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Coking.com 2019

Coke Cutting Systems for India

Technology, experiences and lessons learned

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Dr. Wolfgang Paul,

RUH**RP**UMPEN



Introduction



Location: RuhRPumpen Witten, Germany

1950 Founded in Witten / Germany

Specialist for: API Process pumps API Pipeline pumps for Crudle Oil, Products, Water

- **1963** Part of THYSSSEN 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



RUHRPUMPEN Ruhrpumpen Business Units



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



Tulsa, USA Area: 28,000 m² Testing: 2,000 HP



Monterrey, Mexico Area: 14,370 m² Testing: 7,500 HP



Changzhou, China Area: 7,500 m² Testing: 6,000 HP

Rio de Janeiro, Brazil

Area: 7,500 m² Testing: 6,000 HP



Chennai, India Area: 7,500 m² Testing: 6,000 HP

Buenos Aires, Argentina

Area: 7,500 m² Testing: 1,500 HP



Orland, California Area: 2,500 m²

Suez, Egypt

Area: 2,280 m² Testing: 2,680 HP

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RUHRPUMPEN Area definition







RUHRPUMPEN Coker in India



Company	Location	Coke Drums
IOCL Bau1	Barauni	2 drum
IOCL Guw	Guwahati	2 drum
IOCL Bon1	Bongaigon	2 drum
IOCL Bon2	Bongaigon	2 drum
RIL DTA	Jamnagar	8 drum
NRL 1	Numaligarh	2 drum
IOCL Digboi	Digboi	2 drum
IOCL Pan	Panipat	4 drum
RIL SEZ	Jamnagar	8 drum
BORL Bina	Bina	2 drum
IOCL Guj	Gujarat	4 drum
HMEL	Bhatinda	4 drum
MRPL	Mangalore	4 drum
IOCL Par	Paradip	4 drum
Essar	Vadinar	6 drum
BPCL	Kochi	4 drum
CPCL	Chennai	2 drum
IOCL Bau2	Barauni	2 drum
RIL DTA	Jamnagar	2 drum
IOCL Hal	Haldia	2 drum

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RUHRPUMPEN Coke per drum







RUHRPUMPEN Project Schedule, Live cycle

Live cycle	years	
 Decision by owner and financing 	0	
• Licensor	1	
• EPC		
Purchasing		
 Long lead items 	4	
 Bulk material 		
Construction	6	
 Commissioning 		
Start up, start of operation	8	
– Warranty	10	
 Post warranty 	10 + 5	
Modernization and upgrade		





India

Projects with state own companies

No deviation bids JUST TECHNCIAL ACCEPTABLE, we don't pay a premium 100% according specification

Result

- Required technology with PTR is more than 10 years old
- Basic Requirements don't support deviations and improvements
- New technologies and improvements will be considered late
 - 1990 2000 acceptable
 - 2000 2010 changes in private companies influenced the state own sector
 - 2010 2020 moderate changes in specification
 - 2020 not according the fast growing demands of economy in India





RUHRPUMPEN Project Specification - Licensor

Mechanical Design

Instrumentation and Control

Jet Pump unit

- Design related to coke cutting system (API 610, 613, 614)
- Flow and Head defined very precise,
 - often without relation to detailed piping

Control System

- Licensor spec., basic
- PLC redundant,
- Basic Logic and Safety requirements

Cutting System

- Design spec. with basic requirement
 - Pneumatic / hydraulic / electric
- Basic spec. of CCS-components
 - Detail design responsibility by CCS vendor
 - NO definition of power of Cutting System

Instrumentation

- Project P&ID
 - Detailed design by CCS supplier





RUHRPUMPEN Project Specification - EPC

Mechanical Design

Jet Pump unit + auxiliaries

- 1. Design acc. API 610, 613, 614
- 2. Client specification
- 3. EPC specification (- no deviation)
- 4. Manufacturer standard / Experience

Instrumentation and Control

Control System

- Licensor spec.
- Client specification
- EPC requirement
 - High safety -> QMR/TMR
 - SIL rated (Safety) PLC

Cutting System

- No deviation
 - All components to 1.- 3.
- Special components
 - NO detail definition
 - ie:Auto-Tool, CH-FFA, hoist, HPU, VFD

Instrumentation

- No deviation
 - All components to 1.- 3.
 - All to AVL (App-Vendor-List)
- 100% to licensor P&ID



RUHRPUMPEN Project execution - Supplier

Mechanical Design

Jet Pump unit

 acc. Licensor / EPC and Decoking Service requirements

Cutting System

- Main differences
 - Power, Features
- Hoists
- Drill Stem Drives, RJ
- Crosshead and FFA
 - Free Fall Arrestors
- Cutting Tool
 - Important is pressure at the Tool

Instrumentation and Control

Control System

- Licensor and EPC spec.
- PLC redundant
- Safety requirements by Licensor
- Logic by supplier
 - System responsibility
- Data analysis

Instrumentation

- Project P&ID
- RP improvements
 - Additional instruments





RUHRPUMPEN Power of Cutting System

Power Cutting System related to drum size and jet pump power







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Development of Technology



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Development of Technology









Ruhrpumpen to Owner / PMC / EPC

Cutting System Drive

Electrical

- technical and commercial advantages
 - costs for hydraulic or electric systems are equal
 - total costs are lower
 - cabling is much cheaper than piping
 - less risk

Live cycle costs

- maintenance costs are much lower with electrical equipment
- no oil consumption, no oil treatment

Benefits have not been balanced to the supplier







Supply of Ruhrpumpen to Projects in India

Cutting System	
Crosshead	Wheel type
Free Fall Arrestor	Rail type system, certified as elevator component
Control System	Monitors at Pumps and Cutting deck with interactive P&IDs
Tool	Automatic Drilling / Cutting Tool

Most of the features are now standard feature because they were just implemented not specified





RUHRPUMPEN RP improvements

Projects in India with RP influence

RIL II
IOCL Gujarat
HMEL

- MRPL
- NOCL
- **IOCL Paradip**
- **IOCL** Barauni
- CPCL
- **IOCL** Haldia

- Hydraulic driven cutting system
- Spec. change to hydraulic driven cutting system
- Cutting System with 5t/20t pullforce of hoist/Crosshead
- first electrical driven cutting system in India
- designed for remote and automatic operation
- Hydr. Cutting System with 5t/20t pullforce of hoist/Crosshead
- Electrical Cutting System with 5t/20t pullforce of hoist/CH
- Hyd Cutting System with 5t/20t pullforce of hoist/Crosshead
- Electrical Cutting System with 5t/20t pullforce of hoist/CH
 - Hydraulic Cutting System with 5t/20t pullforce of hoist/CH
- Electrical Cutting System with 5t/20t pullforce of hoist/CH

Since than, all Cutting Systems are specified electrical driven





<u>Example</u>

- Licensor pid : "detail design according Coke Cutting System supplier" PMC : "no deviation to licensor pid"
- EPC : "Deviation with approval of PMC only"

Piping:

- Suction Line
 - 2 Jet Pump installation
 - Jet Pump: Suction flange and area with MAWP
- Discharge Line
 - Size of discharge line



Project Situation, Pump arrangement

<u>India</u>

- Project: all projects are designed with TWO PUMP arrangement increase of reliability of coker
- Licensor : Suction and Discharge design to full MAWP
- EPC : Deviation only with approval of PMC and licensor

Problem:

- Full pressure suction line
- Reduced inside, effective diameter
- Suction pressure instrumentation away from the suction flange Situation
- Pressure drop in pump suction is much higher then measured

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Coker Client 1 private









Client 1 Jet Pump area

 2 Pumps installed
 Jet Pump unit sheltered













Client 1 Jet Pump area

2x Jet Pumps installed

- Sheltered

Suction Line

- Low Pressure
- High Pressure

Tank

- Suction Inlet Basket









India: Client 1 Start up 2010 Problem: Cavitation Investigation of Tank Suction Line Pump



Result:

Change of

- Suction Line
- Suction Basket
- Pumps run ok









Coker	Client 5	
	state owned	
Drum	4	
Dia	max	
FF	max	
Pump	2	
Flow	max	
Pressure	max	







India: Installation 2015









India: Suction Line Investigation Start up 2017 Check 2018







RUHRPUMPEN Ruhrpumpen Issues

<u>Ruhrpumpen</u>

Project bid: according spec, but lowest costs and high competitive situation

Selection of suppliers :

start 2000	castings for pump internals from Germany
2005 - 2010	castings, high quality, from SK
2010 - 2015	castings from low cost foundry, country 1
2015 - 2019	castings from low cost foundry, country 2
2019 -	castings from high quality foundry, country SK

RP had to develop the low cost supplier

this was painful

long time of correction due to project schedule

Meanwhile the quality of casting is good, acceptable and acc. RP spec





Project

Specification:

no definition of pullforce nor lifting system no relation to size of coker

Ruhrpumpen has always provided the strong Cutting / Lifting System

according Ruhrpumpen standard, above requirements, 5 t / 20 t Lift System, 0 to high speed accepted by all parties, because on RP costs

Lessons learned

we did not went away from our high standard for cost savings we want to keep high performance and high reliability



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India: Client 4 Cutting Deck

- Hoist
 - electrical driven
 - slack rope device
 - 3 brake system
 - safety cage
- full baseframe

Capacity pull force hoist 5 t pull force at tool 20 t pull speed 0 – 1 m/s

Operation

- local
- (remote / auto)







RUHRPUMPEN Crosshead with DSD



Client 4 Derrick

Crosshead wheel type Free Fall Arrestor

Meeting larger tolerances in derricks compared to shoe type crossheads

Drill Stem Drive

- electrical driven
- No oiled main bearing

All weather protected







RUHRPUMPEN Automatic Cutting Tool

Basic design

- Slim tool, OD 13"
- Low lift force, low torque
- Switching devices
- Mode Indicator
 - At the top of the tool
- Valves
 - No seals
 - Pressure operated
- Nozzles, cutting
 - 0° / 0°
- Nozzles, drilling
 - 1 strong centre nozzle
 - 3 periphery nozzles

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<u>Ruhrpumpen</u>

Project bid: according spec, with acceptable costs with additional features

RP has increased level of Control System and Operation

acc. RP standard, above requirements
monitors with all available data and information
interactive P&ID's
high acceptance by all operators
ready for remote and auto cutting, even when not specified

Meanwhile, most of the features are standard for Coke Cutting Systems





Client 4 Operator cubicle



Operation in

- heated
- prewired
- Fire resistend material
- Safety glass
- Round and top view







Operator Panel

Control building

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<u>System Design</u>

Target: Mechanical System on high safety level of the entire system Create a Standard NOT JUST TECHNICAL ACCEPTABLE

> Discuss with Licensors to implement improvements Convince Final Clients about benefits of additional features EPC's go for low costs, EPCs don't implement advantages provide costs savings to EPC

RUHRPUMPEN: Complete System responsibility out of one hand

Design: Strong mechanical system with double mechanical safety Control System is just to operate the mechanical system. It cannot balance mechanical weakness.

Costs Don't go to the lowest cost level.







Coke Cutting System

Design: Modification of RP standard to specific needs of Indian Clients

Discussion, relation and contacts on high level with Client with high expertise and experiences in coker business EPC's with very good knowledge to meet local requirements It is necessary to understand Indian mentality

RUHRPUMPEN:

we formed a strong relation to our clients System responsibility not only in good times

- Start: We started to work out of Germany, but now
- Actual: RUHRPUMPEN INDIA with manufacturing facility in Chennai growing support team for coker

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THANKS FOR YOUR ATTENTION

Questions?

