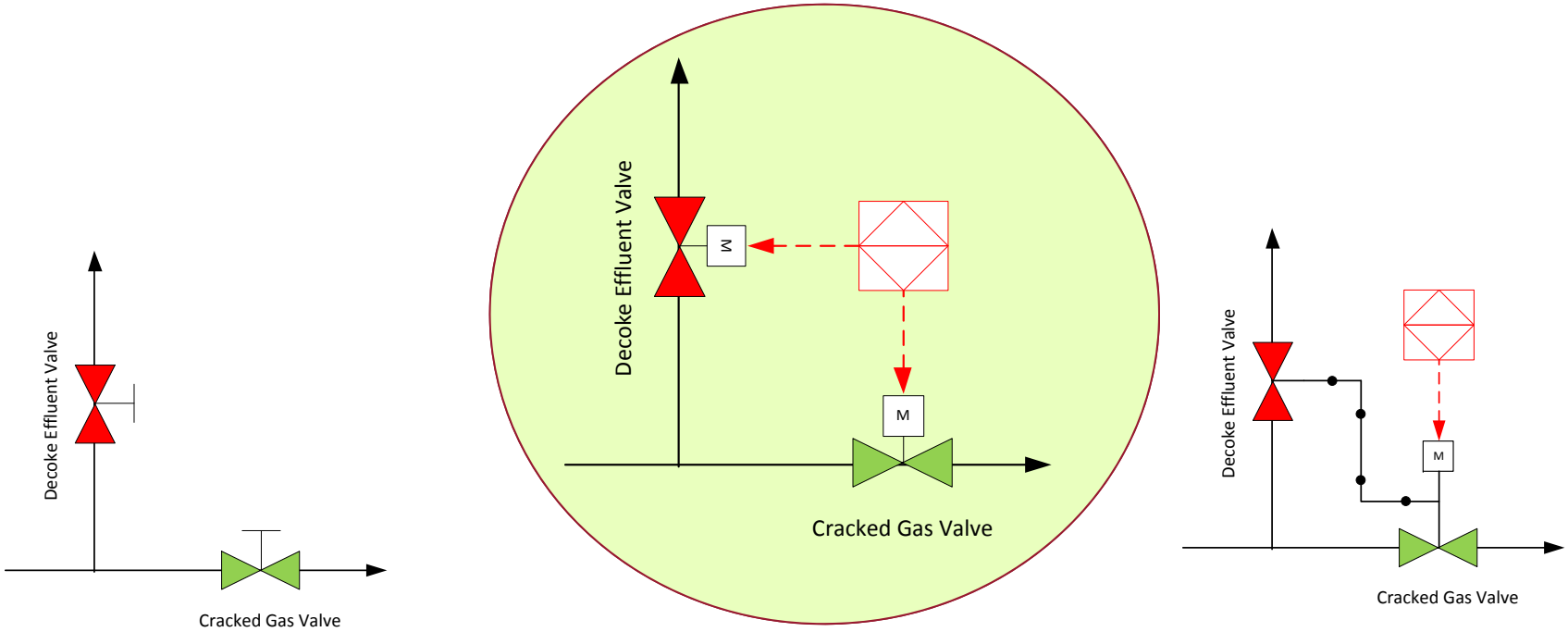
Switching between cracking and decoking
Emergency isolation

Maintaining overpressure protection and preventing backflow of cracked gas to decoke drum only possible with electrically linked valves



Switching between cracking and decoking
Conclusions

Advantages of electrically linked valves compared to mechanically linked valves

- Easier to install
- Easier to maintain pressures within safe limits
- Less dependent of dilution steam flow fluctuations
- Possibility for EMERGENCY ISOLATION after coil rupture while maintain overpressure and back flow protection

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Switching between cracking and decoking
Conclusions

Advantages of 4 gauge pressure transmitters compared to 2 dP-transmitters + 2 gauge transmitters

- Continuous comparison of transmitter availability
- Higher availability and reliability
- Less process connections = less steam purges
- No potential backflow over instrument equalization valve

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Switching between cracking and decoking
Conclusions

Advantages of overpressure protection with pressure transmitters compared to safety valve

- Overprotection always available
- Higher reliability – no blocked PSV inlet
- No key-interlocks required

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QUESTIONS ?

Thank you

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take it further®