Coke Cutting Systems
for
Delayed Cokers in Warm Areas

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RUHRPUMPEN
Introduction

Location: RuhRPumpen Witten, Germany

1950 Founded in Witten / Germany
Specialist for: API Process pumps
   API Pipeline pumps for Crude Oil,
   Products, Water

1963 Part of THYSSEN AG
THYSSEN RUHRPUMPEN

1997 Part of Cooperation EG, Monterrey,
Mexico

Our Mission: Become a worldwide company

2000 Start with Hydraulic Decoking System

2001 First Order: Petroleras Ameriven
/04 ConocoPhillips, PdVSA, Chevron Texaco

Since that time orders for revamps, new Units and Components
Main Business Units
- Monterrey, Mexico
- Tulsa, USA
- Changzhou, China
- Orland, California, USA
- Buenos Aires, Argentina
- Rio de Janeiro, Brasil

Further Service Centers and Sales Offices worldwide

Ruhrpumpen Business Units

Witten, Germany
Area: 48,000 m²
Testing: 8,850 HP

Chennai, India
Area: 7,500 m²
Testing: 6,000 HP
More and more Delayed Coking Units (DCUs) are built in extreme ambient. All equipment including the Coke Cutting Systems have to meet these requirements.

The requirements are summarized as

- **a)** Ambient and Design conditions in warm areas
  - temperature ranges from -3°C / 27°F to +50°C / +122°F
  - sun, wind, rain, dust, humidity
  - Humidity above 90%, often 100%

- **b)** Refinery conditions
  - hazardous, corrosive atmosphere
  - operation mode manual / remote/automated

- **c)** Company specification
  - specification of final user, contractor, licensor

- **d)** Local codes and standards
  - other local codes

In the project and design phase items c) and d) are most important and should be met later. a) and b) are most important.
RP classifies the Decoking systems into 3 classes

• **Class I.** area in warm temperatures  Warm-Warm Area
  – Mech. equipment  T design  >0°C to +50°C  WWA
  – Instruments

• **Class II.** area in medium temperatures  Cold Area
  – Mech. equipment  T design  >-29°C/-20°F  CA
  – Instruments  Tdesign >-29°C/-20°F  CA

• **Class III.** area in low temperatures  Cold-Cold Area
  – Mech. equipment  Tdesign >-50°C/-59°F  CCA
  – Instruments  Tdesign >-60°C/-76°F  CCA
<table>
<thead>
<tr>
<th>Year</th>
<th>Area</th>
<th>Company</th>
<th>Design Temp. Equipment</th>
<th>Design Temp. wetted parts</th>
<th>Humidity</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>India, North</td>
<td>HMEL</td>
<td>+ 1 to +46°C</td>
<td>+65°C / max 93°C</td>
<td>85 %</td>
</tr>
<tr>
<td>2008</td>
<td>Saudi-Arabia</td>
<td>Yanbu</td>
<td>+ 0 to +45°C</td>
<td>+60°C / max 100°C</td>
<td>100%</td>
</tr>
<tr>
<td>2009</td>
<td>India, South-West</td>
<td>MRPL</td>
<td>+17 to +40°C</td>
<td>+66°C / max 93°C</td>
<td>91%</td>
</tr>
<tr>
<td>2009</td>
<td>Egypt</td>
<td>ERC</td>
<td>+ 2 to +45°C</td>
<td>+60°C / max 75°C</td>
<td>85%</td>
</tr>
<tr>
<td>2009</td>
<td>Saudi-Arabia</td>
<td>Jerp</td>
<td>+ 6 to +47°C</td>
<td>+66°C</td>
<td>100%</td>
</tr>
<tr>
<td>2009</td>
<td>India, South-East</td>
<td>Paradip</td>
<td>+11 to +44°C</td>
<td>+65°C / max 90°C</td>
<td>99.7%</td>
</tr>
<tr>
<td>2012</td>
<td>India, South-East</td>
<td>CPCL</td>
<td>+18 to +45°C</td>
<td>+66°C / max 93°C</td>
<td>80%</td>
</tr>
<tr>
<td>2012</td>
<td>UAE</td>
<td>Takreer</td>
<td>+ 7 to +48°C</td>
<td>+66°C</td>
<td>100%</td>
</tr>
<tr>
<td>2014</td>
<td>Oman</td>
<td>SOHAR</td>
<td>+ 5 to +50°C</td>
<td>+65°C</td>
<td>100%</td>
</tr>
<tr>
<td>2014</td>
<td>India, East</td>
<td>Barauni</td>
<td>+ 5 to +46°C</td>
<td>+65°C</td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>Kuwait</td>
<td>KNPC</td>
<td>-3 to +50°C</td>
<td>+65°C / max 90°C</td>
<td>100%</td>
</tr>
</tbody>
</table>
## Decoking Systems in Warm-Warm Areas

<table>
<thead>
<tr>
<th>Location</th>
<th>Mech. equipment Design Temp.</th>
<th>Instruments Design Temp.</th>
<th>Comments / Special requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Middle East</td>
<td>Material acc. ASTM / DIN-ISO</td>
<td>Zone 2 ATEX</td>
<td>Humidity 100% Dust, sand (Seaside atmosp) Refinery atmosp.</td>
</tr>
<tr>
<td>India</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WWA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pump area</td>
<td>Hazardous area</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pump / wet parts 65° C / 93° C Equipment 1° C to 50° C</td>
<td>Instrumt. 50° C ATEX Control Panel, purged, cooled</td>
<td></td>
</tr>
<tr>
<td>Cutting Deck</td>
<td>Hazardous area</td>
<td>Wetted Parts 65° C/ 93° C Equipment 1° C to 50° C</td>
<td>Instrumt. 50° C ATEX</td>
</tr>
<tr>
<td>Derrick</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operator Shelter</td>
<td>Hazardous area</td>
<td></td>
<td>2x HVAC, inside 1°C to 35°C</td>
</tr>
<tr>
<td>(local / remote)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control Room</td>
<td>Control house, safe area</td>
<td></td>
<td>PLC &lt;40°C Safe area</td>
</tr>
</tbody>
</table>

Coking.com, Bahrein 2015
Summary

Design conditions
Installation in Hazardous area, Zone 2

- **Pump and wetted parts**: rated 65°C, max 93°C
- **Mechanical equipment**: 1°C to 50°C
- **Instrumentation, outside**: 1°C to 50°C
- **Instrumentation and control inside shelter**: 1°C to 35°C
- **HVAC in shelter**: 2x 100% redundant
RUHRPUMPEN
Hydraulic-Decoking-System

Control system
- PLC
- Process visualization
- Automatic control

Pump area
- Pump unit
  - HP-Barrel-pump
  - Driver, gear if app.
  - Lube oil system
- Suction line
  - Valve
  - Strainer
  - Instrumentation
- Discharge line
  - Decoking valve
  - Pressure bleed valve
  - Instrumentation

Derrick
- Platform
  - Operator panel
    - Panel
    - Cubicle
    - Drill stem guide plate
- Valve
  - Isolation valve
  - Drain valve
- Hoist
  - Hoist, pneu,hyd,elec
  - Hydraulic unit
  - Slack rope device

Derrick
- Crosshead
  - Crosshead, Guide rails
  - Free Fall Arrestor
  - Pulley blocks
- High Pressure line
  - HP water hose, swivel
  - Drill stem
  - Tool
- Drill Stem Drive
  - Gear
  - Motor, pneu,hyd,elec
  - Seal cartridge

Auxiliaries
- Pumps
  - Feed Pumps
  - Pit Pumps
- Top deheading system
  - flanged / bolted
  - Double gate valve
- Bottom deheading syst
  - flanged / bolted
  - Double gate valve

Coking.com, Bahrein 2015
Coker HMEL

Installation: India
HMEL
Jet Pump area
Jet Pump unit sheltered
Installation: India
Jet Pump

HMEL
Jet Pump area

- Jet Pump unit sheltered

Installation: India

Coking.com, Bahrain 2015
Cutting system: Hoist and DSD

**Hydraulic system**

- **Features**
  - Hydraulic power unit HPU
    - Redundant m-p
    - Designed for hoist and DSD operation
  - Hyd. Driven hoist + DSD

- **Special features for WWA**

**Electrical system**

- **Features**
  - VFD for hoists and DSD
    - Redundant
    - Installed in safe area
    - Or on cutting deck (DSD)
  - Motor + breaks explosion proof

- **No limitation due to T**

  - 1 Operator panel (3 sections) per pair of drum on cutting deck
  - Or, 1 Operator Panel per coker (remote)
  - Control electric/electronic for manual, remote / automatic operation
    - Integrated in PLC / DCS system
  - Measurement of force, tension, rpm of Drill Stem
    - Tool position and Tool mode
    - Jet to wall and coke fall out

*Coking.com, Bahrein 2015*
Control and process instrumentation

• Hoist,
• Operation

• Variable Frequency Converter VFD

• Hoist ATEX, CSA

• Rope tension in the rope
  – indication at the operator panel
  – avoiding of overload

• Variable Frequency Converter VFC
  – Installed in purged cabinet
Hoist and Rope

• Hoist with integral cartridge gear
  – drum with grooves
  – Pull force 5 t
  – slack rope indicator
    • locks the hoist

• Rope
  – 16/18 mm
  – measurement of tension in the rope
  – indication at the operator panel
  – avoiding of overload
Lifting System

HMEL
Cutting Deck

- Hoist
  electrical driven
  protected equipment

Capacity
  pull force  5000 kg

Installation: India

Coking.com, Bahrain 2015
Crosshead with DSD

Derrick

- Crosshead
- wheel type
- Free Fall Arrestor

Drill Stem Drive
- Electrical driven

All weather protected

Installation: Egypt
Drill Stem Drive

Derrick
- Drill Stem Drive
- electrical driven

Installation: India

Coking.com, Bahrein 2015
**Basic design**
- Slim tool, OD 13"
- Low lift force
- Low torque

**Switching devices**
- Manual / Automated
- At the top of the tool

**Valves**
- Ballshape valves
- No seals
- Pressure operated

**Nozzles, cutting**
- 0°
- 10°up both cutting nozzles

**Nozzles, drilling**
- 1 strong centre nozzle
- 3 periphery nozzles
Control system

Operator cubicle

- Installation
  - heated
  - prewired
  - Fire resistend material
  - Safety glass
  - Round and top view
HMEL
Cutting Deck

Operator Shelter
2 x 100% HVAC
roof-mounted
fire resistant material
safety glass
Pre wired

Operator Panel
- VFD Cabinet for hoist
  purged, cooled

Installation: India

Coking.com, Bahrein 2015
Control system

HMEL
Cutting Deck

Operator Shelter
2 x 100% HVAC
fire resistant material
safety glass

Operator Panel
- VFD Cabinet for hoist
  purged, cooled

Installation: India

Coking.com, Bahrain 2015
Control and process visualisation

Operator Panel

Control of hoist and DSD

With monitor interactive PID tendency

Installation: India

Coking.com, Bahrein 2015
Operation

• Manual operation
  • LOCAL: commissioning, trouble operation, maintenance
  • REMOTE: from operator shelter at safe location

• Batch operation (remote or semi-automatic)
  • Batch
  • Batch
  • manual override
  • Drilling
  • Cutting
  • Cleaning

• Automatic Operation
  • Standard program
    • Drilling, Switching,
    • Cutting, Cleaning
  • Self Optimising program
    • Integrated control subroutines
    • Integrated problem solving routines

Coking.com, Bahrein 2015
Remote Decoking

Operation from Remote Location

• Remote Control Panel  RCP
  • Installed in remote shelter or remote Operator shelter

Instrumentation in field

• Cameras
  • Indication
  • Cutting deck, chute
  • Clear operation at cutting deck

• Vibration probes
  • Indication
  • Drum wall
  • Jet to Wall
**Operation by PLC from Control Room**

- **PLC Control Panel**  PLC-CP
  - Installed in Control room
  - One local panel at cutting deck for auto – local operation

**Instrumentation in field**

- **Cameras**
  - Indication
    - Clear operation at cutting deck and chute

- **Vibration probes**
  - Indication
    - Drum wall
    - Jet to Wall

- **Vibration Probes/Microphones**
  - Indication
    - Shute
    - Coke fall out
<table>
<thead>
<tr>
<th>Year</th>
<th>Company</th>
<th>Drums</th>
<th>Scope</th>
<th>Type</th>
<th>Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>Hunt Ref., USA</td>
<td>2 x 28'</td>
<td>Cutting system,</td>
<td>Electric / Remote</td>
<td>Extension</td>
</tr>
<tr>
<td>2008</td>
<td>C-Chem, Japan</td>
<td>2 x 21'</td>
<td>Cutting system,</td>
<td>Electric</td>
<td>Extension</td>
</tr>
<tr>
<td>2008</td>
<td>HMEL, India</td>
<td>4 x 30'</td>
<td>HDS,</td>
<td>Electric</td>
<td>New</td>
</tr>
<tr>
<td>2009</td>
<td>Statoil, Norway</td>
<td>2 x 26'</td>
<td>Cutting System,</td>
<td>Electric</td>
<td>Revamp</td>
</tr>
<tr>
<td>2009</td>
<td>SHELL CAPSA, Argentina</td>
<td>2 x 17'</td>
<td>Cutting System,</td>
<td>Electric / Remote</td>
<td>Revamp</td>
</tr>
<tr>
<td>2009</td>
<td>NOCL, India</td>
<td>2 x 28'</td>
<td>HDS</td>
<td>Electric</td>
<td>New</td>
</tr>
<tr>
<td>2009</td>
<td>MRPL, India</td>
<td>4 x 30'</td>
<td>HDS</td>
<td>Hydraulic</td>
<td>New</td>
</tr>
<tr>
<td>2010</td>
<td>Lukoil, Volgograd, Russia</td>
<td>2 x 30'</td>
<td>HDS</td>
<td>Electric</td>
<td>New</td>
</tr>
<tr>
<td>2010</td>
<td>IOCL, Paradip, India</td>
<td>4 x 32'</td>
<td>HDS</td>
<td>Hydraulic</td>
<td>New</td>
</tr>
<tr>
<td>2011</td>
<td>Naftan, FW Ib, Belorussia</td>
<td>2 x 28'</td>
<td>HDS</td>
<td>Electric</td>
<td>New</td>
</tr>
<tr>
<td>2011</td>
<td>PetroChina, China</td>
<td>2 x 31'</td>
<td>Jet Pump and DC-Valve</td>
<td>Electric</td>
<td>New</td>
</tr>
<tr>
<td>2012</td>
<td>NCRA, KS-USA</td>
<td>2 x 26'</td>
<td>HDS</td>
<td>Electric, Remote</td>
<td>New</td>
</tr>
<tr>
<td>2012</td>
<td>CPCL, India</td>
<td>2 x 32'</td>
<td>HDS</td>
<td>Hydraulic</td>
<td>New</td>
</tr>
<tr>
<td>2013</td>
<td>Lukoil, Perm</td>
<td>4 x 25'</td>
<td>HDS</td>
<td>Elec, Remote, Auto</td>
<td>New</td>
</tr>
<tr>
<td>2013</td>
<td>ERC-GS, Egypt</td>
<td>2 x 31'</td>
<td>HDS</td>
<td>Electric, Remote</td>
<td>New</td>
</tr>
<tr>
<td>2013</td>
<td>Tatneft, Russia</td>
<td>4 x 25'</td>
<td>HDS</td>
<td>Elec, Remote, Auto</td>
<td>New</td>
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<tr>
<td>2013</td>
<td>Antipinsk, Russia</td>
<td>2 x 23'</td>
<td>HDS</td>
<td>Elec, Remote, Auto</td>
<td>New</td>
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<tr>
<td>2014</td>
<td>IOCL, Bariuni, India</td>
<td>4 x 24'</td>
<td>HDS</td>
<td>Elec, Auto</td>
<td>New</td>
</tr>
<tr>
<td>2015</td>
<td>ExxonMobil, Antwerp, Belgium</td>
<td>4 x 32'</td>
<td>HDS</td>
<td>Electric, Remote</td>
<td>New</td>
</tr>
<tr>
<td>2015</td>
<td>Gazprom, Omsk, Russia</td>
<td>2 x 30'</td>
<td>HDS</td>
<td>Electric, Auto</td>
<td>New</td>
</tr>
<tr>
<td>2015</td>
<td>KNPC, Kuwait</td>
<td>4 x 27'</td>
<td>HDS</td>
<td>Hydraulic, (Auto)</td>
<td>New</td>
</tr>
</tbody>
</table>
Design and Calculation: Derrick
Operation remote
THANKS FOR YOUR ATTENTION