Coke Cutting Systems
for
Cokers in Cold Areas

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Area definition
Decoking Systems in Cold Areas

More and more Delayed Coking Units (DCUs) are built in cold ambient. All equipment including the Coke Cutting Systems have to meet these requirements.

The requirements are summarized as:

a) Ambient conditions
   - temperature ranges from +35°C / 95°F to -50°C/-59°F
   - sun, wind, rain, snow, ice, dust, humidity

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
   - CSA, ABSA
   - COSGORTECNADSOR
   - other local codes

In the project and design phase items a) and b) are most important and should be met first. c) and d) are important and should be met after a) and b) are met.

Decoking Systems in Cold Areas

RUHRPUMPEN classifies the Decoking systems into 3 classes:

- **Class I. area in warm temperatures**
  - T design > 0°C/ 0°F

- **Class II. area in medium temperatures**
  - Mech equipment Tdesign >-29°C/-20°F
  - Instruments Tdesign >-29°C/-20°F

- **Class III. area in low temperatures**
  - Mech equipment Tdesign >-45°C/-49°F
  - Instruments Tdesign >-50°C/-58°F

Cold Area

CA

Cold Cold Area

CCA
### Decoking Systems in Cold Areas

#### Version A, North America CCA

<table>
<thead>
<tr>
<th>Area</th>
<th>Equipment Description</th>
<th>Material Group</th>
<th>Instrument</th>
<th>Comments / Special Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump area</td>
<td>Pump house, heated, hazardous</td>
<td>Group II</td>
<td>Temp class II, ex</td>
<td>Local Building codes have to be met</td>
</tr>
<tr>
<td>Cutting deck</td>
<td>Sheltered, heated, hazardous</td>
<td>Group II</td>
<td>Temp class II, ex</td>
<td></td>
</tr>
<tr>
<td>Derrick</td>
<td>Open, Hazardous / safe (upper part)</td>
<td>Group III</td>
<td>Temp class III, Ex / non-ex</td>
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</tr>
<tr>
<td>Control room</td>
<td>Control house, safe</td>
<td></td>
<td>Temp class I, Non ex</td>
<td></td>
</tr>
</tbody>
</table>

### Decoking Systems in Cold Areas

#### Version B, North America CCA

<table>
<thead>
<tr>
<th>Area</th>
<th>Equipment Description</th>
<th>Material Group</th>
<th>Instrument</th>
<th>Comments / Special Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump area</td>
<td>Pump shelter, unheated, hazardous</td>
<td>Group III</td>
<td>Temp class II, ex</td>
<td>No Local Building code</td>
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<tr>
<td>Cutting deck</td>
<td>Sheltered, unheated, hazardous</td>
<td>Group III</td>
<td>Temp class II, ex</td>
<td></td>
</tr>
<tr>
<td>Derrick</td>
<td>Open, Hazardous / safe (upper part)</td>
<td>Group III</td>
<td>Temp class III, Ex / non-ex</td>
<td></td>
</tr>
<tr>
<td>Control room</td>
<td>Control house, safe</td>
<td></td>
<td>Temp class I, Non ex</td>
<td></td>
</tr>
</tbody>
</table>
Jet Pump

- Motor
- Lube oil system
- Decoking Control valve

Capacity: 272 m³/h
1200 gpm

Head: 3120 m
4500 psi

Speed: 3600 rpm

Temperature: 65 °C

Medium: Water with coke fines

Installation:
CCA, pump house
Material: Glass II

Jet Pump

Performance test
(RP-test field)
Full speed

Functional test:
(50 Hz)

- Jet Pump
- Motor
- Lube oil system
- Decoking Control valve

Capacity: 272 m³/h
3120 m

Speed: 3600 rpm

Temperature: 70 °C

Medium: Water with coke fines
Decoking Control Valve

- **Design**, rev 2005
  - Motor driven cam controlled spindle lift valve
  - Heavy duty design
  - Internal bypass orifice, non clogging type

- **Operation**, range
  - exact positioning and smooth operation
  - Pressure 415 bar (6 000 psi)
  - Flow 6x3 450 m³/h (2 000 gpm)

- **Control**
  - Encoder with position visualisation
  - Limit switch at main piston

- **Material**
  - CCA material class II or III
  - CA material class II

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Decoking Control Valve

**Operation**

Version 2005

- **Pressure** 300 bar
  4 500 psi (design 6 000 psi)

- **Flow, type 6x3**
  272 m³/h
  1 200 gpm (design 2 000 psi)

**Installation**

- CCA, pumphouse
- Material Class II
Cutting system: hoist and DSD

RUHRPUMPEN offers 3 versions:
- **Temp Class I.**
  - Hydraulic or electric driven Hoists
  - Hydraulic or electric driven Drill Stem Drives (DSD)
- **Class II.**
  - Hydraulic or electric driven Hoists
  - Hydraulic or **electrical** driven Drill Stem Drives
- **Class III.**
  - Hydraulic or **electric** driven hoists
  - **Electrical** driven Drill Stem Drives

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Cutting system: Hoist and DSD

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

  - 1 Operator panel (3 sections) per drum pair
  - Control electric/electronic for manual, remote / automatic operation
  - Integrated in PLC / DCS system
  - Measurement of force, tension, RPM of Drill Stem
  - Measurement of Tool position, Tool mode

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

HPU
- Hoist
- Drill Stem Drive
- Top deheading (Optional)
- Bottom deheading (Optional)

Hydraulic unit

- Driver
  - Electric motor
    - Power 60 kW
- Hydraulic Pump
  - Triple pump
  - Redundant inst.
- Hydraulic oil
  - Non flammable
Hoist, block and rope

- Hoist with integral cartridge gear
  - drum with grooves
  - Pull force 4.5 t
  - slack rope indicator
    - locks the hoist

- Rope
  - measurement of tension in the rope
  - indication at the operator panel
  - avoiding of overload

- Material class II

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Hoist, block and rope

- Hoist with integral cartridge gear
  - drum with grooves
  - Pull force 4.5 t
  - slack rope indicator

Break
  - 2 Elect/hyd breaks
  - 1 motor break
  - Overload protection

Material class III, CCA
- Explosion proof
Hoist, block and rope

- Hoist, electrical driven, cartridge gear
  - Pull force $F_{\text{max}} = 4.5$ t
  - Slack rope device

- Rope
  - Measurement of tension in the rope
  - Indication at the operator panel
  - Avoiding of overload

- Variable Frequency Converter
  - Installed in safe area

- Material class II CA
- Explosion proof

Crosshead w DSD

- Drill Stem Drive
  - Hydraulic driven

- Free fall Arrestor

- Pulley Block

- Gooseneck / Swivel

Material class II, CA
Drill Stem Drive

- Drill Stem Drive
  - Motor
  - Hydraulic, elect., pneum.
  - High load bearing
  - Grease lubrication
  - Cartridge packing
  - Swivel

- Material class III for CCA

Patent available

Drill Stem Drive

- Drill Stem Drive
  - Electric motor
  - High load bearing
  - Grease lubrication
  - Cartridge packing
  - Swivel

- Standard version
  (down to -20°C)

- Variable Frequency Converter VFC
  - At Cutting deck, or
  - At safe area
Crosshead with FFA

- Drill Stem Drive
  - Electric motor
  - High load bearing
  - Grease lubrication
  - Cartridge packing
  - Swivel
- Variable Frequency Converter VFD
  - At Cutting deck, or
  - At safe area
- Material Class III
- Explosion proof

HP - Water Hose

- HP – Hose
  - Flange 4” 2500 # RTJ
  - 4” ID
  - 6” OD
  - Min design T -45°C/-49°F
    - Water Temperature
    - 1°C to +120°C
- Material class III
  - due to integrated electrical heat tracing
**RP - Cutting Tool**

**Basic design**
- Slim tool, OD 13" 
- Low lift force 
- Low torque

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

**Valves**
- Ball shape valves 
- No seals 
- Pressure operated

**Nozzles, cutting**
- 0" or 10" up both cutting nozzles

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

Patent available

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**RP – Tool with Top deheading valve**

**Top - deheading**
- with Z&J double gate and purge valve
- Tool in working mode
- Size 36", 30", 24"
RP – Top deheading

Top - deheading

Guide plate ver3
- floating dome
  - Horizontal/vertical
- opening for venting
- 8" vent connection

Patent pending
RP - Top deheading

RP-system with
- ZJ 36" top valve
- Guideplate
- Dome
- Operatorhouse

Control system

Operator cubicle
- Operation in
  - heated
  - prewired
  - Fire resistant material
  - Safety glass
  - Round and top view
Control system

Local Operator panel
Operator deck
- Operation of
  - Decoking valve
  - Isolation valve
  - Hoist
  - Drill stem drive
- Interactive P&ID

Operator shelter, Canada

Deep temp version
- Fire safe material
- (T30 / T60)
- Safety glass
- Heated
- Prewired
Control system

- Local Operator panel
- Operator deck

Control and process visualisation
Control and process visualisation

Ruhrpumpen – References, systems

<table>
<thead>
<tr>
<th>Year</th>
<th>company</th>
<th>CA/CCA</th>
<th>drums</th>
<th>scope</th>
<th>type</th>
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</thead>
<tbody>
<tr>
<td>2001</td>
<td>Petroleras Ameria, Venezuela</td>
<td>CA</td>
<td>4 x 26&quot;</td>
<td>complete cutting system, hydraulic</td>
<td>new</td>
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<td>2002</td>
<td>BP-Gelsenkirchen, Germany</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>bottom deheading</td>
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<td>2004</td>
<td>Jinling, China</td>
<td>CA</td>
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<td>Jet Pump and Decoking Valve</td>
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<td>2005</td>
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<td>CCA</td>
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<td>2005</td>
<td>Enercon, Chile</td>
<td>CCA</td>
<td>2 x 29&quot;</td>
<td>complete cutting system</td>
<td>new</td>
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<tr>
<td>2005</td>
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<td>CA</td>
<td>2 x 17&quot;</td>
<td>cutting system, 36&quot; top deheading valves, semi-automated bottom deheading</td>
<td>revamp</td>
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<td>2006</td>
<td>BP Castillon, Spain</td>
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<td>2 x 25&quot;</td>
<td>complete cutting system</td>
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<tr>
<td>2006</td>
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<td>CA</td>
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<td>36&quot; top deheading valves</td>
<td>revamp</td>
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<tr>
<td>2006</td>
<td>Shiproc, CNOOC, China</td>
<td>CA</td>
<td>4 x 32&quot;</td>
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<td>new</td>
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<td>2007</td>
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<td>2007</td>
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<td>2007</td>
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<td>CA</td>
<td>2 x 26&quot;</td>
<td>Jet Pump and Decoking Valve</td>
<td>revamp</td>
</tr>
</tbody>
</table>

CA Cold Area, CCA Very Cold Area
Petroleras Ameriven

Hamaca
Venezuela

Licencor: FW
Contractor: Fluor Inelectra

Order: 2001-04
Start up: 2004-10

BP – ERE, Germany

BP - ERE
Germany
Licencor: FW
Contractor: BP, EDL-Germany

Scope:
Cutting system
Top deheading, ZJ automatic
Bottom deheading, semi-automatic

Order: 2003-12
Start up: 2004-10
TPIT for CNRL Canada

Horizon Oil Sands Canada
Licensor: ABB
Contractor: Technip Italy
Order 2005
Start up 2009, planned
Material class III, CCA

Bantrel for suncor, Can

Suncor, Voyageur Canada
Licensor: ConocoPhillips
Contractor: Bantrel, Calgary
Scope:
- Cutting system, 2 pumps, 6x32' drums
- Order: 2006-12
- Start up: 2011, planned
Material class III, CCA
THANKS FOR YOUR

ATTENTION