



*Specialist for Pumping Technology*

**Session 22 –  
Coking Process &  
Hydraulic Decoking  
Equipment**

*Simon Smith March 2023*





# Presenter Profile – Simon Smith

Simon graduated with an honours degree in Chemical Engineering from the University of Surrey in 1978 and began a long career in the engineered pump industry spanning 40 years (so far!) with Peerless Pump, BW/IP International / Flowserve, SPP Pumps, Ruhrpumpen and Ebara Cryodynamics.

Over his long career he has filled various roles as Applications Engineer / Manager, Project Manager, Key Account Specialist, Vertical Pump Product Specialist, International Sales Engineer / Manager / Director and he has considerable experience in Training & Mentoring young engineers.





# RuhrPumpen Short Courses

Here is a listing of all the previous courses.

- No 1 – API610 12th v 11th editions
- No 2 - Curve Shape
- No 3 – The Importance of System Curves
- No 4 - Selecting the Right Pump for the Application
- No 5 - NPSH & Nss
- No 6 - Mechanical Seals & Systems
- No 7 - Firepumps
- No 8 - BB5 Barrel Pumps
- No 9 - Pump Instrumentation
- No 10 – Non-Destructive Examination
- No 11 - Vertical Pumps (Part 1) Type VS1, VS2, VS3
- No 12 – Vertical Pumps (Part 2) Type VS4, VS5, VS6 & VS7
- No 13 – Performance Testing of Centrifugal Pumps; the What, the Why & the How
- No 14 – Testing & Inspection of API 610 Pumps
- No 15 – Start-Up, Commissioning & Troubleshooting Centrifugal Pumps
- No 16 – Introduction to Positive Displacement (Plunger) Pumps
- No 17 – Refresher Session
- No 18 – Overhung Process Pumps OH1 & OH2
- No 19 – Vertical Overhung Process Pumps OH3-OH6
- No 20 – New Developments in the VS6 Market
- No 21 – BB4 Multistage Pumps for the Power Industry

Any you have missed you can get from our website using this link <https://short-courses.ruhrpumpen.com/>

Or from [www.ruhrpumpen.com](http://www.ruhrpumpen.com) and follow the link to [RP Short Courses](#)



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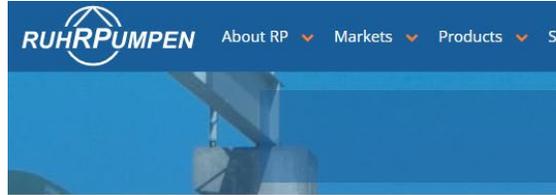
Ruhrpumpen is an innovative and efficient pump technology company that offers highly-engineered and standard pumping solutions for the oil & gas, power generation, industrial, chemical and water markets. We offer a broad range of centrifugal and reciprocating pumps that meet and exceed the requirements of the most demanding quality specifications and industry standards such as API, ANSI, ISO and Hydraulic Institute.

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### SHORT COURSE 3

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Full session.

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### SHORT COURSE 8

## Double Case Pumps (Barrel Pumps - BB5).

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### SHORT COURSE 9

## Understanding pump instrumentation.

Full session.

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### SHORT COURSE 10

## Non-Destructive Examination (NDE).

Full session.

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# Session 22 – Coking Process Overview & Hydraulic Decoking Process & Equipment

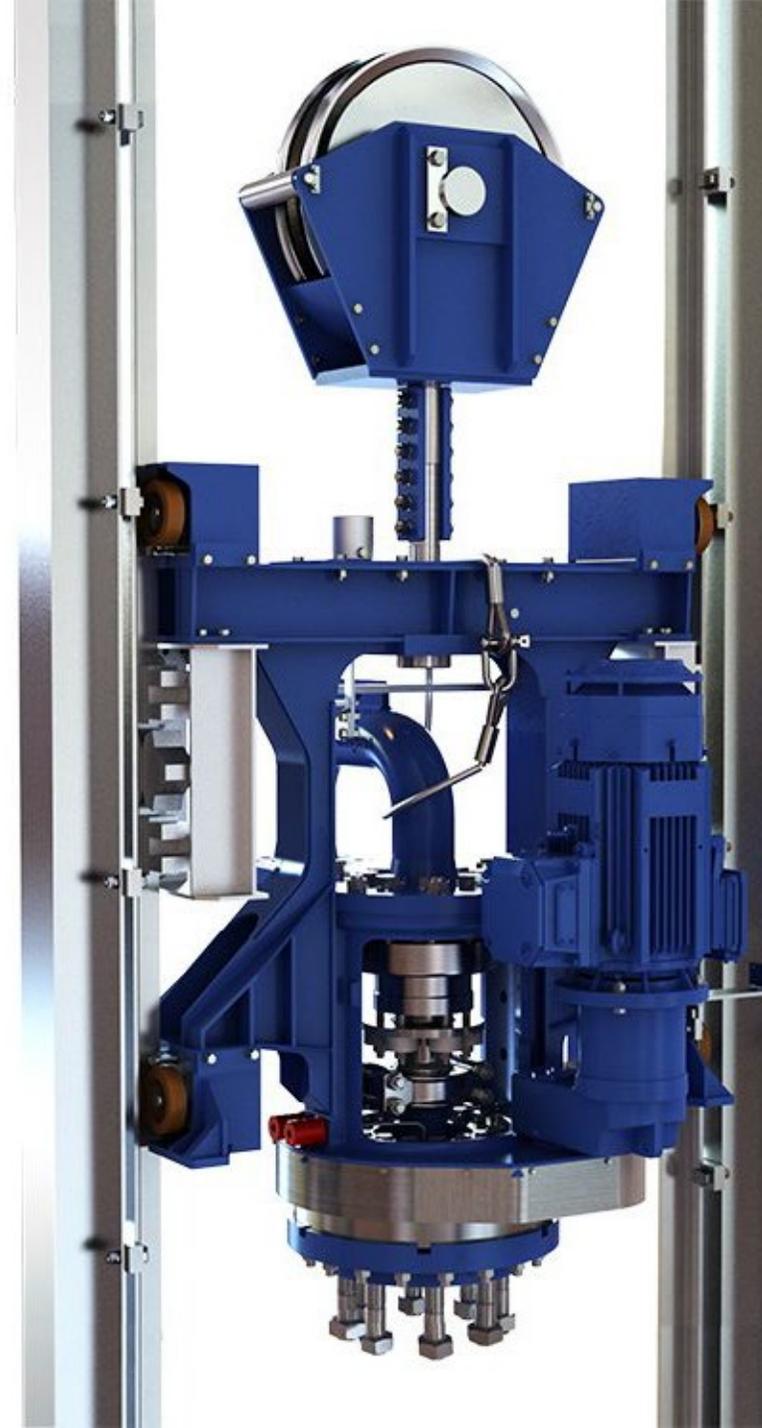
*This short course will look at the Coking Process in Refineries as an overview and will look in detail at the Decoking Systems that Ruhrpumpen has developed and is now the market leader in their design and supply.*

*Aimed at Process and Mechanical Engineers, and Consultant Engineers who specify pumping equipment as well as Applications & Sales Engineers selecting and quoting them*

*Source Material – RP Decoking Team with special support from John Wong – Ruhrpumpen Decoking Specialist, Los Angeles*

# Agenda

- Delayed Coking
- Installation References
- Jet Pump Unit
- Cutting System
  - Hoist & Pulleys
  - Crosshead with Free Fall Arrestor
  - Drill Stem Drive
  - Cutting Tool (Drilling/Cutting)
- Control System





# Introduction

## Ruhrpumpen Today

- 2000 Start of Hydraulic Decoking Systems
- Witten, Germany – Heart of Decoking Operations
- Service Centers and Distribution Centers Worldwide



# Delayed Coking

## Coking and Decoking Processes



A delayed coker is a type of coker whose process consists of heating a residual oil feed to its thermal cracking temperature in a furnace with multiple parallel passes. This cracks the heavy, long chain hydrocarbon molecules of the residual oil into coker gas oil and petroleum coke.

Delayed coking is one of the unit processes used in many oil refineries. The adjacent photograph depicts a delayed coking unit with 4 drums. However, larger units have tandem pairs of drums, some with as many as 8 drums, each of which may have diameters of up to 10 meters and overall heights of up to 43 meters.

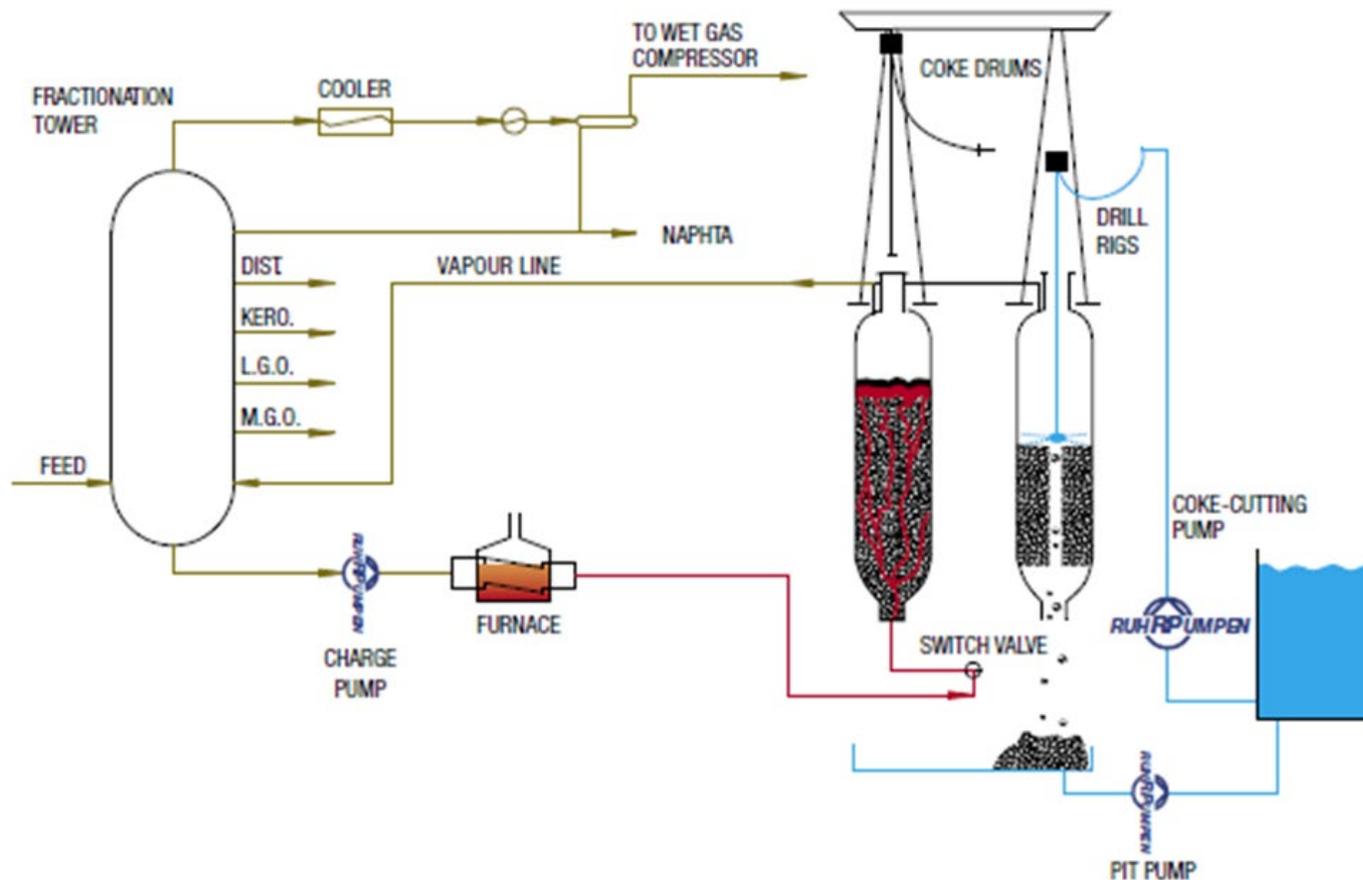
The yield of coke from the delayed coking process ranges from about **18 to 30 percent by weight** of the feedstock residual oil, depending on the composition of the feedstock and the operating variables. Many refineries worldwide produce as much as **2,000 to 3,000 tons per day** of petroleum coke and some produce even more.



# Delayed Coking

## Coking and Decoking Processes

COKER-DECOKER-ARRANGEMENT

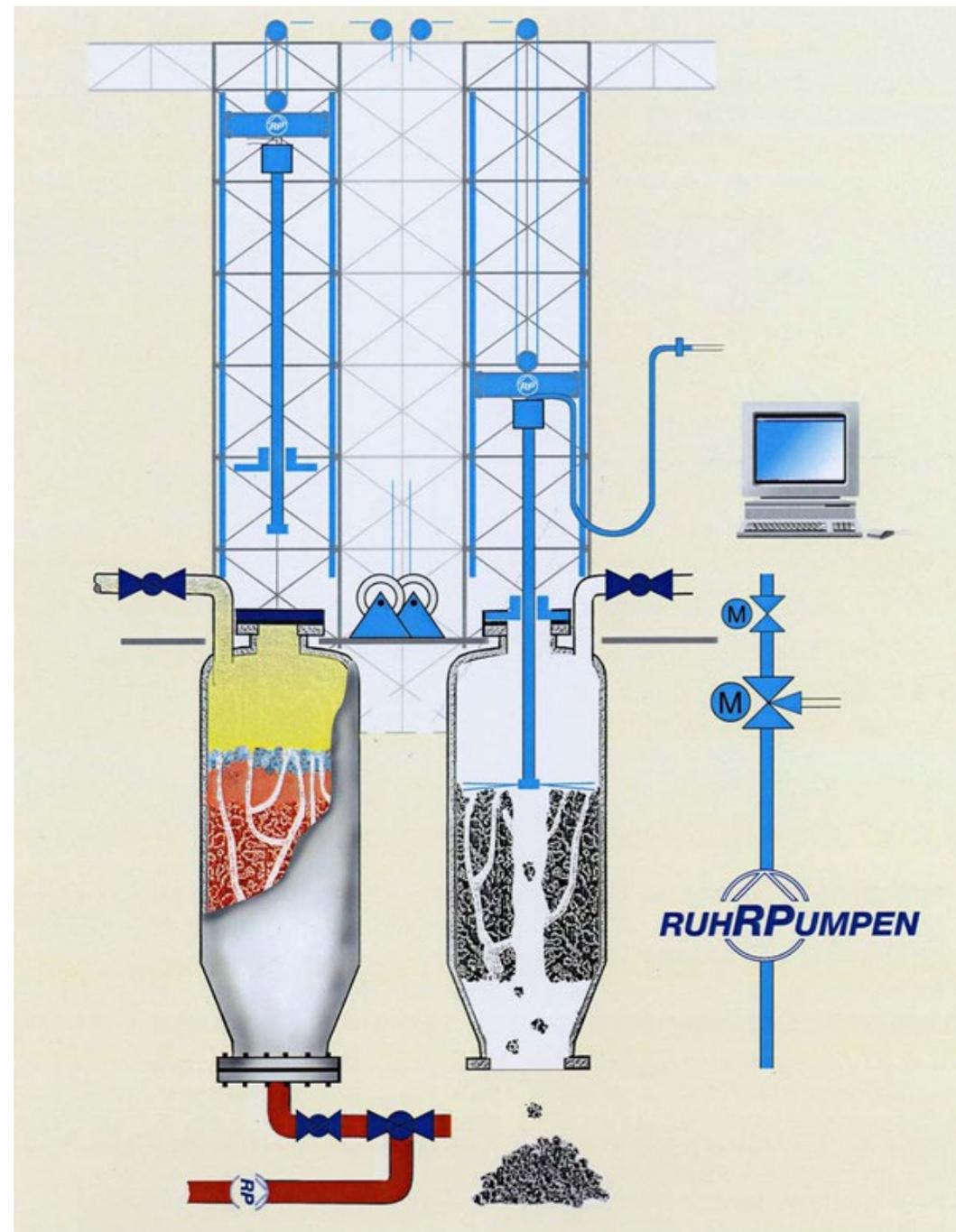


- Delayed Coking
  - Formation of coke from residuum is delayed, occurring in the drum
- Decoking
  - Removal of petroleum coke
- Hydraulic Decoking
  - Removal of coke by hydraulic (water) power

# Delayed Coking

## Batch Process

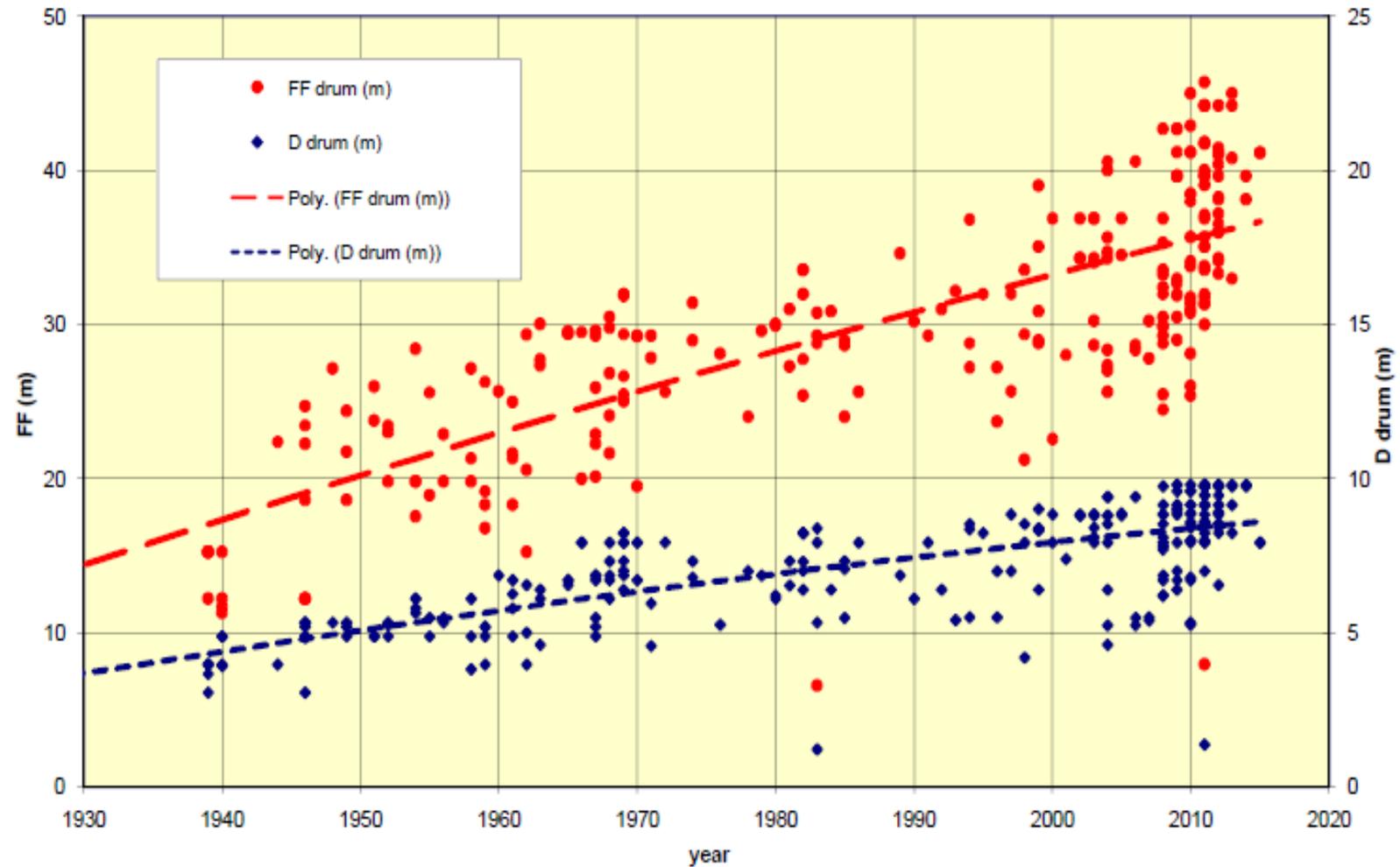
- Decoking Jet Pump
- Lifting System (Drilling / Cutting)
- Control System
  - Operation of System
    - By operator (local or remote)
    - By PLC (Programmable Logic Controller)
  - Protection for
    - Operator
    - Decoking System





# Delayed Coking

## Trend in Coke Drum Size





# Installation References

REFERENCE LIST - DECOKING SYSTEM February 2023									
No.	Constr.	Commissioning	Final Customer			Cutting System Type		Drum No.	Pump No.
			Country	Company	City				
<b>RUNNING</b>									
1	2002	2004	Venezuela	Petroleras Ameriven	San Jose	hyd.	manual	4	1
2	2003	2004	Germany	BP-Gelsenkirchen	Gelsenkirchen	el.	manual / automatic	4	
3	2003	2004	Germany	BP-Gelsenkirchen	Gelsenkirchen	hyd.	manual	4	1
4	2003	2004	Germany	BP-ERE	Lingen	hyd.	manual	2	2
6	2004	2004	China	Jinling	Nanjing	local		2	1
7	2004	2005	Venezuela	Petroleras Ameriven	San Jose	hyd.	manual		1
8	2005	2006	China	Jinling	Nanjing	local		2	1
9	2005	2008	Canada	CNRL	Ft McMurray	hyd./el.	manual	4(6)	2
10	2005	2008	Chile		Concon	hyd.	manual	2	1



# Installation References

RUNNING									
11	2005	2005	Germany	BP-ERE	Lingen	hyd.	manual	2	2
12	2006	2008	Spain	BP-Castellon	Castellon	hyd.	manual	2	1
13	2006	2007	USA	Sinclair Oil	Wyoming	hyd.	manual	2	
15	2007	2008	China	Hiuzhou	Hiuzhou	local	manual	4	2
16	2007	2008	USA	Frontier Refinery	Kansas	el.	remote	1	1
17	2007	2008	Germany	OMV	Burghausen	pneumatic /hyd.		2	2
18	2007	2010	Russia	Rosneft	Komsomolsk	el.	manual	2	1
19	2007	2009	Russia	Lukoil	Volgograd	el.	manual	3	1
21	2007	2009	Japan	C-Chem	Kita-Kyushu	el.	manual	2	1
23	2008	2011	India	HMEL-GGSR	Bhatinda	el.	manual	4	2
24	2008	2010	USA	Hunt Refining	Alabama	el.	remote	2	1
25	2009	2011	Norway	StatoilHydro	Mongstad	el.	manual	2	1
26	2009	2010	Argentina	Shell	Buenos Aires	el.	remote	2	1
28	2009	2014	India	MRPL	Mangalore	hyd.	manual	4	2
30	2010	2012	Russia	Lukoil	Volgograd	el.	manual	2	2



# Installation References

RUNNING									
31	2010	2013	India	IOCL	Paradip	hyd.	manual	4	2
32	2011	2021	Belorussia	Naftan	Novopoletsk	el.	manual	2	1
33	2011	2013	China	PetroChina, Jinzhou	Jinzhou			2	1
34	2013	2016	India	CPCL	Chennai	hyd.	manual/ automatic	2	2
35	2011	2012	Korea	OCI	Seoul	el.	manual	3	1
36	2011	2013	USA	NCRA	Kansas	el.	remote	2	1
37	2013	2016	Russia	Lukoil	Perm	el.	remote/ automatic	4	1
38	2013	2019	Egypt	ERC	Cairo	el.	manual	2	1
39	2013	2016	Russia	JSC Tatneft	Nizhnekamsk	el.	remote/ automatic	4	1
40	2013	2016	Russia	JSC Antipinski	Tyumen	el.	remote	2	1
41	2013	2016	Kazakhstan	Kazmunaigas	Pavlodar	el.	manual	3	1
42	2014	2016	India	IOCL	Barauni	el.	manual/ automatic	2	2
43	2014	2018	Belgium	ExxonMobil	Antwerp	el.	manual/ automatic	4	1
44	2015	2022	Russia	Gaspromneft	Omsk	el.	manual/ automatic	2	1

# Installation References

45	2015	2020	Kuwait	KNPC	Kuwait	hyd.	manual/ automatic	4	2
46	2016	2019	Poland	LOTOS	Gdansk	el.	manual/ automatic	2	1
48	2016	2020	India	IOCL	Haldia	el.	manual	2	2
50	2017	2017	Germany	Miro	Karlsruhe	hyd.	manual	2	1
51	2018	2018	USA	Chevron	Pascagoula	hyd.	manual	2	
52	2018	2018	Germany	OMV	Burghausen		manual	2	1
54	2018	2022	Russia	Lukoil	Kstovo	el.	remote/ automatic	4	1
56	2019	2021	Russia	JSC Tatneft	Nizhnekamsk	el.	remote/ automatic	4	1
<b>UNDER COMMISSIONING</b>									
47	2016	2023	Venezuela	PDVSA Petropiar	Jose Barcelona	el.	manual	4	1
49	2016	2023	Russia	Bashneft	Ufa	el.	remote	4	1
55	2018	2023	Oman	DRPIC	Duqm	el.	remote/ automatic	4	1
57	2019	2023	Mexico	PEMEX	Paraiso	el.	remote	6	2
58	2020	2023	Croatia	INA - INDUSTRIJA NAFTE	Rijeka	el.	remote	2	1

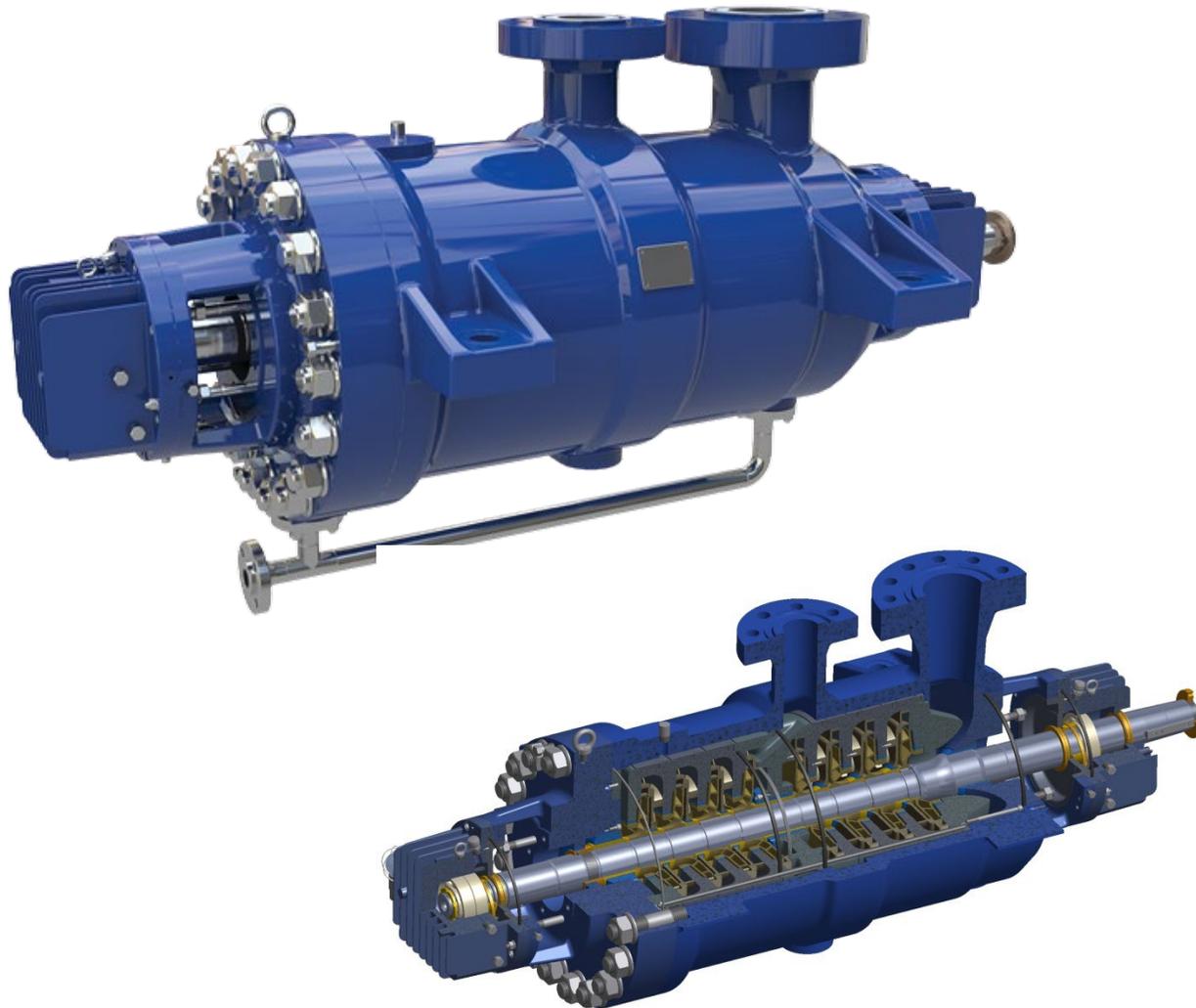
# Installation References

UNDER MANUFACTURING									
59	2020	2023	India	HRRL	Pachpadra	el.	remote	4	2
60	2021	2023	Romania	Petrotel Lukoil	Ploiesti	el.	manual	4	1
61	2022	On Hold	Russia	Slavneft - YANOS	Jaroslavl	el.	manual / automatic	4	1
62	2022	2023	Romania	OMV Petrom	Ploiesti	el.	manual	4	1
63	2022	2024	India	IOCL	Barauni	el.	manual	2	2
64	2022	2024	Romania	Rompetrol	Constanta	el.	manual	4	1



# Jet Pump Unit

## Decoking Jet Pump Design



- Horizontal, BB5 barrel pump
- Forged steel barrel (Std. C-6)
- Cartridge design – Easy change out
- Radially split casing
- Designed acc. to API 610
- Balance drum
- Sleeve bearings (forced oil)
- Flanges: Top/Top, Side/Top, Side/Side
- In-line impeller design
- Back-to-back impeller design



# Jet Pump Unit

## Double Case Pump Type BB5

We covered the detailed design and features of BB5 pumps in a previous session (Session 8)

You can download the Video and the Slideshow PDF from our Webpage

Go to [www.Ruhrpumpen.com](http://www.Ruhrpumpen.com)

Follow the top menu link to “RP Short Courses” and find Session 8



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### **Session 8 – Double Case Pumps (Barrel Pumps – BB5)**

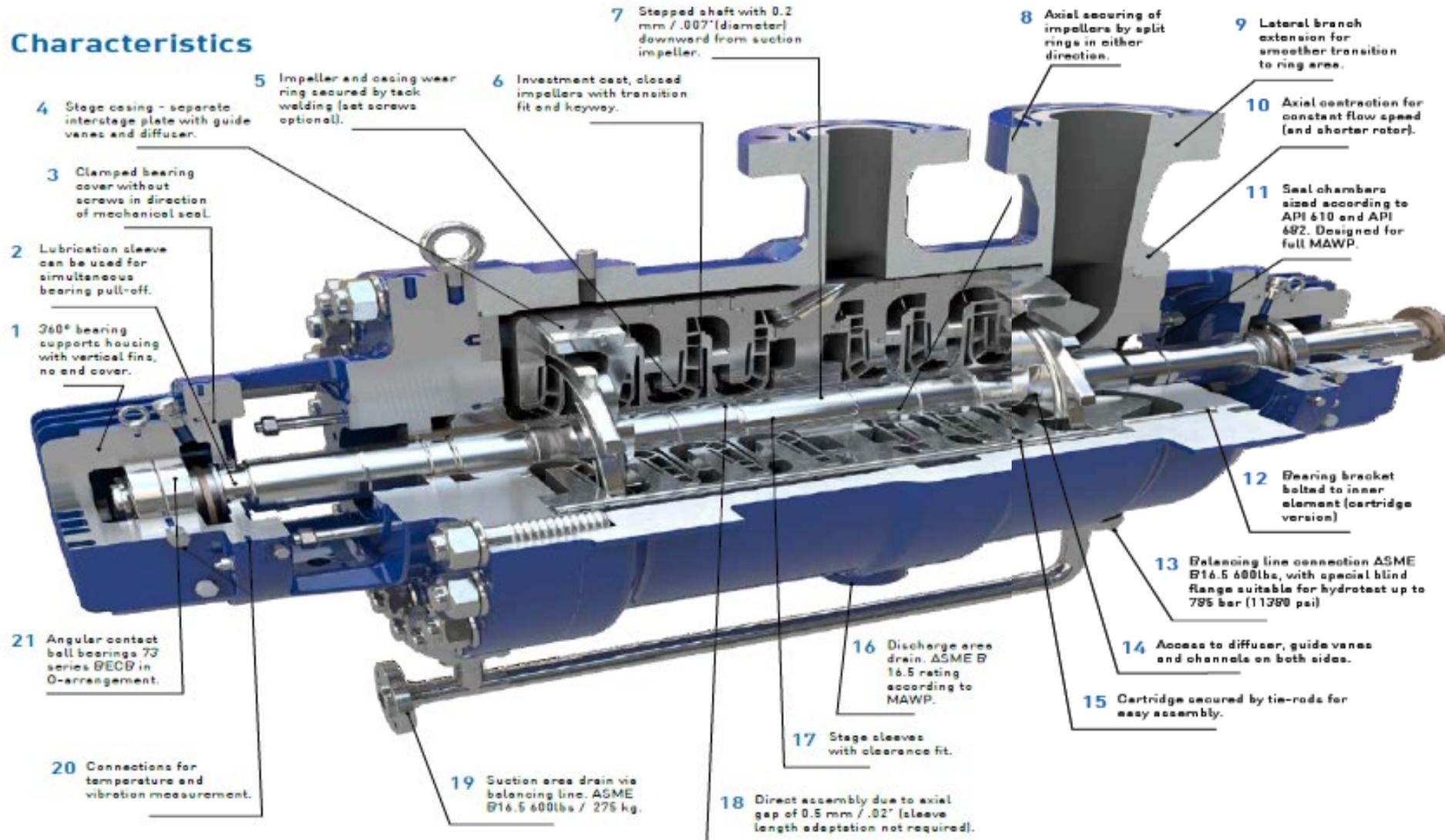
*Simon Smith October 2021*





# Double Case Pump Type BB5

## Characteristics

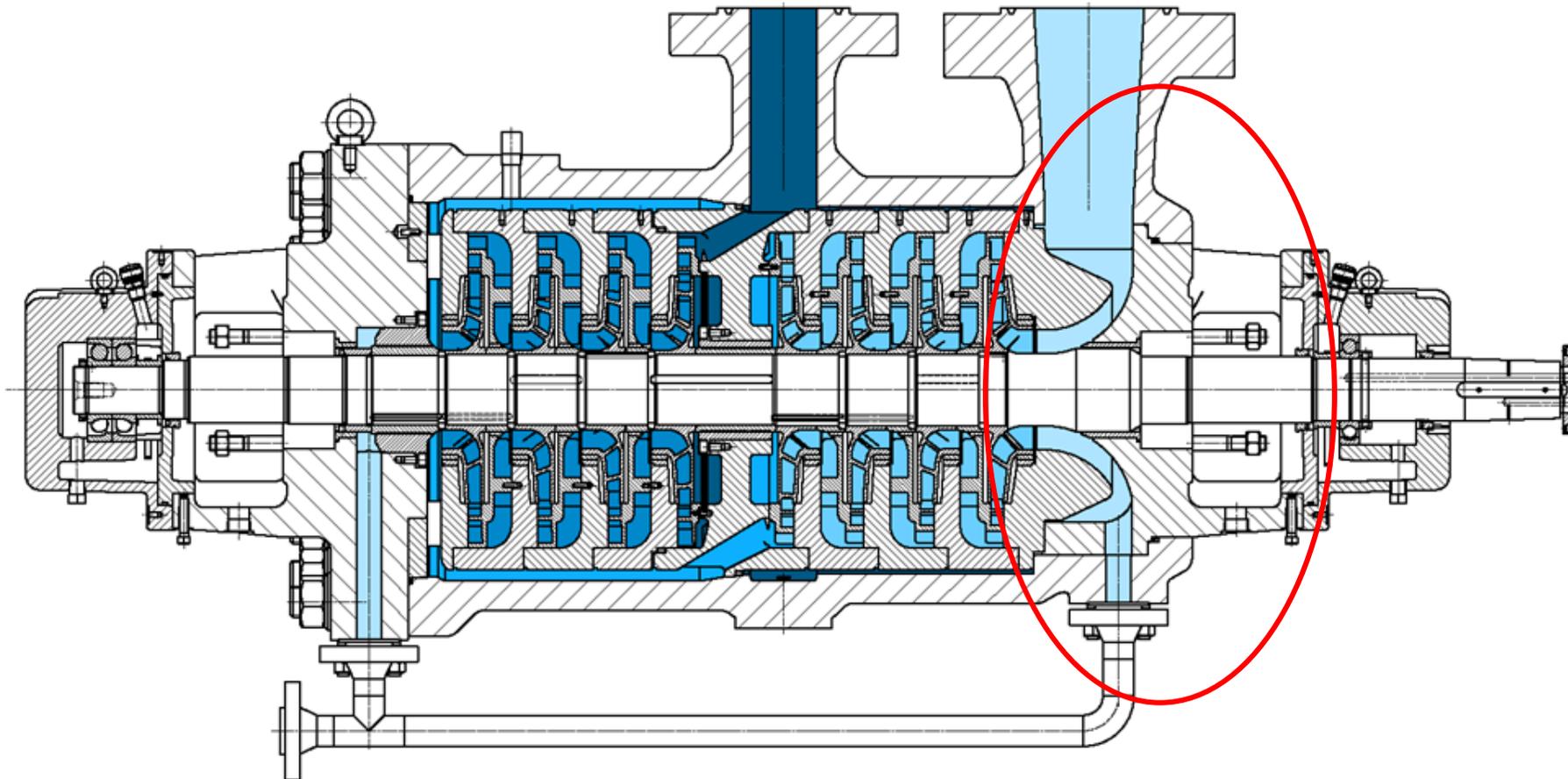




# Double Case Pump BB5

## Complete Pullout Design

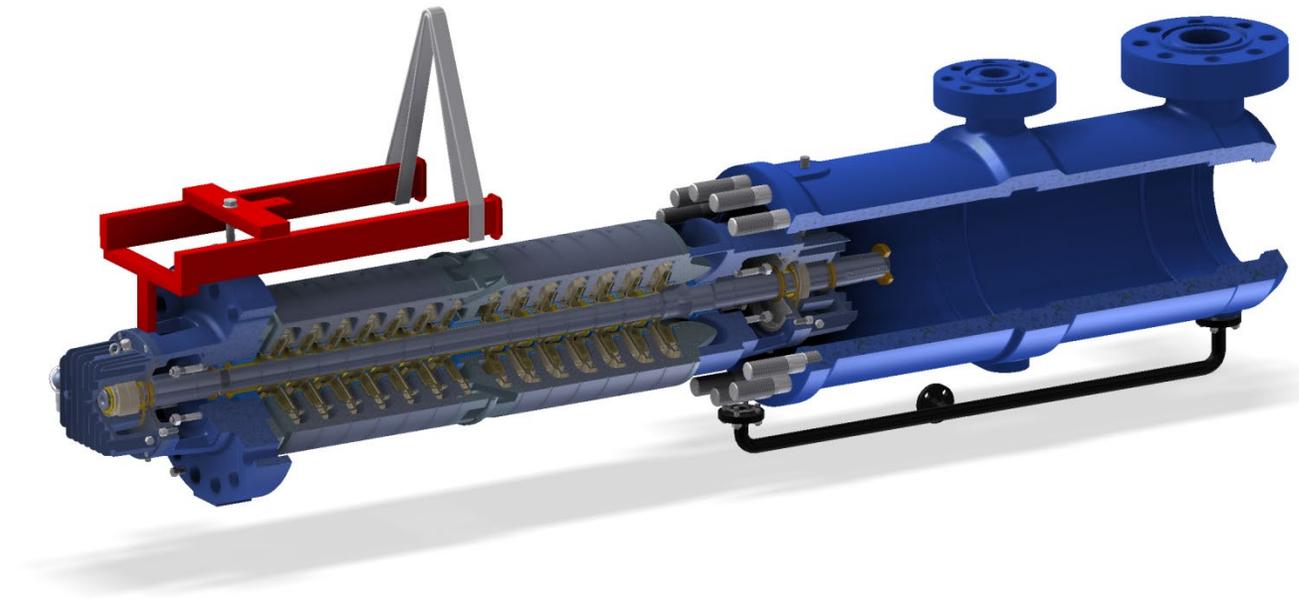
Separate suction cover, which is mounted on inner element – Advantage Full pullout design. No disassembly required before cartridge removal





# Cartridge Installation / Removal

Complete Pullout Design

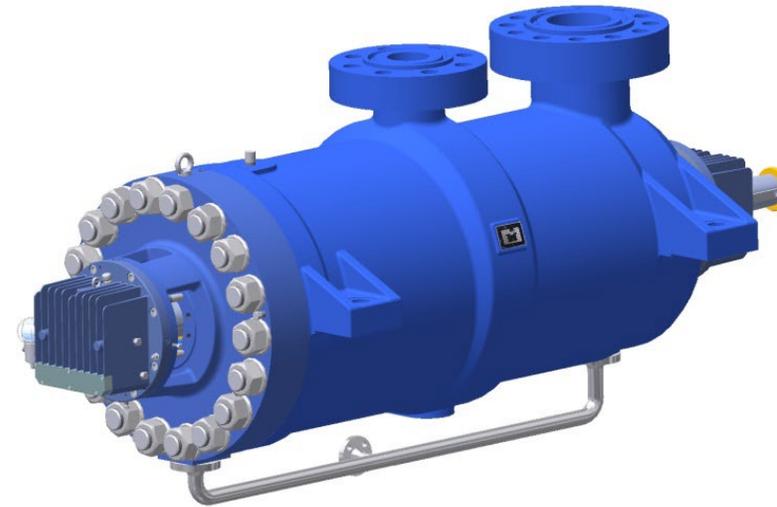
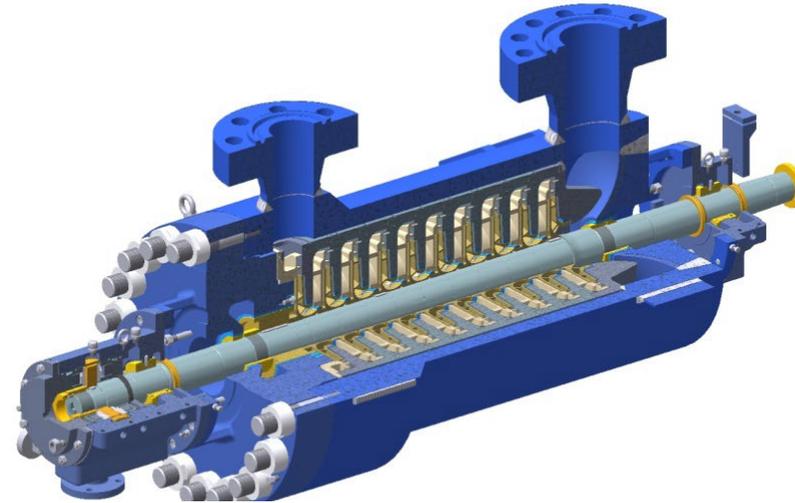




# Jet Pump Unit

## Decoking Jet Pump Design

- Performance
  - Capacity, up to 350 m<sup>3</sup>/h (1541 gpm)
  - Head, up to 4000 m (13,123 ft)
  - Pressure, up to 400 bar (5802 psi)
  - Speed, up to 4500 rpm





# Jet Pump Unit

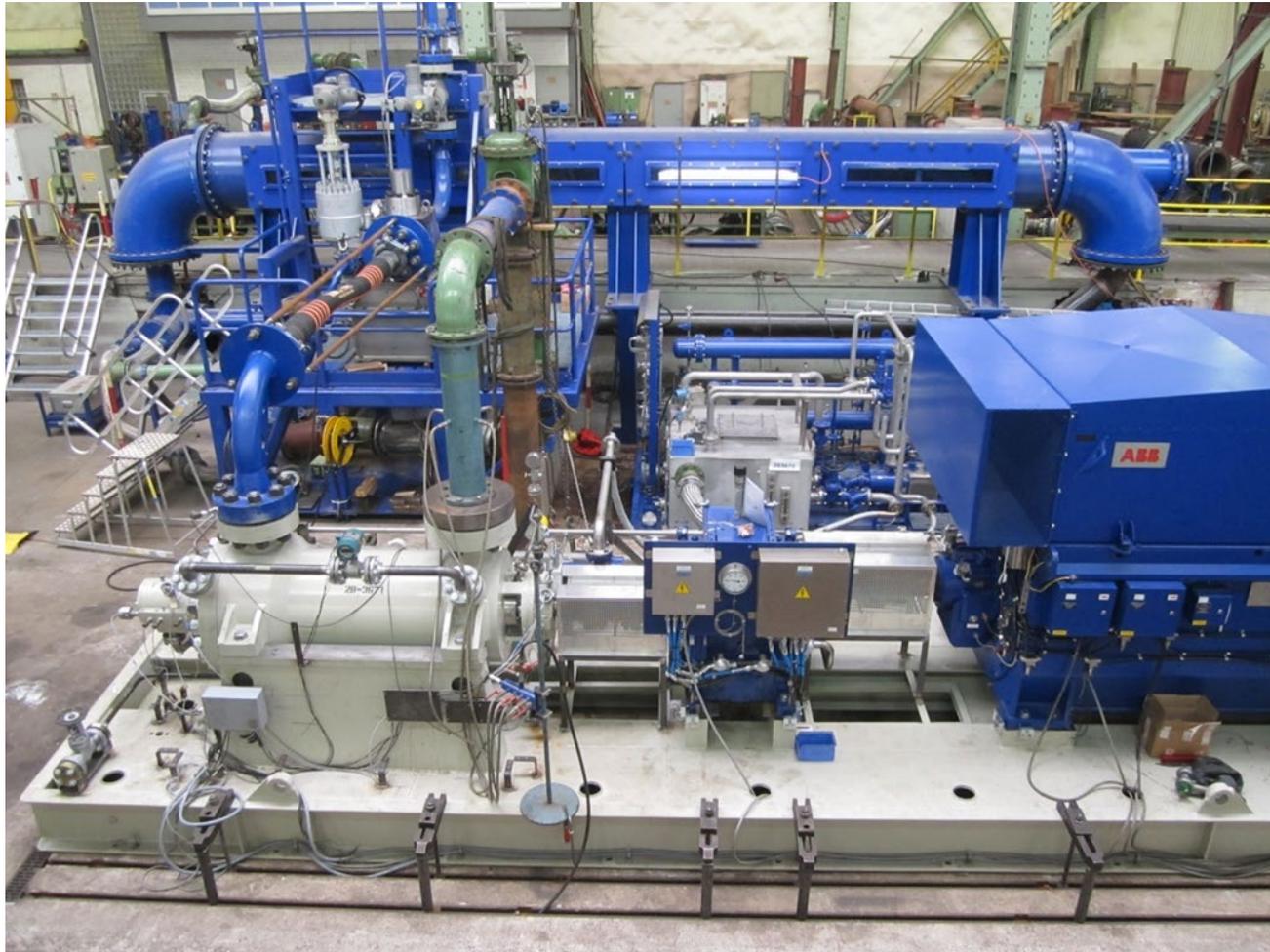
## Decoking Jet Pump Manufacturing



- Horizontal, 10-stage, single suction, BB5 barrel pump
- Ruhrpumpen ADC 6x10
- Hydraulic decoking system
- Performance
  - Capacity 312 m<sup>3</sup>/h (1374 gpm)
  - Head 3436 m (11,273 ft)
  - Temperature 90 °C (194 °F)
  - Medium: Water with coke fines

# Jet Pump Unit

## Complete Unit Testing of Jet Pump Skid



- Functional Test
  - Jet pump
  - Motor
  - Lube oil system
  - Decoking Control Valve
  - Cutting Tool (CT)
- API 610, 11th Ed, Sect 6.1.26, ...pump and driver shall perform on test stand and permanent foundation within vibration criteria specified in 6.9.3...
- Pump skid on “massive” foundation, not raised up on temporary supports



# Jet Pump Unit

## Complete Unit Testing of Jet Pump Skid



- Lube oil skid sunken to allow for gravity flow back to oil reservoir
- Full-speed Performance Test
- Observation windows for CT
- Spray pattern and force measurement
- Accurately simulates field conditions



# Jet Pump Unit

## Decoking Jet Pump in the Field

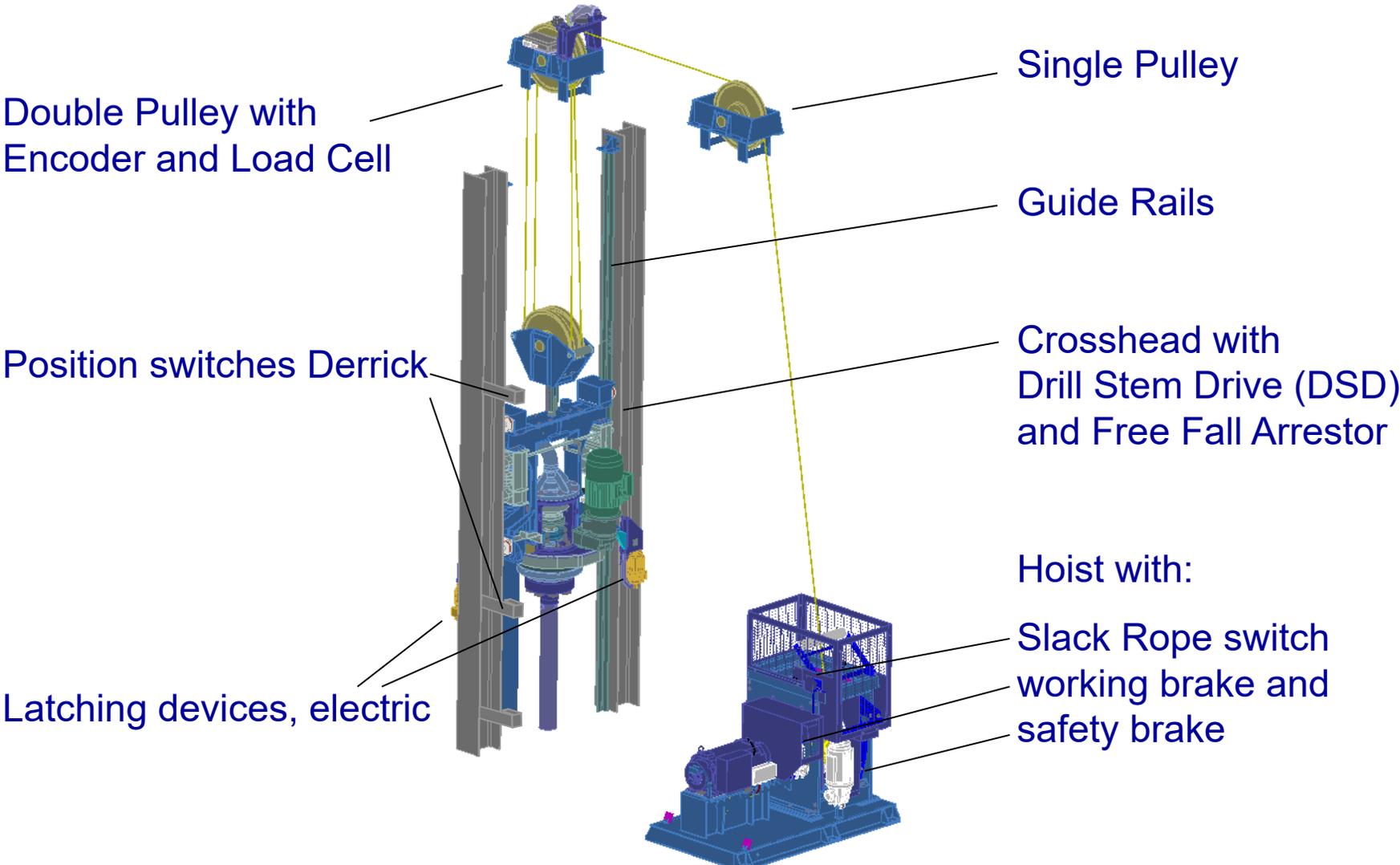


- Horizontal, 12-stage, single suction, BB5 barrel pump
- Ruhrpumpen ADC 6x12
- Hydraulic decoking system for crude upgrader
- Performance
  - Capacity: 272 m<sup>3</sup>/h (1198 gpm)
  - Head: 3120 m (10,236 ft)
  - Temperature: 70 °C (158 °F)
  - Motor: 3500 kW (4694 HP)
  - Motor speed: 3560 rpm



# Cutting System

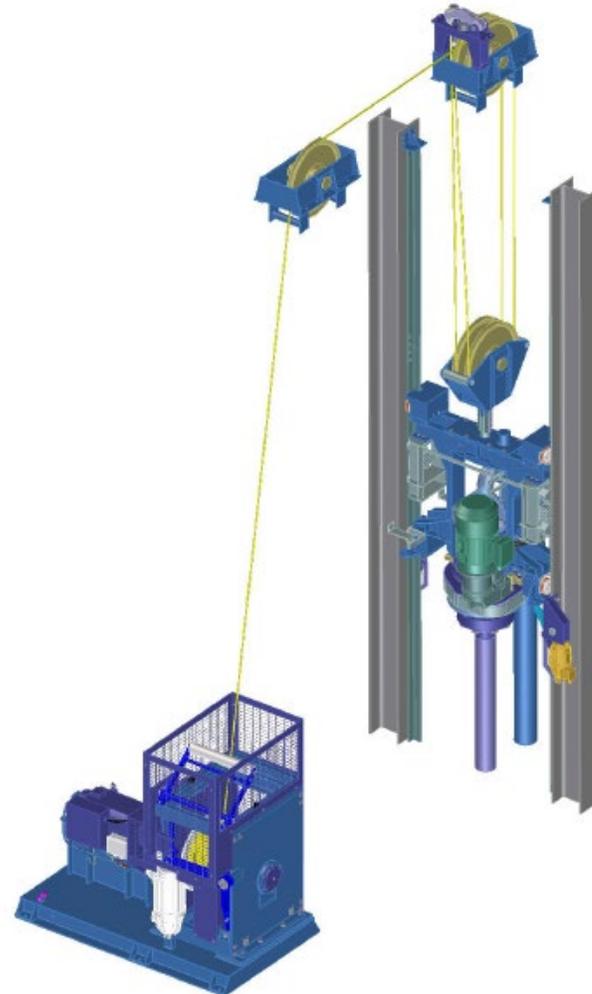
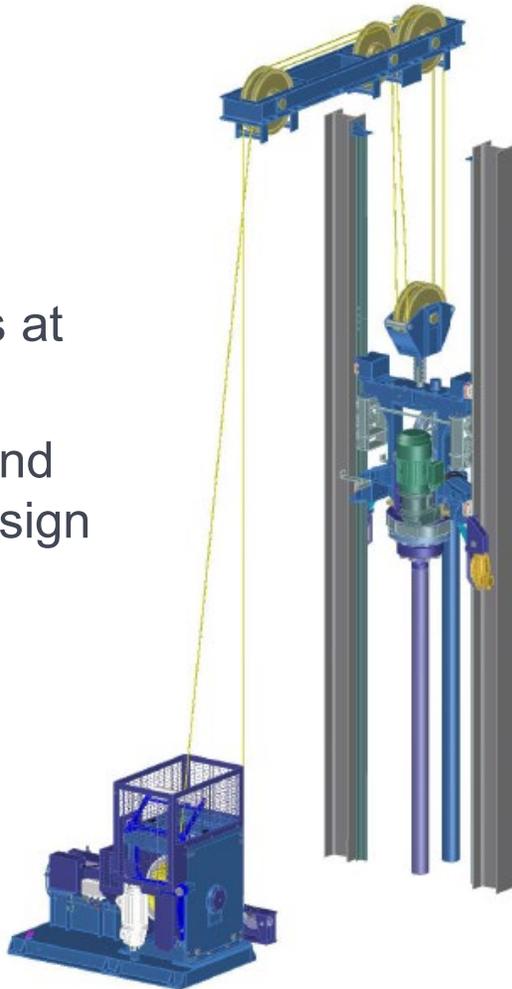
## Derrick



# Cutting System

## Wire Rope Configurations

- Wire rope terminates at deck
- Bechtel (and others) design

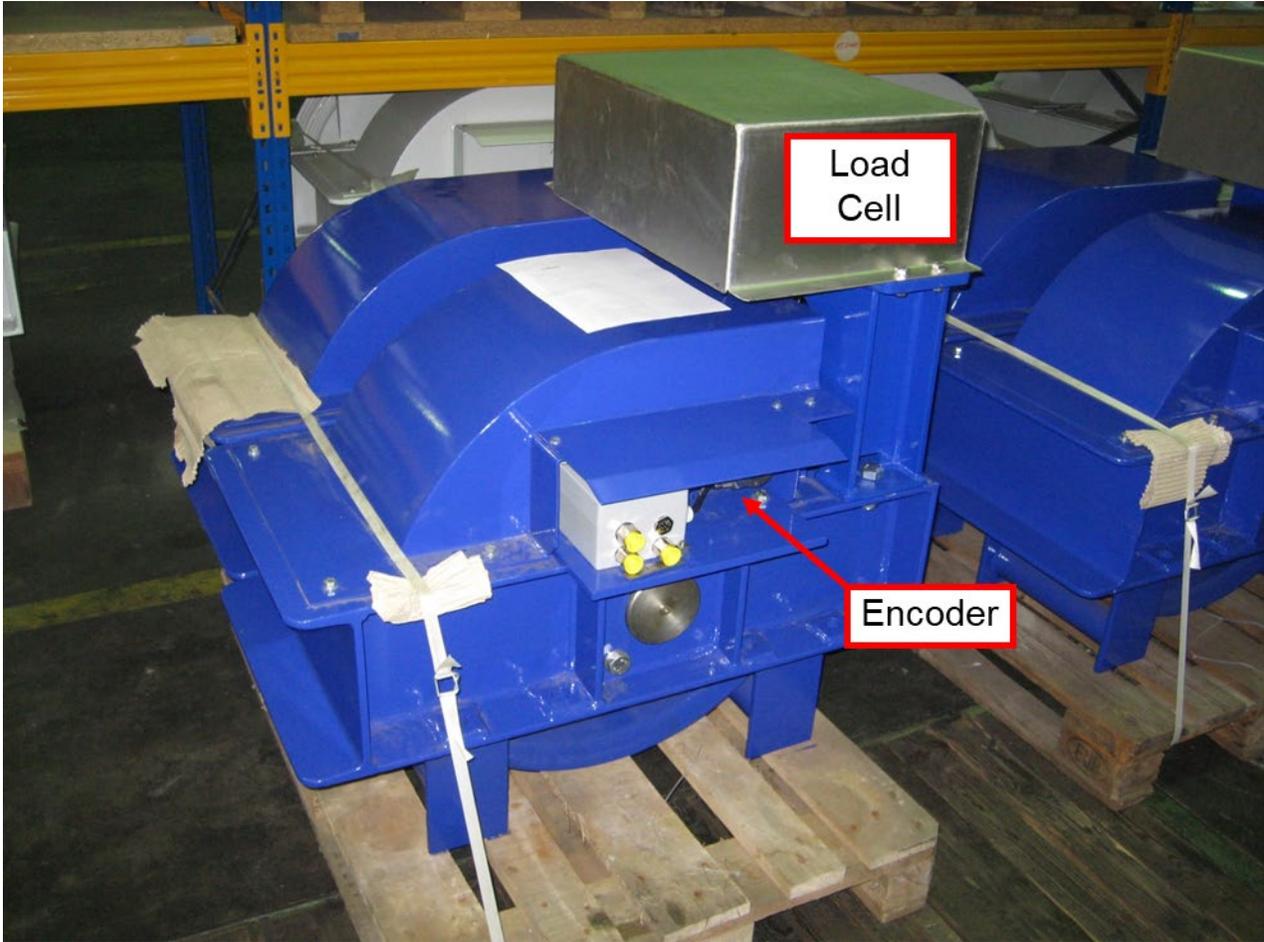


- Wire rope terminates at crown block
- RP prefers this configuration
- Measures loading directly rather than through another pulley



# Cutting System

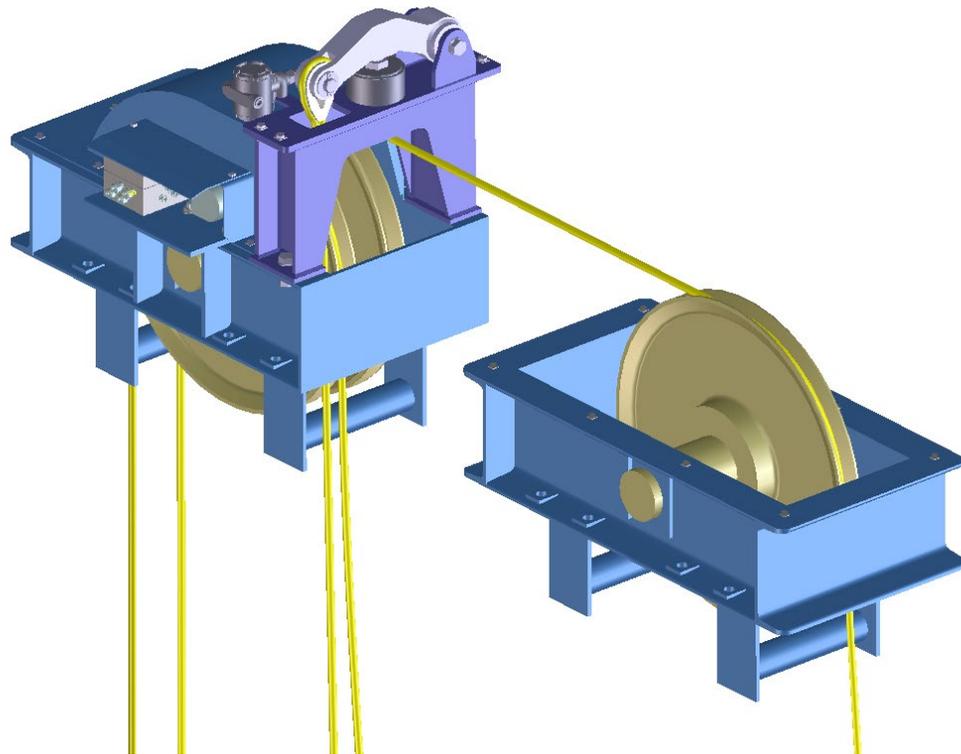
## Pulley Block



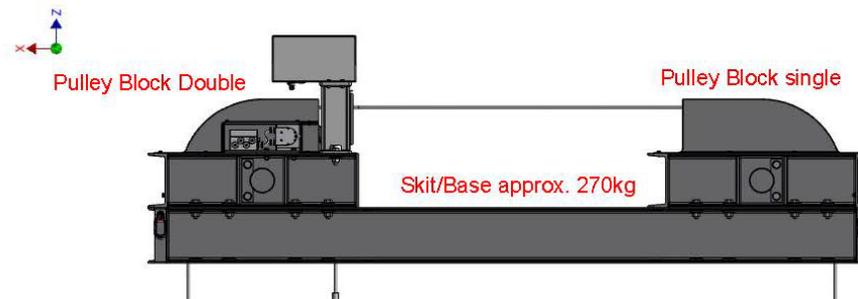


# Cutting System

## RP Pulley Block Design

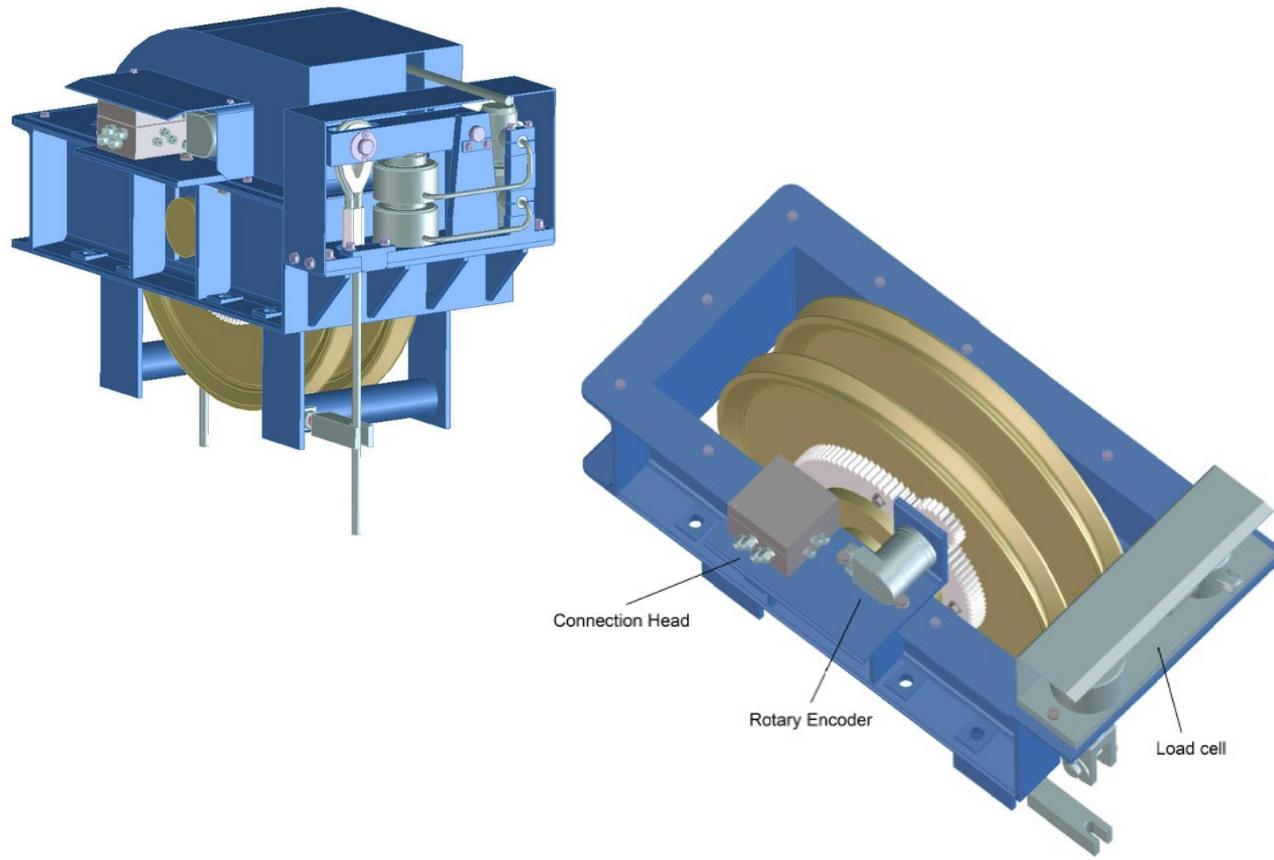


- Large Diameter Sheaves, Ø600mm (24") dia. pulley
- Loading, 20 tons (20,000 Kg, 44,000 lbs.)
- Wire Rope Load Cell (pull force transmitter, indication at operator panel)
- Crown block subassembly and single pulley block subassembly and may be bolted on a common I-Beam frame supplied by RP (length per Project requirements)
- Safety feature: Double catch bars hold pulley and rope should pulley shaft ever break



# Cutting System

## RP Pulley Block Design

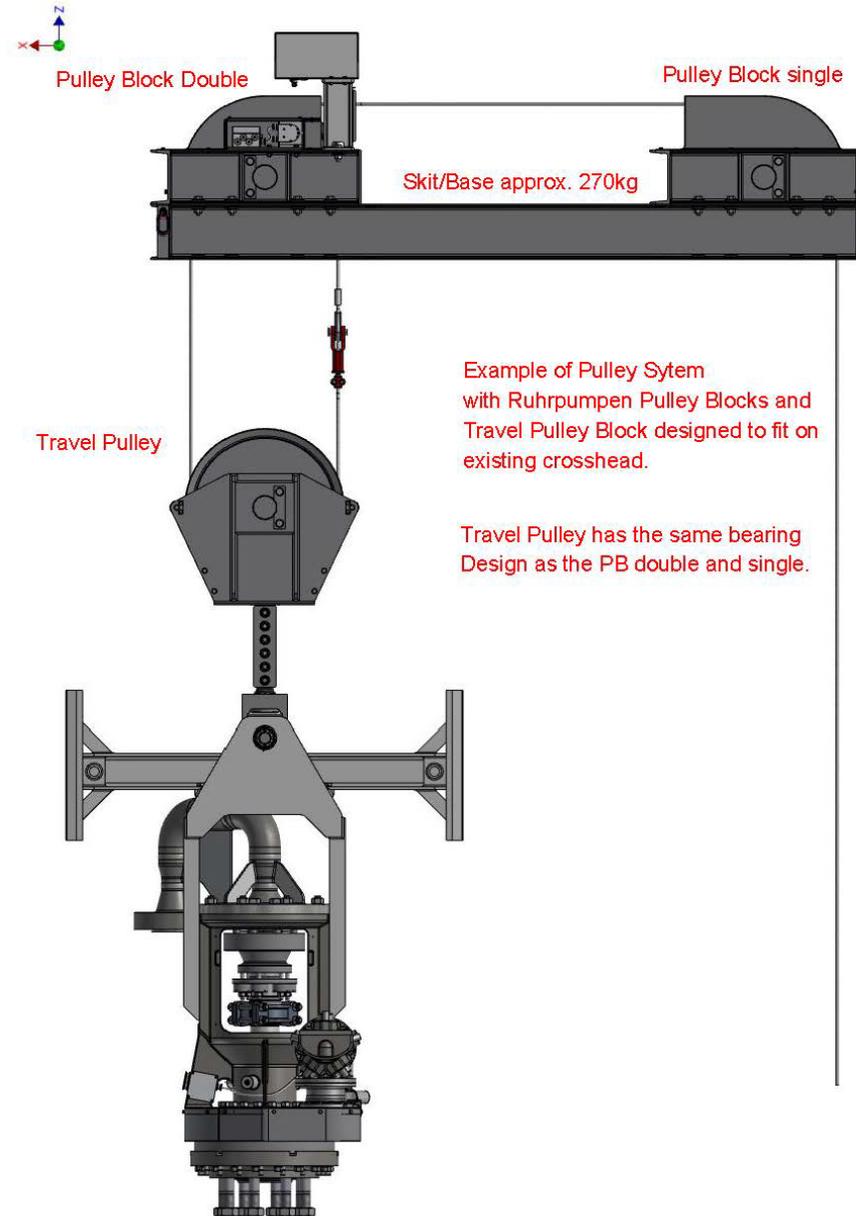


- Drill stem position absolute encoder, Gear driven; Indication at operator panel; Additional information to tower switches
- High accuracy, no slip
- Sheaves (Pulley Wheels) are mechanically captured by protection cap; Safety and keeps out debris
- Maintenance free (permanently sealed bearings)

# Cutting System

## Retrofit Options

- RP Pulleys (Single, Crown and Travelling) and base frame
- Flowserve Shoe-type Crosshead (using I-beams instead of guide rails)
- RP DSD (drill stem drive)





# Cutting System

## Hoist

### Electrical system

#### ■ Features

- 1 VFD set for hoists
  - 1 running, 1 stand by
- 1 VFD set for DSDs
  - 1 running, 1 stand by
- VFDs, 1 set per coker,
  - Installed in safe area, or
  - Cutting deck
- Redundant installation

### Hydraulic system

#### ■ Features

- Hydraulic power unit
- 1 hyd. hoist/DSD per drum
- 1 Operator panel per drum pair
- Control electric/electronic
- Integrated in PLC system
- Measurement of force, tension

### Pneumatic system

#### ■ Not recommended

- Insufficient power
- Oil polluted air
- High noise level
- Remote / automatic control
  - Not reliable

# Cutting System

## Hoist



- Drive options
  - Electric motor w/VFD (safe area)
  - Hydraulic via HPU
- Integral gear cartridge
- Pull force: 5,000 Kg (11,000 lbs)
- Mining industry design

# Cutting System

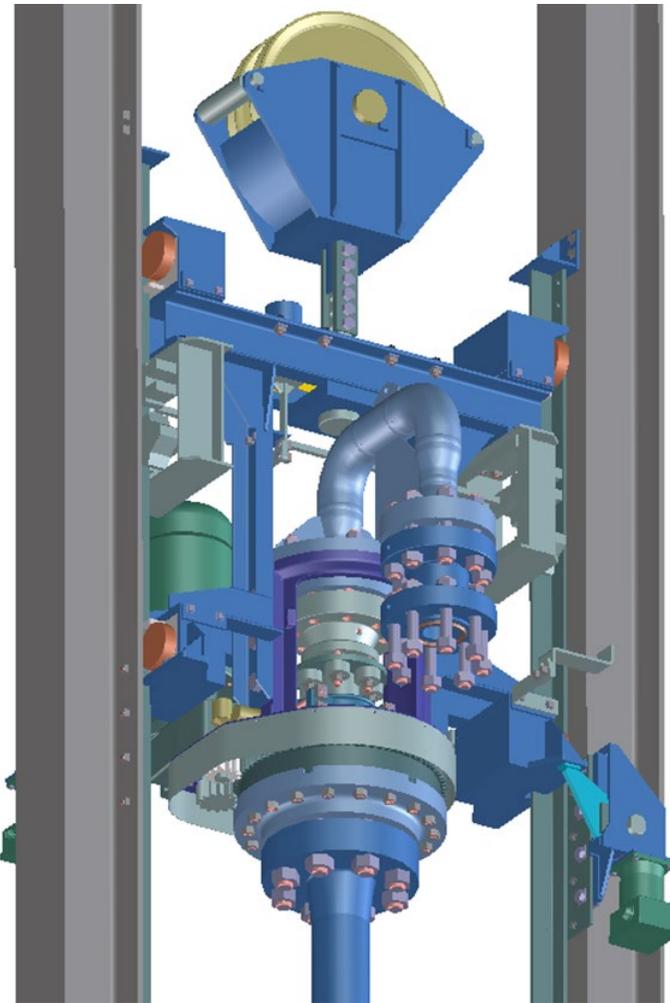
## Hoist

- Wire rope
  - Tension measurement via load cell/transmitter
  - Avoids slack rope and overloading
  - Indication at main operator cutting panel



# Cutting System

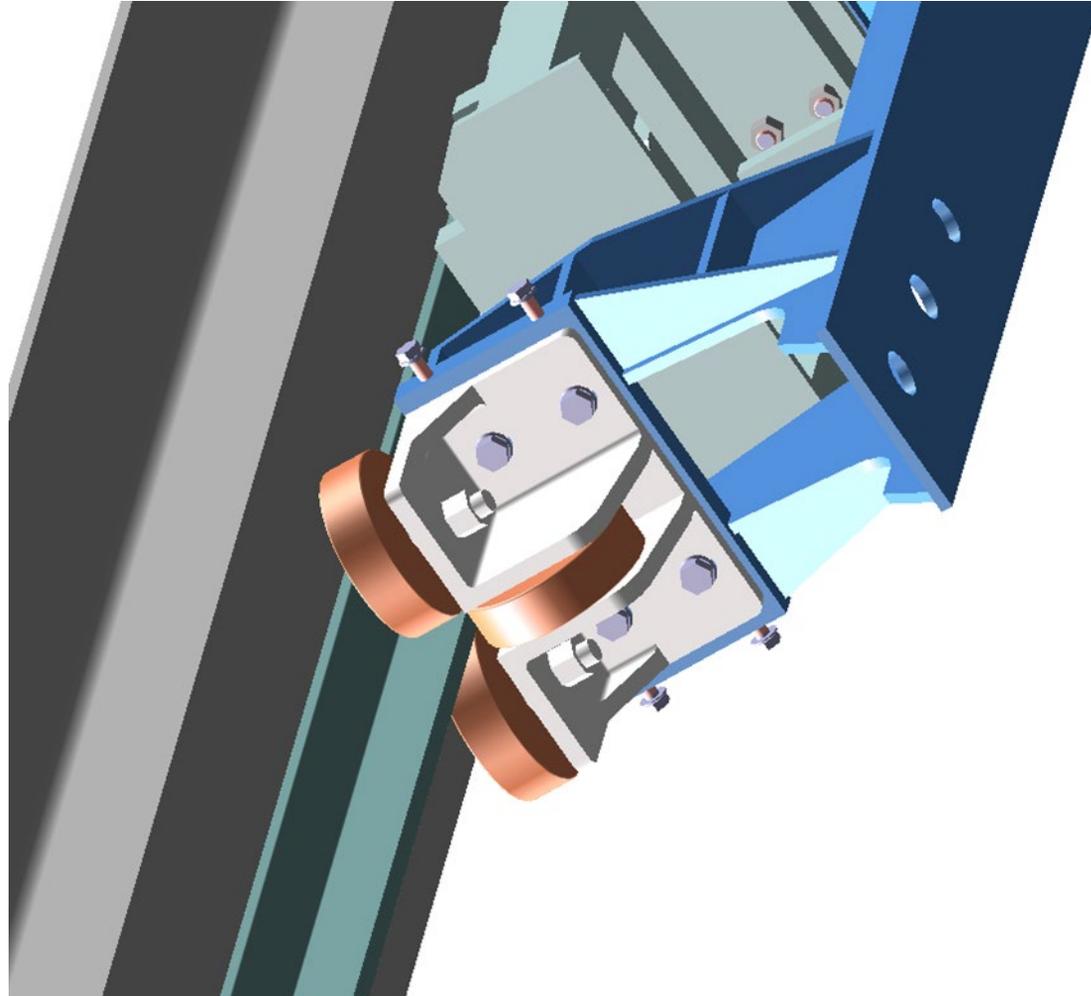
## Crosshead with Free Fall Arrestor



- Crosshead
  - 4 guided points
  - 3 wheels each
- Drill stem Drive
  - Electric motor driven
- Free fall arrestor
  - Automatic operation on loss of pull force
  - TÜV Approval
- Pulley block
- Gooseneck / Swivel

# Cutting System

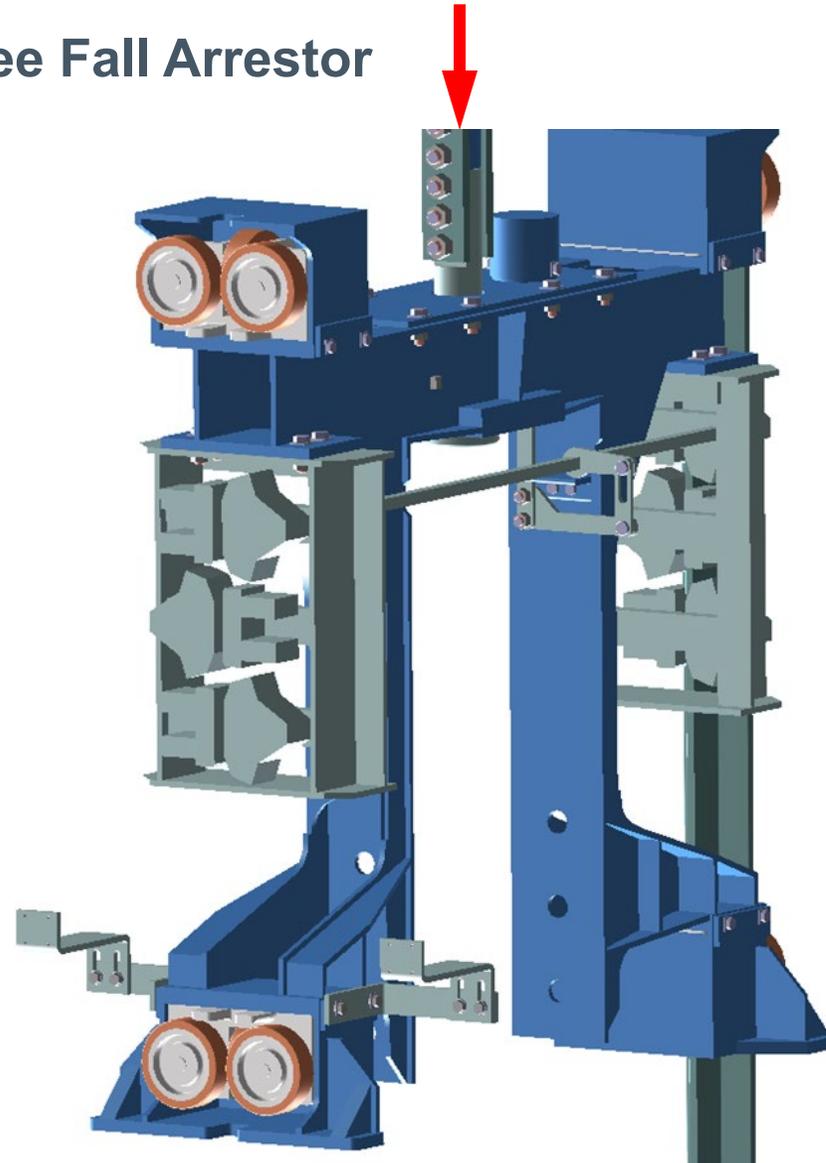
## Crosshead with Free Fall Arrestor



- Roller guide
  - 3 wheels
- Heavy-duty Commercial Elevator Industry “T” Rail

# Cutting System

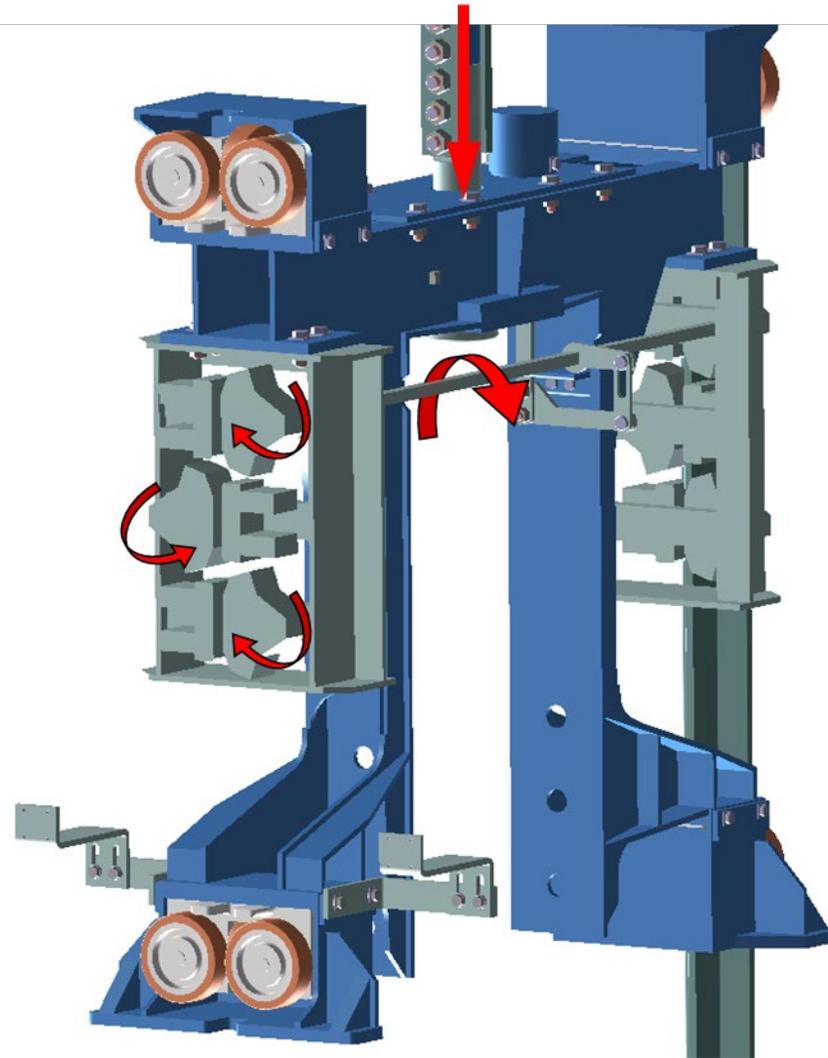
Crosshead with Free Fall Arrestor



- Free fall arrestor
  - Activated as soon as no upward pull force on travelling pulley

# Cutting System

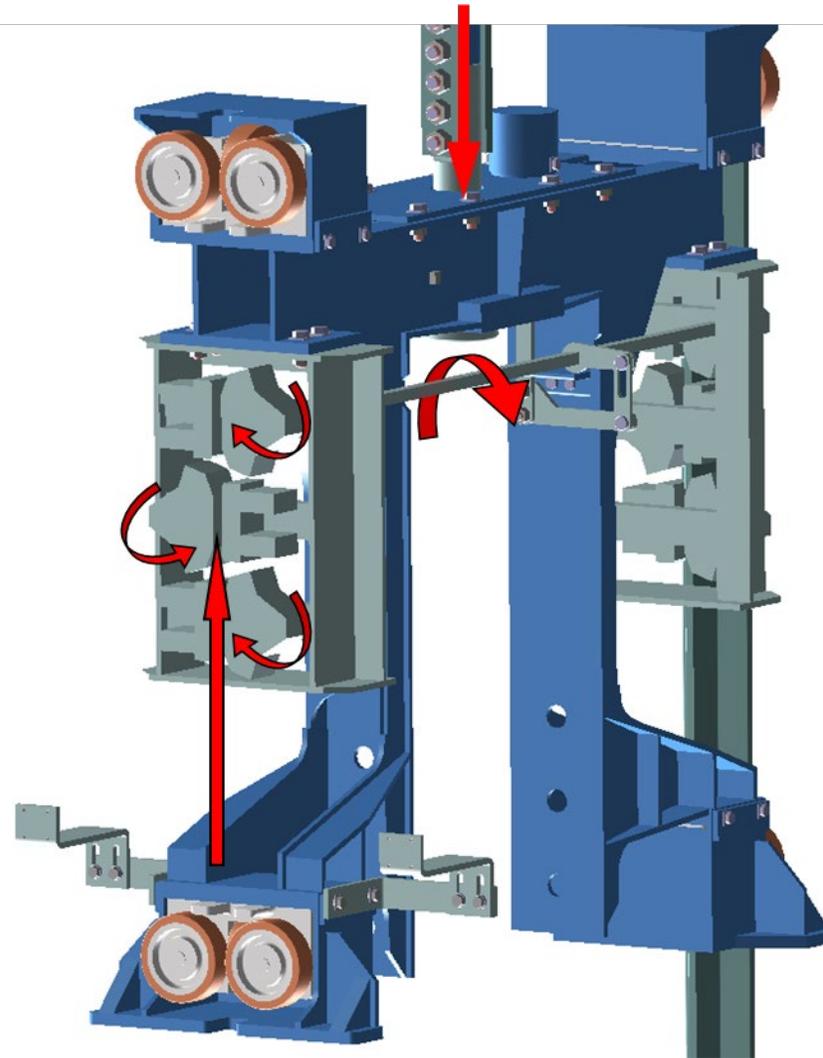
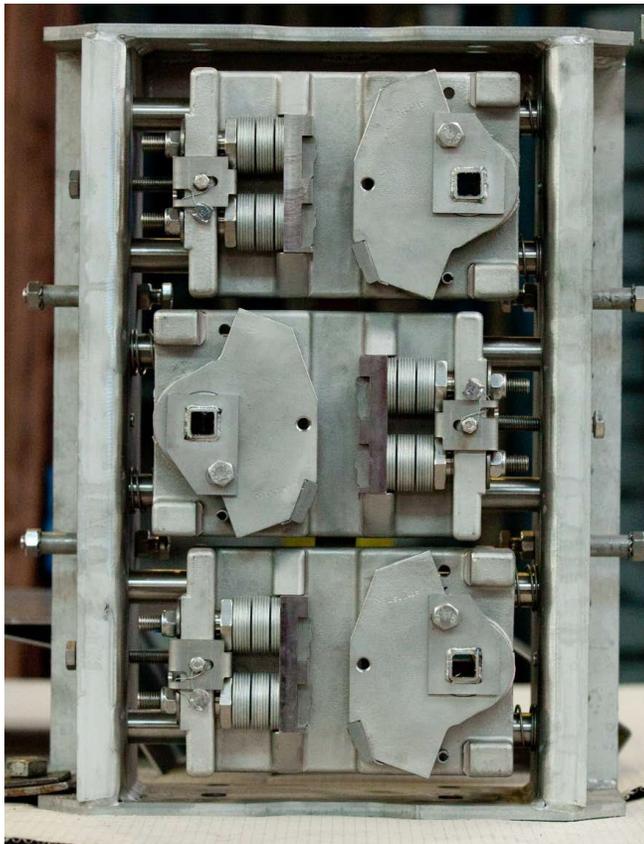
## Crosshead with Free Fall Arrestor



- Free fall arrestor
  - Activated as soon as no upward pull force on travelling pulley
  - Linkage enacts the cams to rotate

# Cutting System

## Crosshead with Free Fall Arrestor



- Free fall arrestor
  - Tungsten carbide grippers cam into the heavy duty "T" rail
  - Simply "winch up" to reset

# Cutting System

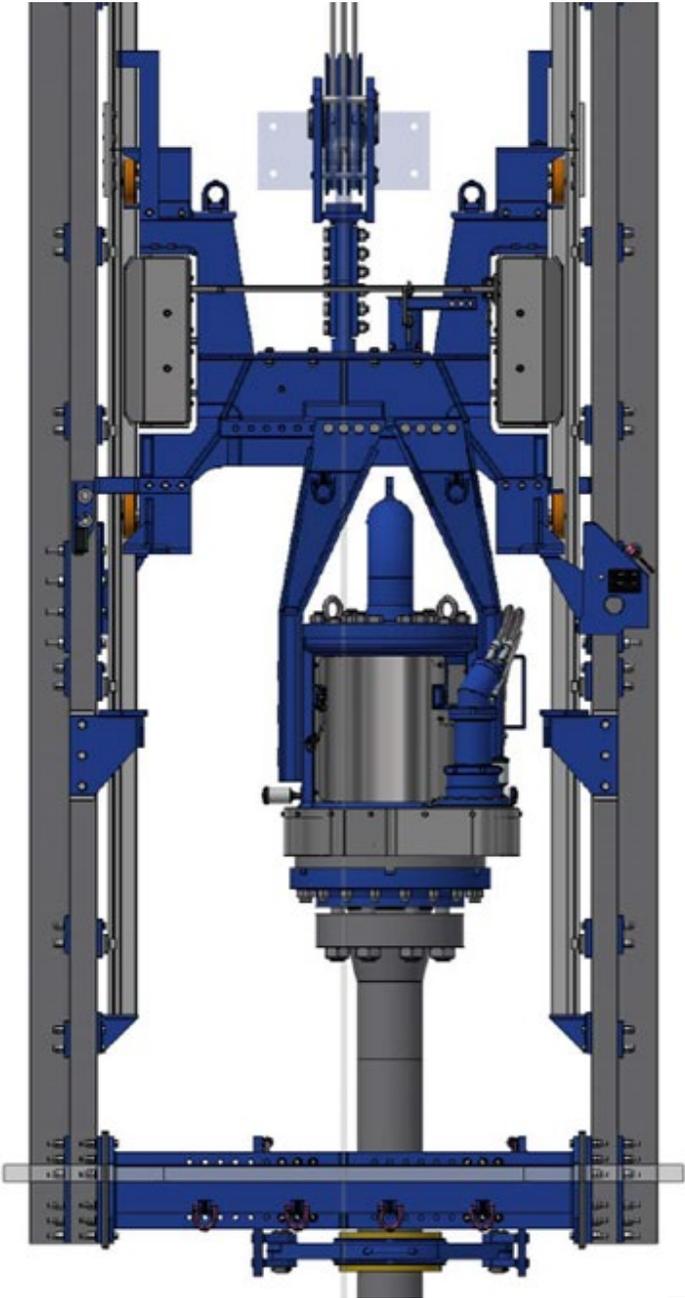
Crosshead with Free Fall Arrestor

- Full-load functional test in shop
- Weight 9500 Kg (20940 lbs)
- Functional test at site available



# Cutting System

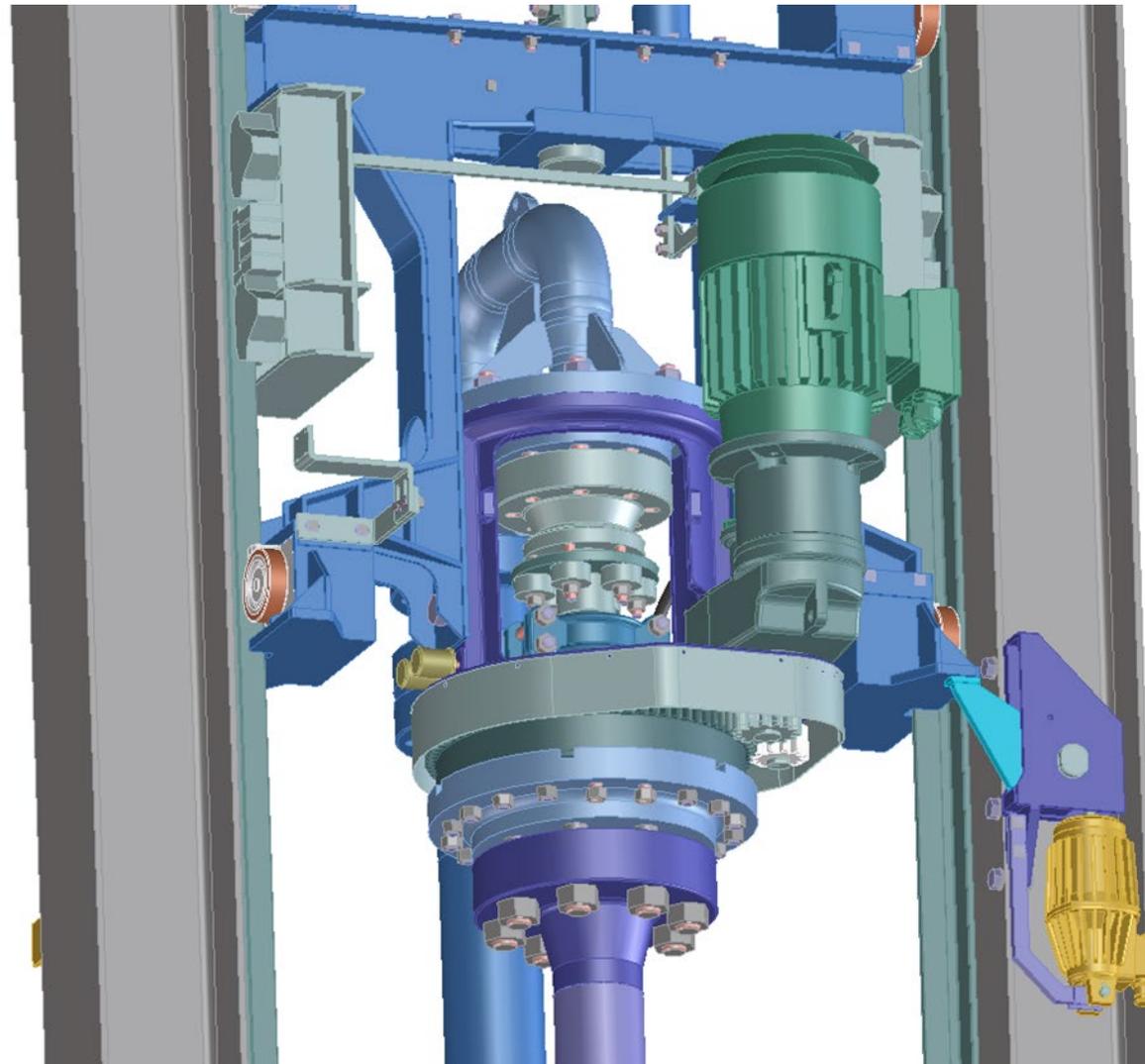
Crosshead with Free Fall Arrestor – Offset Design



# Cutting System

## Drill Stem Drive

- VFD-driven electric motor
- High load bearing
- Grease lubrication
- Cartridge packing
- Swivel



# Cutting System

## Drill Stem Drive – Exploded View

- Drivers: Electric (VFD), Hydraulic, or Pneumatic Motor
- High load slewing ring type bearing
- Automatic greaser eliminates oil reservoir
- Overall cartridge design allows for repairs on the cutting deck
- 4 Sub-Assemblies:
  - Casing and high pressure piping
  - Bearing/gear cartridge
  - Drive unit
  - Seal cartridge

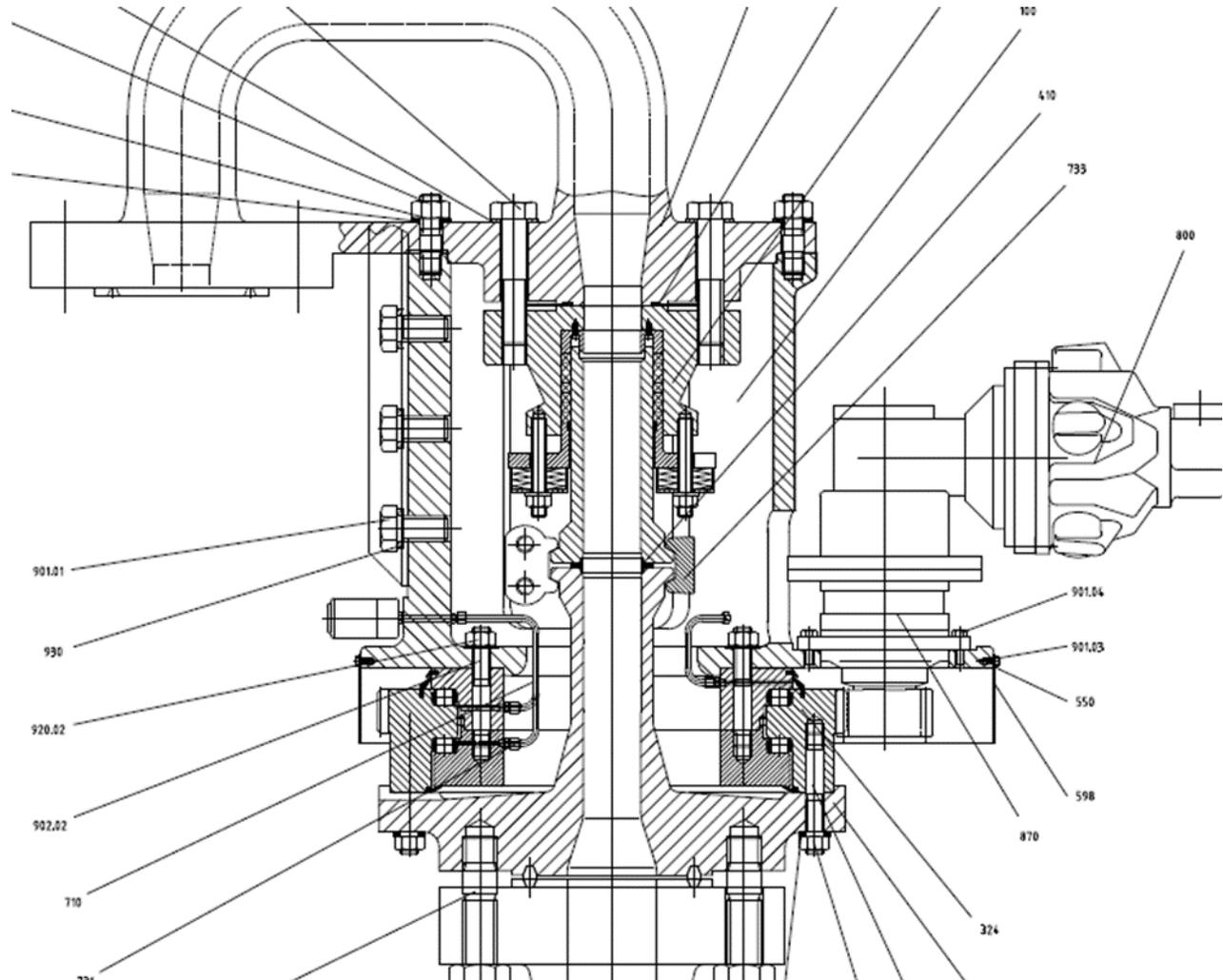




# Cutting System

## Drill Stem Drive – Cross Section

- Pneumatic motor (shown)
- Max. Loading 65,000 Kg (143,000 lbs.)
- Grease lubrication
- Cartridge packing
- Gooseneck



# Cutting System

## Drill Stem Drive – Easy Serviceability at Deck Level

- RP rails allow for safe and quick exchange of the packing seal cartridge



- Deck level exchange of the bearing gear cartridge

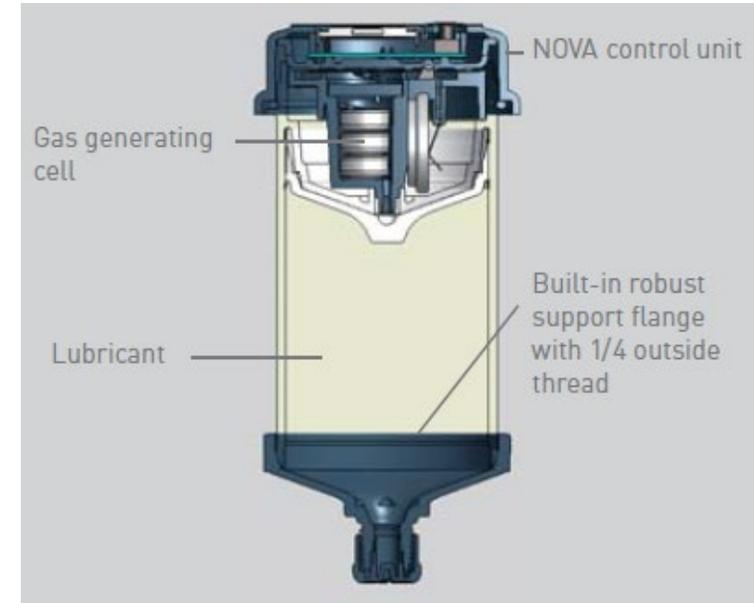




# Cutting System

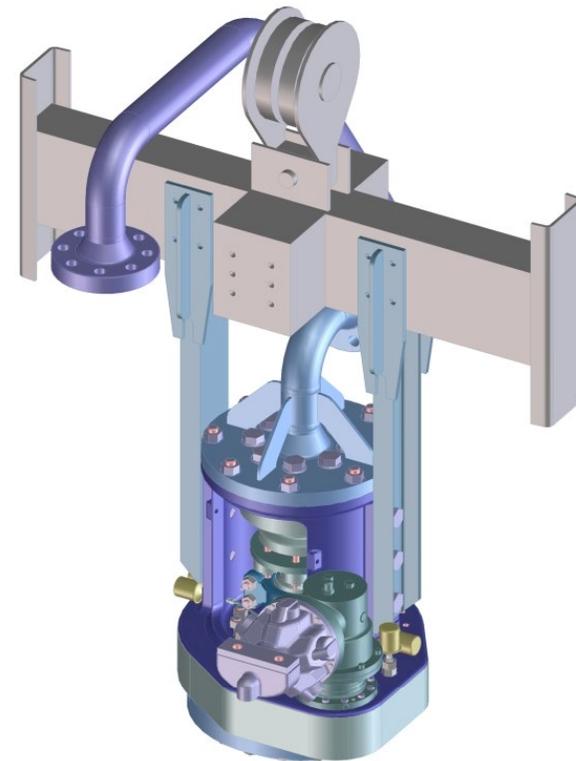
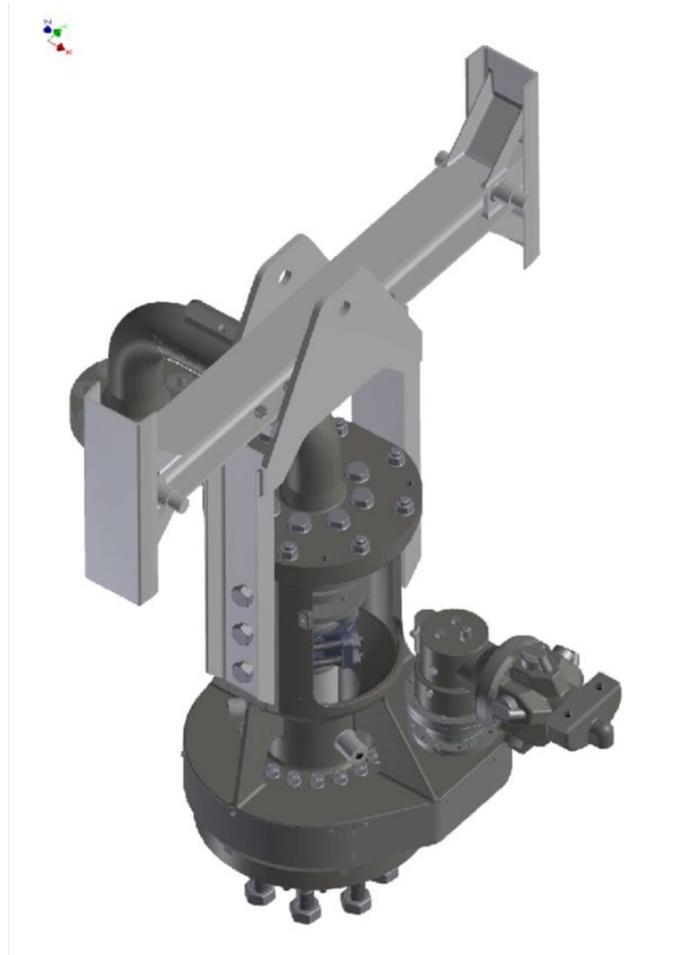
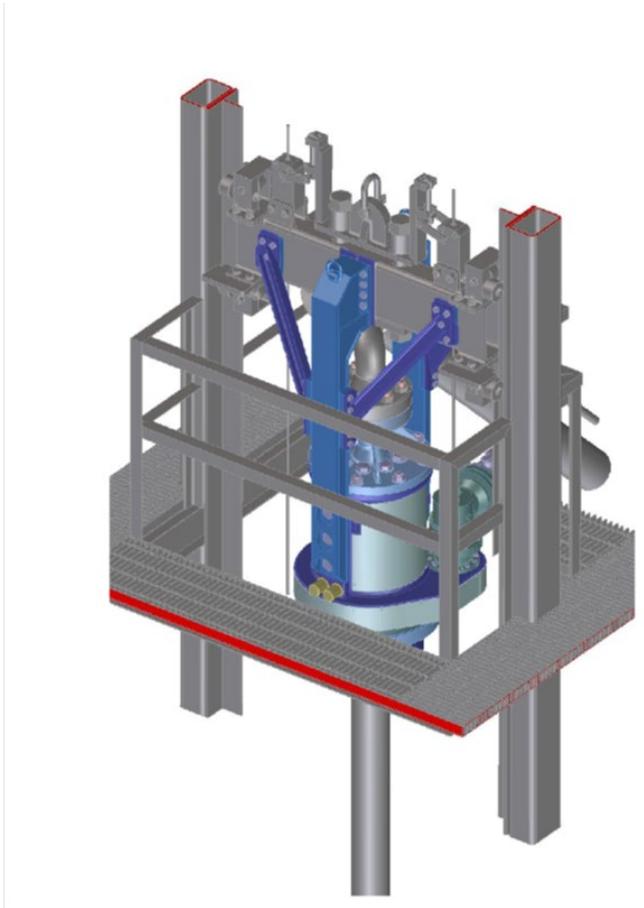
## Drill Stem Drive – Automatic Greasers

- Single-Point Lubrication System
- Driven by electrochemical reaction via gas generating cell
- Pressure build-up, max. 6 barg (87 psig)
- Holds 130 cm<sup>3</sup> (4.4 oz) of lubricant
- Discharge entire amount in 1, 2, 3,...12 months
- Compensates for ambient temperature



# Cutting System

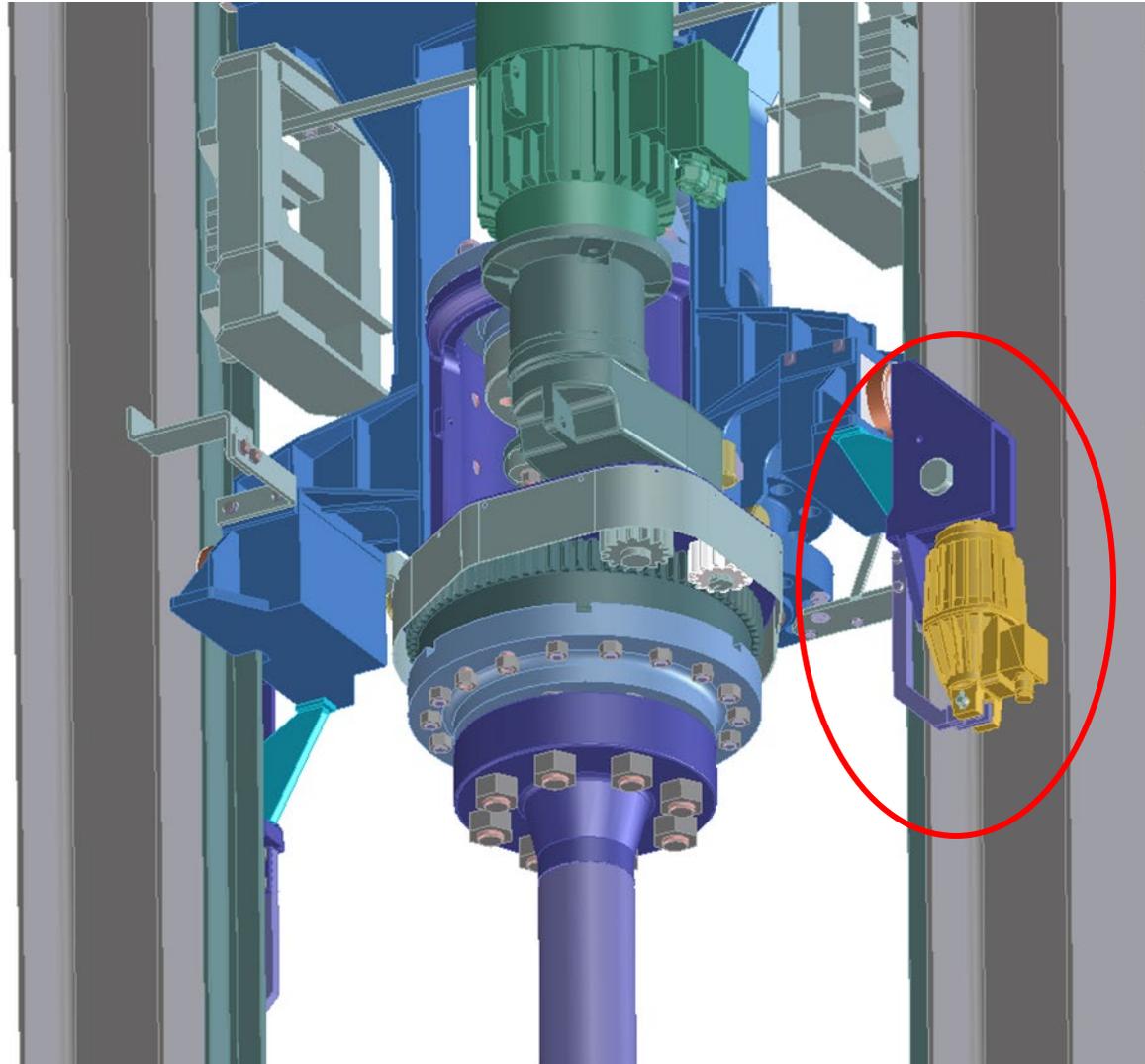
Drill Stem Drive – Adaptable to competitor crossheads



# Cutting System

## Latching Device

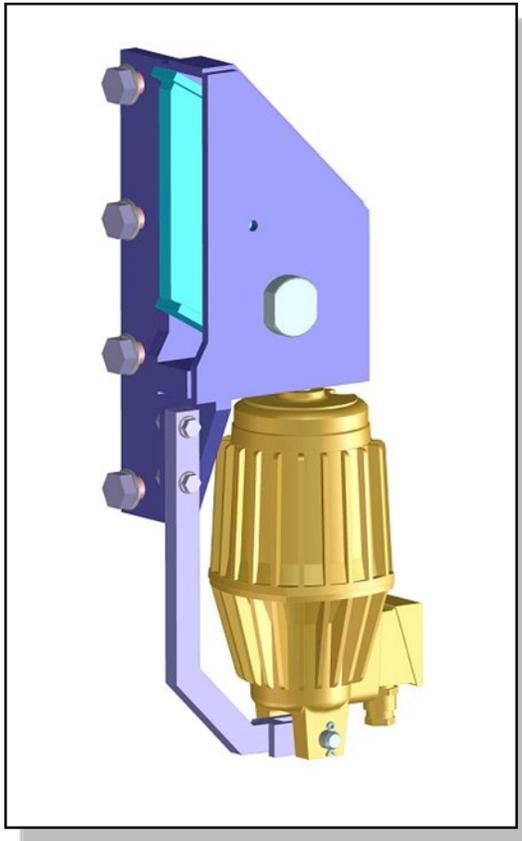
- **Drill Stem Drive**
  - Electric motor
  - High load bearing
  - Grease lubrication
  - Cartridge packing
  - Swivel





# Cutting System

Latching Device – Unlatched position

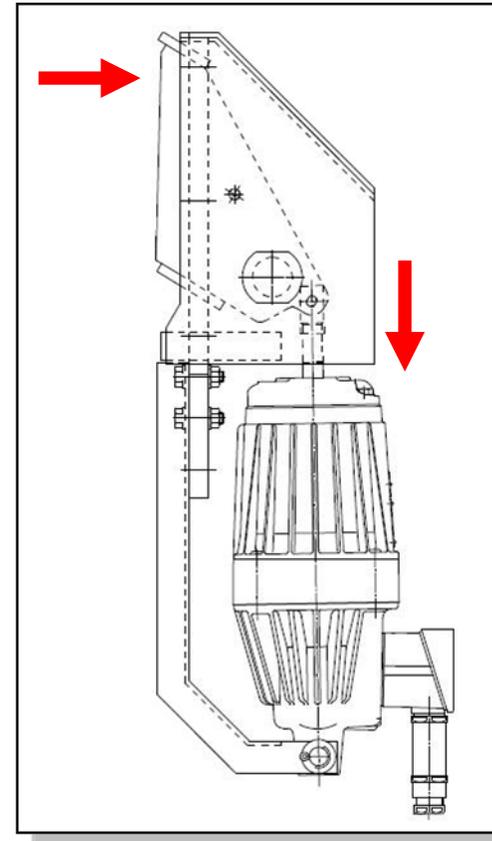


*Power deactivated*

**Electro-hydraulic actuator**

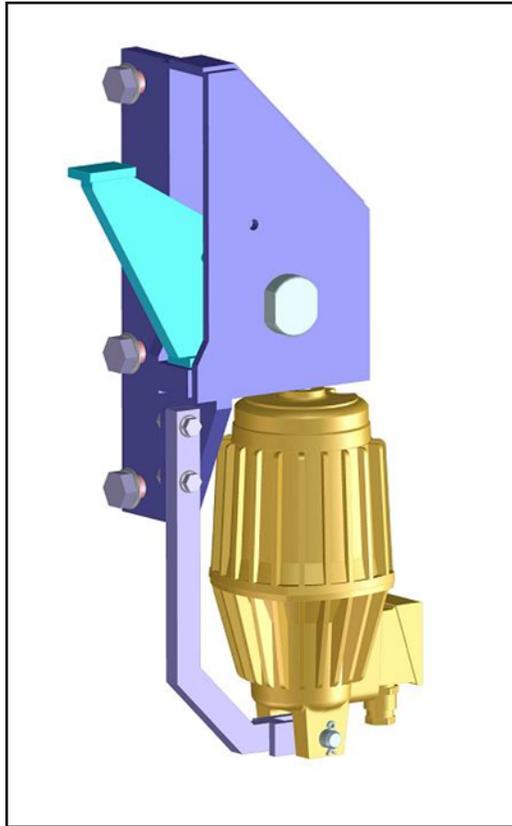
**Piston retracted by internal spring**

**Piston pushed out when powered**



# Cutting System

Latching Device – Latched position

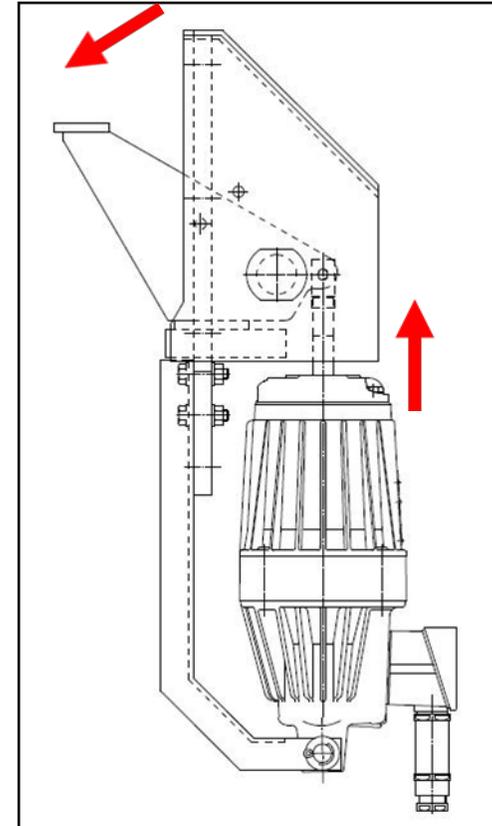


*Power activated*

**Electro-hydraulic actuator**

**Piston retracted by internal spring**

**Piston pushed out when powered**





# Cutting System

## Drill Stem

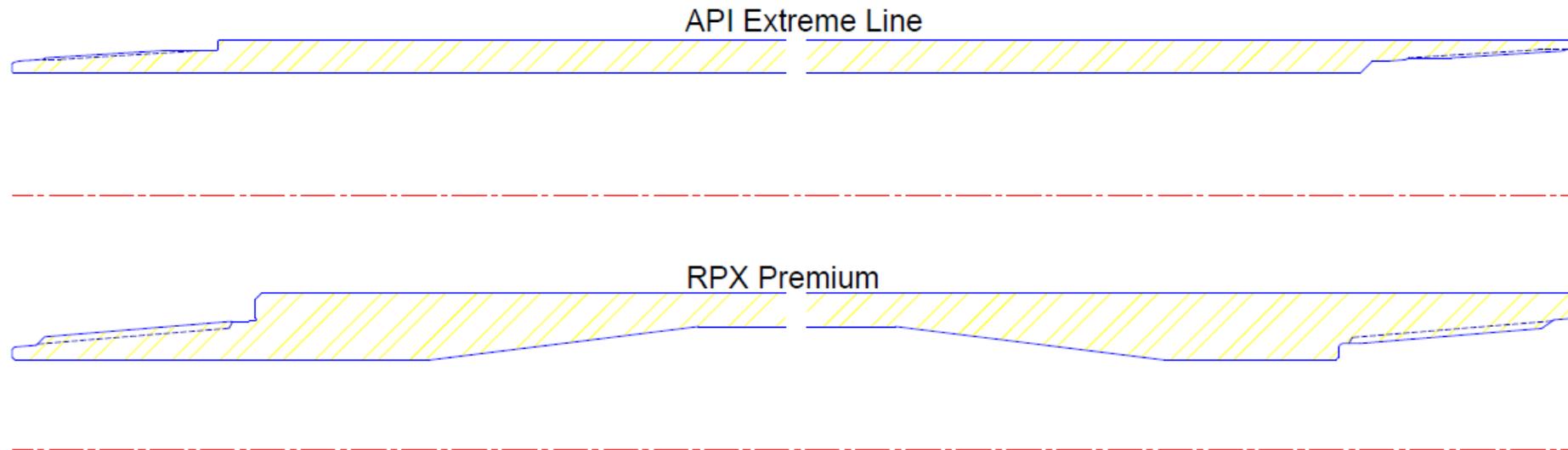
- History:
- First generation delayed coker drill stem design was welded sections of 6" schedule 160 seamless pipe ASTM-A-106 Grade B.
- In the 1980's the first threaded drill stem was introduced to the Delayed Coker industry. This new design featured the API Extreme Line casing thread and a material upgrade to 7" OD x 3/4" wall AISI / SAE 4140 HT to 29-37Rc.
- Due to the higher demands on the Delayed Coker Unit and in particular the decoking equipment, there have been attempts to solve the weak link in the decoking drill stem, the threaded connection.
- The Swaged Extreme Line or the Coupled (Hydrill MacII) designs still just incorporate a casing thread. These connections were designed for oil well casing installations with no-load static conditions.
- Ruhrpumpen offers the traditional API Extreme Line (per the licensor callout), but also offers the RPX Premium which is a true drilling connection designed for the most severe decoking service.



# Cutting System

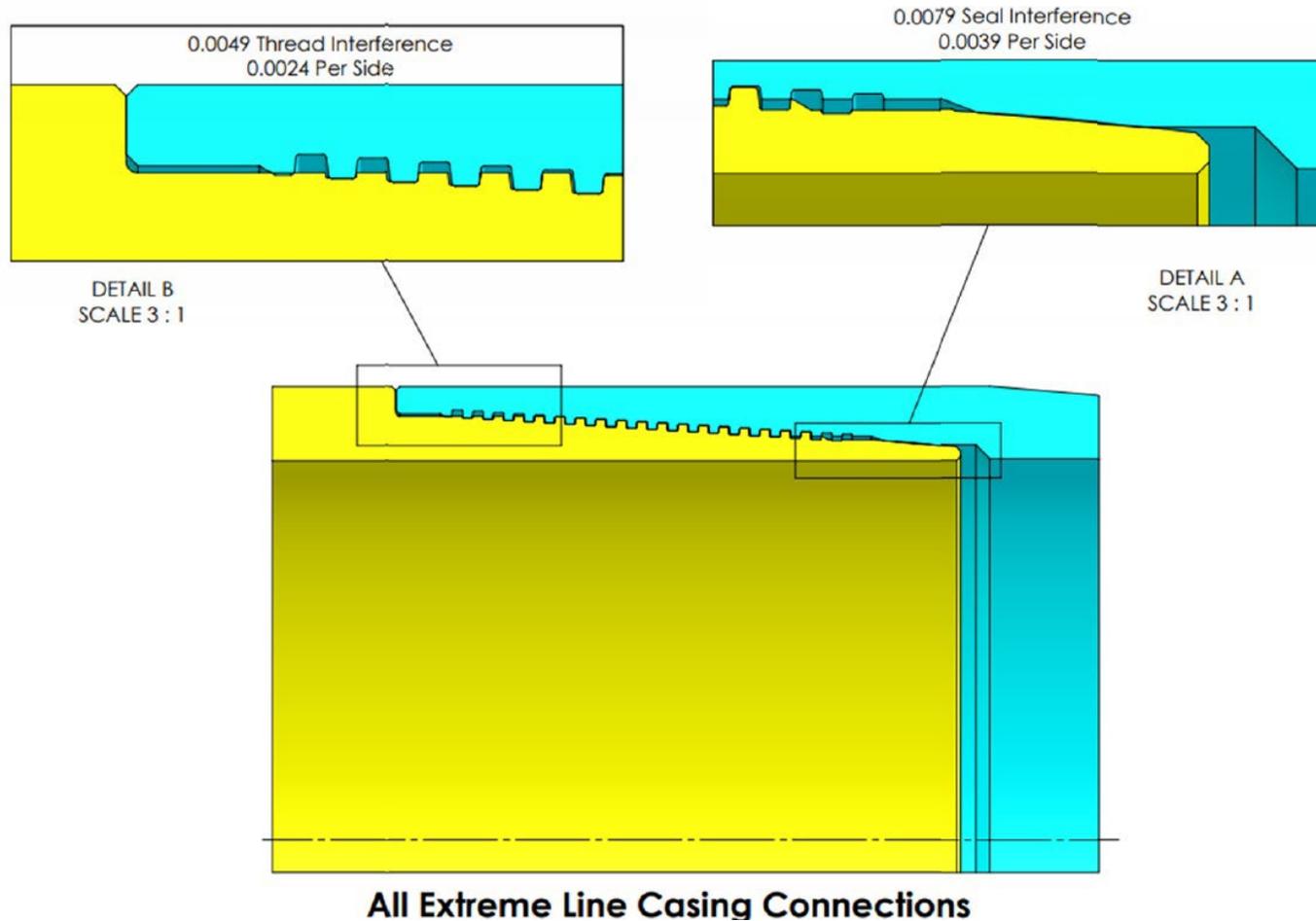
## Drill Stem – RPX Premium

- $\frac{3}{4}$ " (19.05 mm) wall thickness vs. RPX with 1.5" (38.1 mm) before machining



# Cutting System

## Drill Stem – API Extreme Line Casing

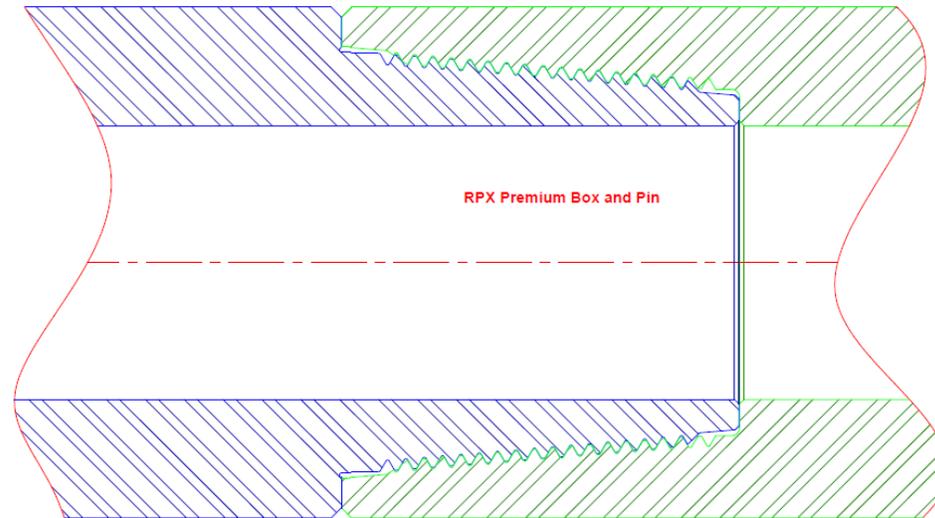


- No Internal Shoulder Seal
- Low thread engagement
- Low Torque (weak connection)
- Easy to Over-Torque

# Cutting System

## Drill Stem – RPX Premium

- The RPX Premium has a double shoulder, outside and inside, to seal the threads off from water
- The double shoulder is also what gives it extra strength
- V-shaped threads w/radiused roots, larger pitch and steeper pitch angle all contribute to a superior thread





# Cutting System

## Drill Stem – Comparison

- Comparing the specs side by side, the drill stem connection tensile yield of the RPX Premium threading is more than 2X that of the Extreme Line threading

Side by Side Comparison						
	RPX Premium 7"™			7 5/8 Extreme Line		
Tube OD Nom	7.000 in	177,80 mm		8.000 in	203,20 mm	
Tube Wall Nom	0.750 in	19,05 mm		0.750 in	19,05 mm	
Tube ID Nom	5.500 in	139,70 mm		6.500 in	165,10 mm	
Tube Grade (ref)	TSC110-HDS			P110		
Tube SMYS	110,000 psi	758 Mpa		110,000 psi	758 Mpa	
Tube Upset Type	Internal (IU)			Non Upset (NU)		
Tube External Pressure Capacity (Collapse) <sup>5</sup>	21,046 psi	145 MPa		18,691 psi	129 MPa	
Tube Internal Pressure Capacity <sup>5</sup>	20,625 psi	142 MPa		18,047 psi	124 MPa	
Tube Torsional Strength <sup>3</sup>	220,456 ft-lbs	298 899 Nm		299,998 ft-lbs	406 743 Nm	
Tube Tensile Strength <sup>5</sup>	1,619,884 lbs	734 767 kg		1,879,065 lbs	852 330 kg	
Tube Charpy Impact Absorbed-Energy	40 ft-lbs	54 J		28 ft-lbs	38 J	
Product Weight <sup>2</sup>	1,141 lbs	517 kg		1,329 lbs	603 kg	
Product Internal Volume Capacity <sup>2</sup>	28 gal	105 l		39 gal	147 l	
Connection Type	RPX Premium 7"™			7 5/8 Extreme Line		
Connection OD	7.000 in	177,80 mm		8.000 in	203,20 mm	
Connection ID	4.000 in	101,60 mm		6.504 in	165,20 mm	
Connection Drift Diameter <sup>5</sup>	3.875 in	98,43 mm		6.375 in	161,93 mm	
Connection SMYS	130,000 psi	896 Mpa		110,000 psi	758 Mpa	
Connection Torsional Strength <sup>1</sup>	79,420 ft-lbs	107 670 Nm				
Connection Tensile Yield*	1,371,200 lbs	621 900 kg		597,932 lbs	271 218 kg	
Make-Up Torque Min <sup>1</sup>	35,740 ft-lbs	48 450 Nm		5,679 ft-lbs	7 700 Nm	
Recommended Make-Up Torque <sup>1</sup>	47,650 ft-lbs	64 600 Nm		5,900 ft-lbs	7 999 Nm	



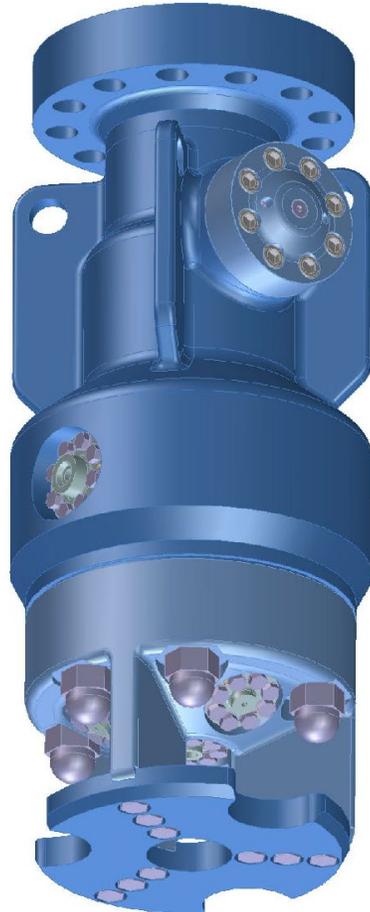
# Cutting System

Drill Stem – RPX Premium



# Cutting System

## Cutting Tool (Drilling / Cutting)



- Basic Design
  - Slim tool, OD 13.7" (350 mm), minimizes getting stuck in pilot
  - Direct bolt-in replacement of existing
  - Nozzles are recessed to prevent shearing off
  - Nozzles can be replaced on the deck
- Switching devices
  - No oil to change
  - Automatic / manual (emergency)
  - At the top of the tool

# Cutting System

## Cutting Tool (Drilling / Cutting) - Animation

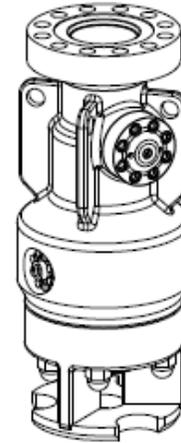
- Autoswitch Cartridge Operation
  - Extends with water pressure reduced
  - Retracts with water pressure applied



# Cutting System

## Cutting Tool (Drilling / Cutting)

- Ball-shape Valves
  - Double coating system
  - No seals required (lower maintenance)
  - Pressure operated
- Nozzles – Drilling
  - 1 strong center, 3 peripheral nozzles
- Nozzles – Cutting
  - 0°, or 10° upwards, both nozzles
- No oil needed for internal parts





# Cutting System

## Cutting Tool (Drilling / Cutting)

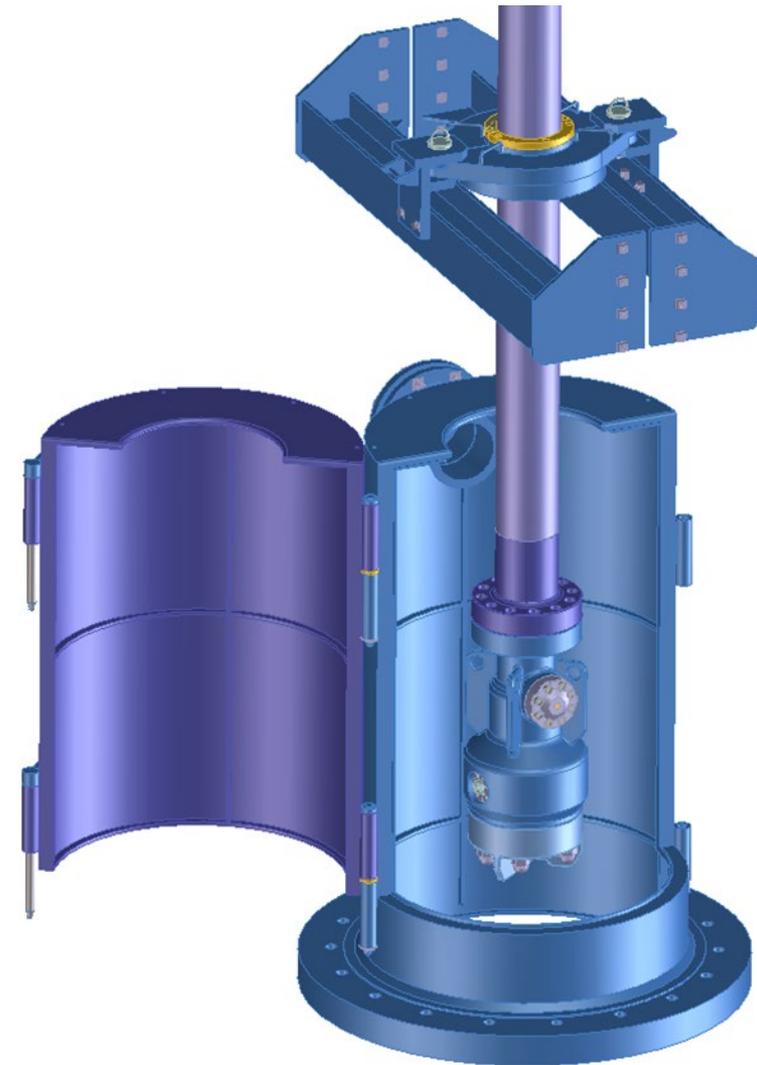
Each automatic cutting tool leaving the factory is been tested on our test bed.  
Functional test and static pressure test (7700psi).



# Cutting System

## Guide Device and Tool Enclosure

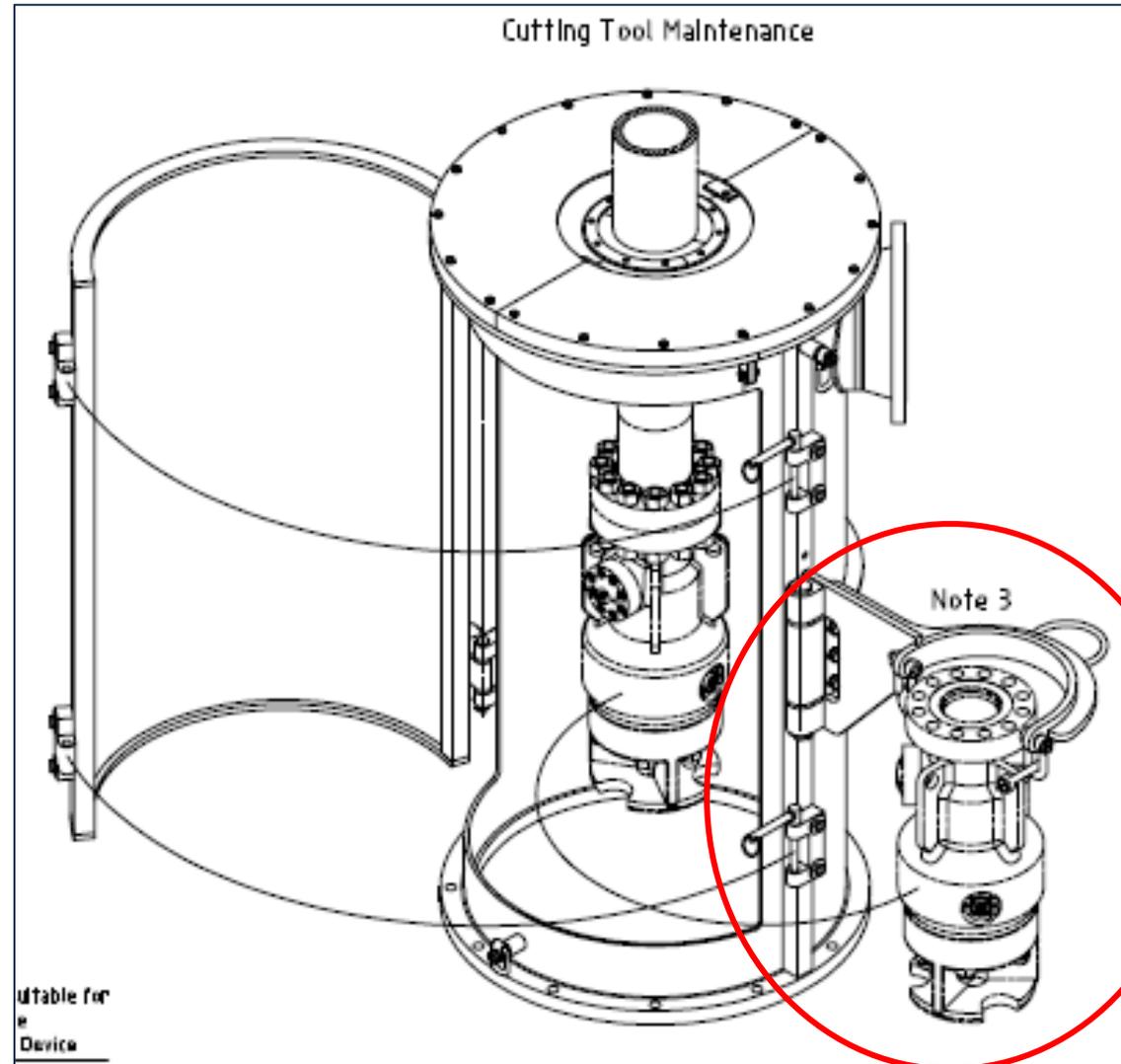
- Guide Device
  - Centers the rotating drill stem
- Tool Enclosure
  - Fixed; Used when TUD is installed
  - Provides safety when the tool is outside of the drum
  - Large door provided easy access to the cutting tool



# Cutting System

## Guide Device and Tool Enclosure

- Closed top design; (2) removable pieces for easy installation, but meant to be fixed during operation
- 30" or 36" size
- Fixed; Bolted onto TUD (Top Unheading Device)
- 12" ASME B16.5 150# RF vent flange; Piping leads to coke pit
- Cutting Tool Carrier holds tool, and swivels out for easy tool maintenance
- Glide disc for extra sealing and drill stem misalignment



# Decoking Control Valve

## Technical Data

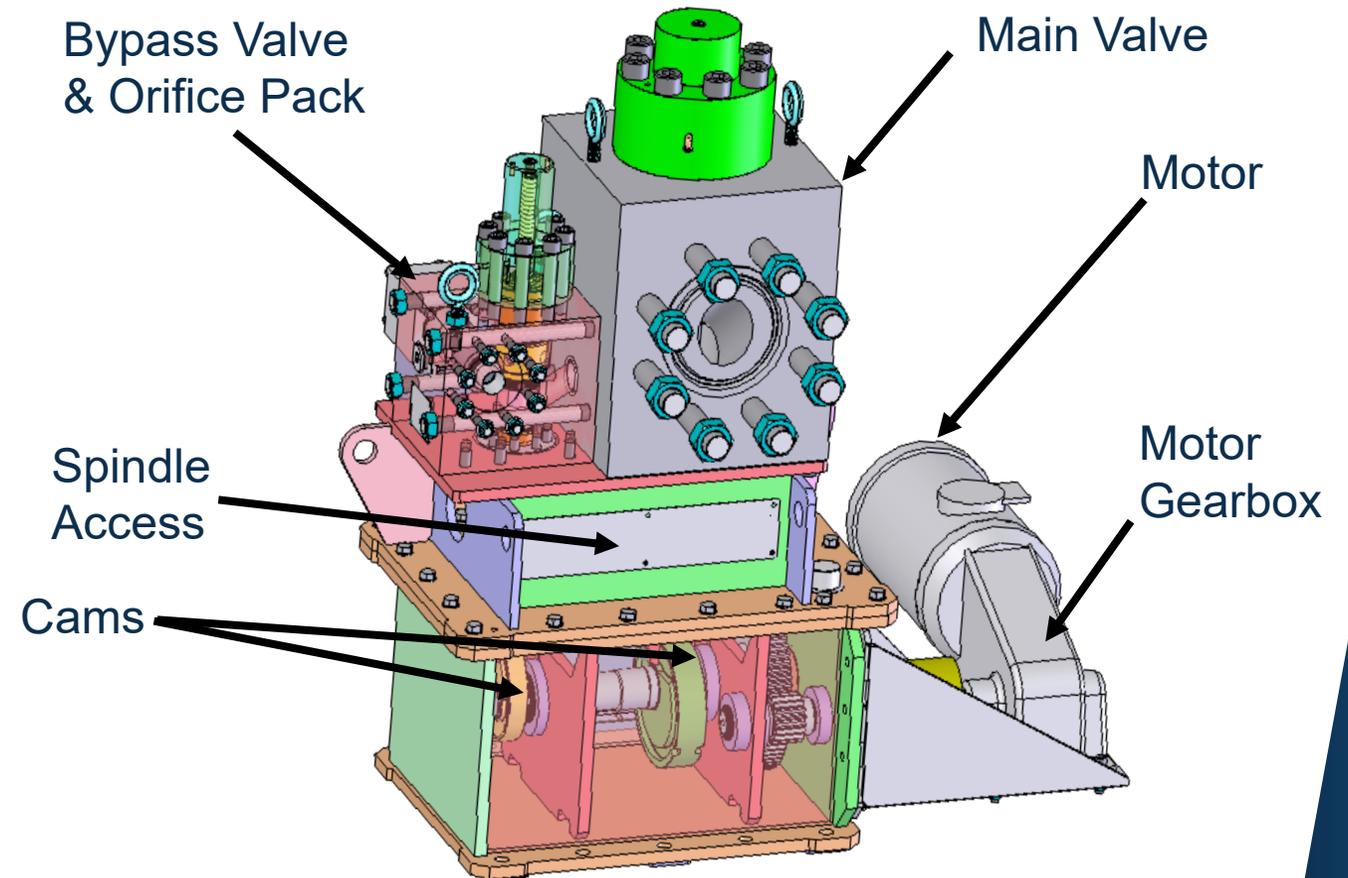


- Nordberg/Elwood proven design
- Current standard sizes, 8"x8"x3", or 6"x6"x3"
- MAWP, 415 barg (6019 psig)
- Max. Flow, 450 m<sup>3</sup>/hr (1981 gpm)
- Max. Temp, 100 °C

# Decoking Control Valve

## Features and Benefits

- Motor-driven cam controlled spindle lift valve system
- Drivetrain (cams, gears, shafts and bushings) runs immersed in an oil bath and is virtually maintenance-free
- Heavy duty robust design; Lower velocities of moving parts lead to greater MTBF

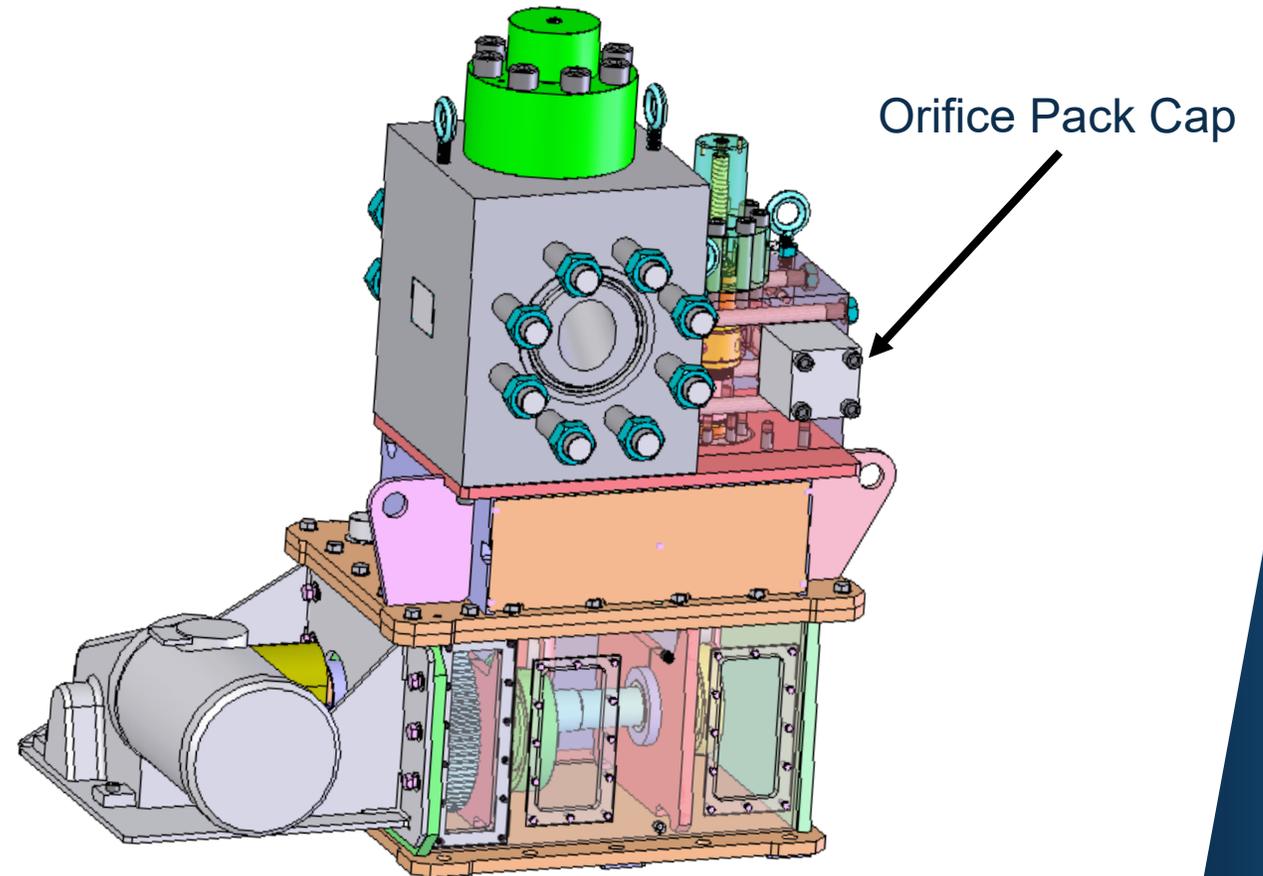


*(Main Valve Inlet-Side View)*

# Decoking Control Valve

## Features and Benefits

- Per Licensor requirement, the decoking system is designed for decoking particles to be  $<1/8''$  ( $<3$  mm)
- Non-clogging valve design; Able to safely pass coke fines up to 5 mm diameter
- Easy access for maintenance at grade level

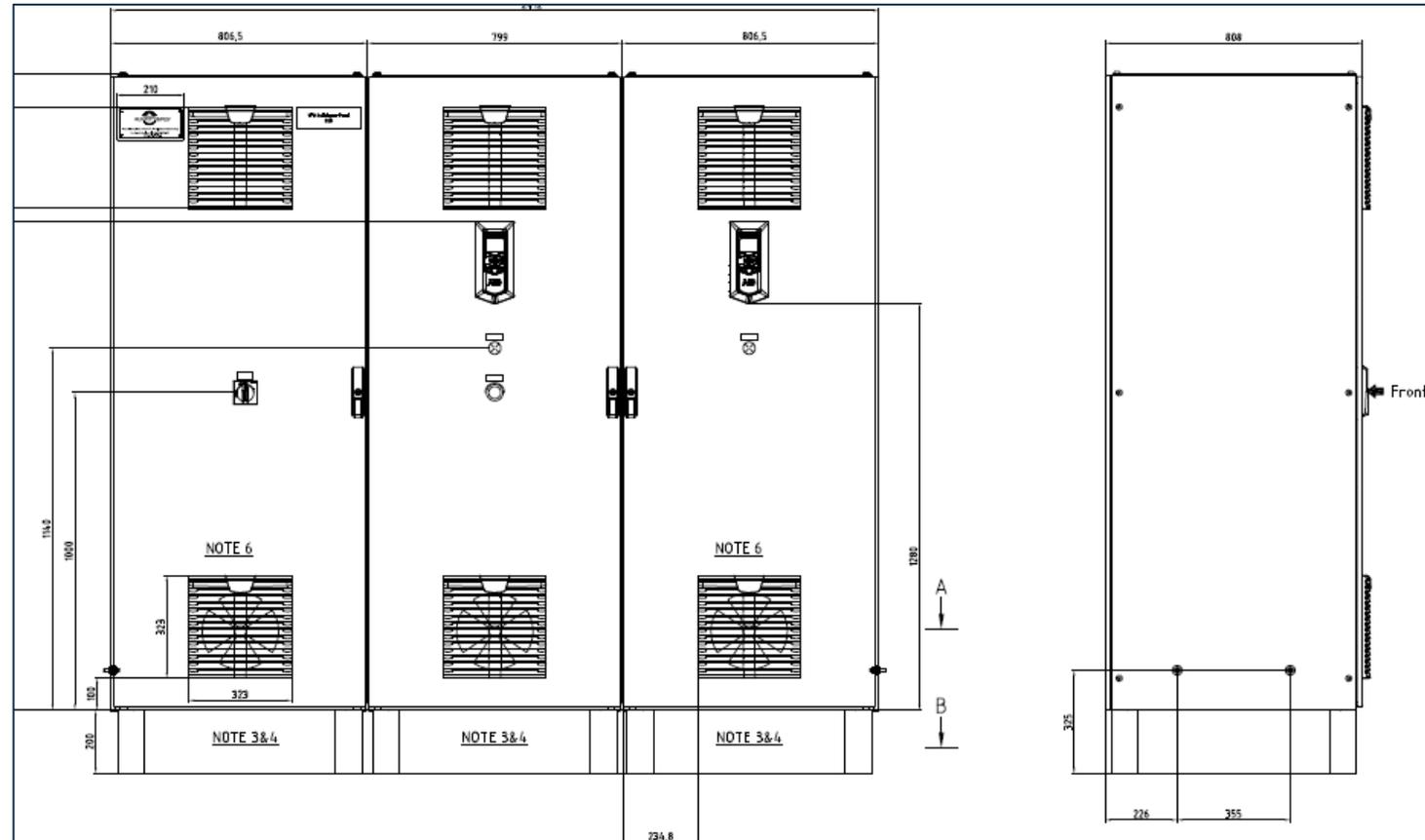


*(Main Valve Outlet-Side View)*

# Control System

## RP Control Philosophy

- PLC Panel
  - Intended to be in a safe area
- VFD Panel
  - Intended to be in a safe area
  - Within 250m distance from Hoist and DSD motors



# Control System

## RP Control Philosophy

- VFD Panel
  - Located at the Deck (Ex/Hazardous area)
  - To meet the 250m max. distance from Hoist and DSD motors
  - Customized SS panels
  - Purged instrument air (provides cooling)



# Control System

## RP Control Philosophy

- PCP (Pump Control Panel)
  - Operates Pump & LOS
  - Condition monitoring (MMS)
  - Located in hazardous area
  - Equipment in panel is Ex d or IS (HMI, buttons, switches, lamps)
  - Not a “Z” purged panel
  - Suitable IP rating



# Control System

## RP Control Philosophy

- LCP (Local Control Panel)
  - Operator Panel
  - Deck Level – Hazardous area
  - Equipment in panel is Ex d or IS (HMI, buttons, switches, lamps)
  - Not a “Z” purged panel
  - Panel is generally Non-Ex





# Control System

Operator Shelter (typical)



# Control System

Operator Panel (Local, at cutting deck)



- Local Operator Panel
- Cutting Deck Level
- Operation of:
  - Decoking Control Valve
  - Isolation Valve
  - Hoist
  - Drill Stem Drive
- Interactive P&ID on HMI



# Control System

Operator Panel (Remote, at grade)

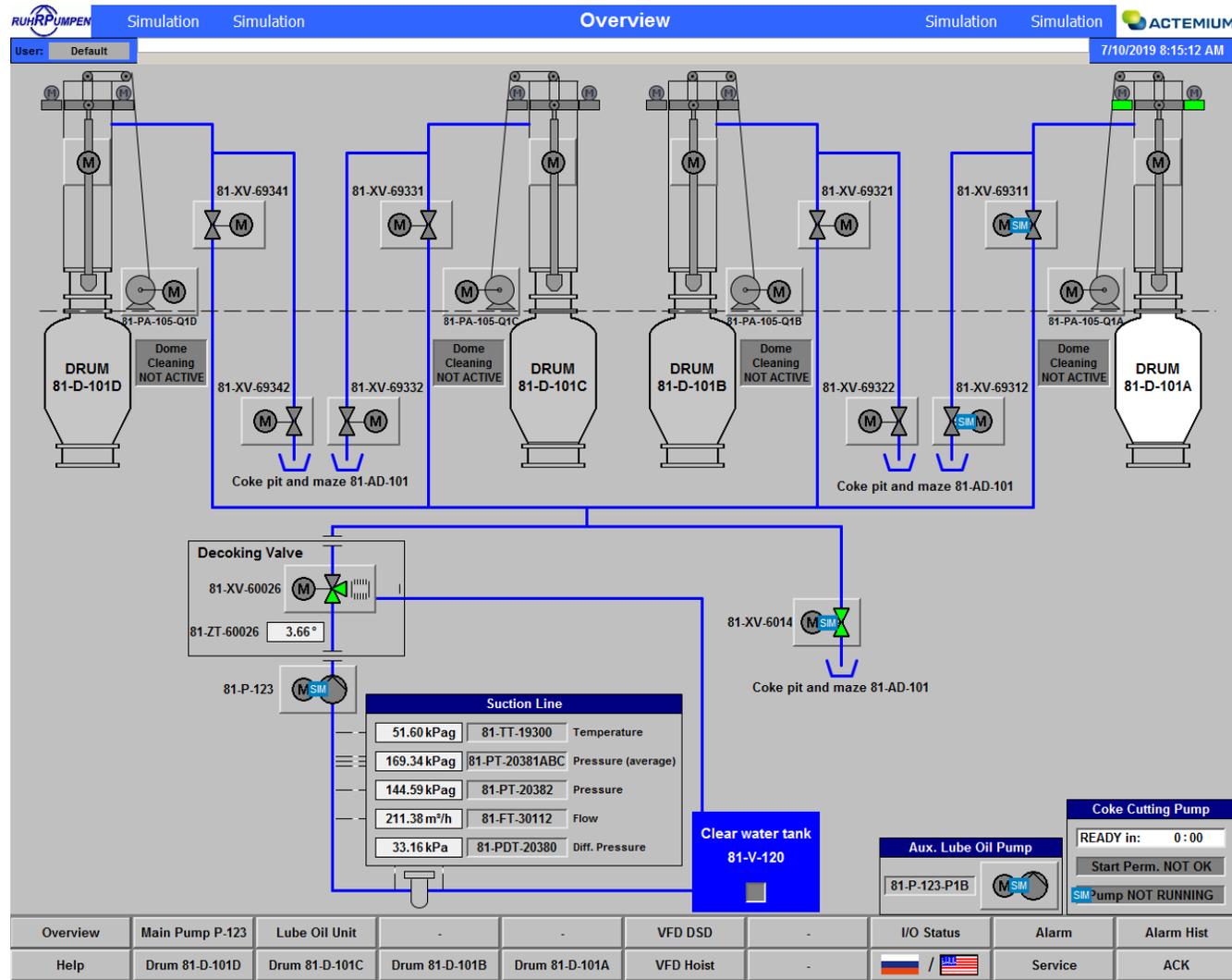


- Remote installation
- Grade Level
- Option of having Video Monitoring System (PTZ cameras at hoist, bottom chute, top of drum)



# Control System

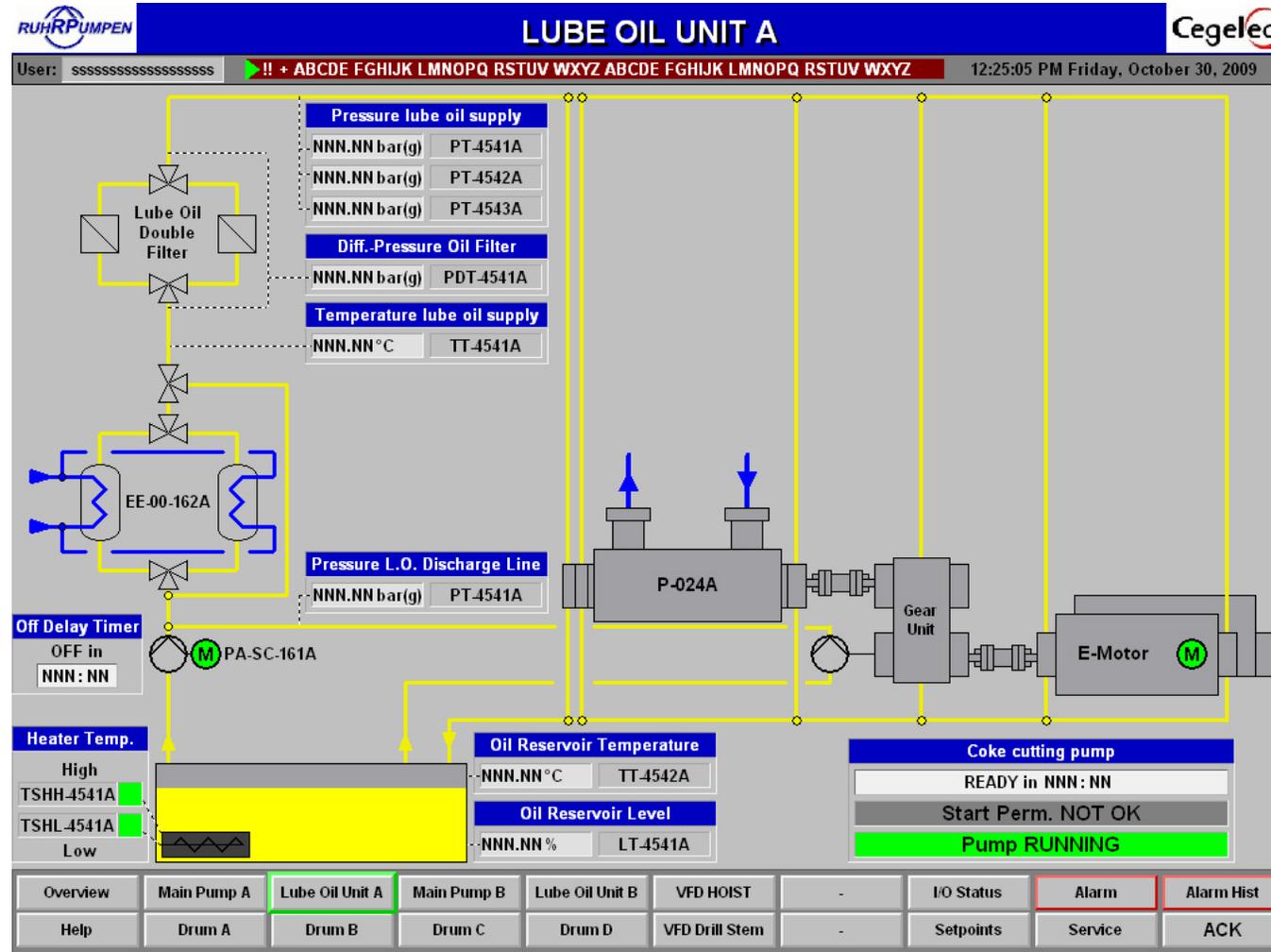
## Control and Process Visualisation





# Control System

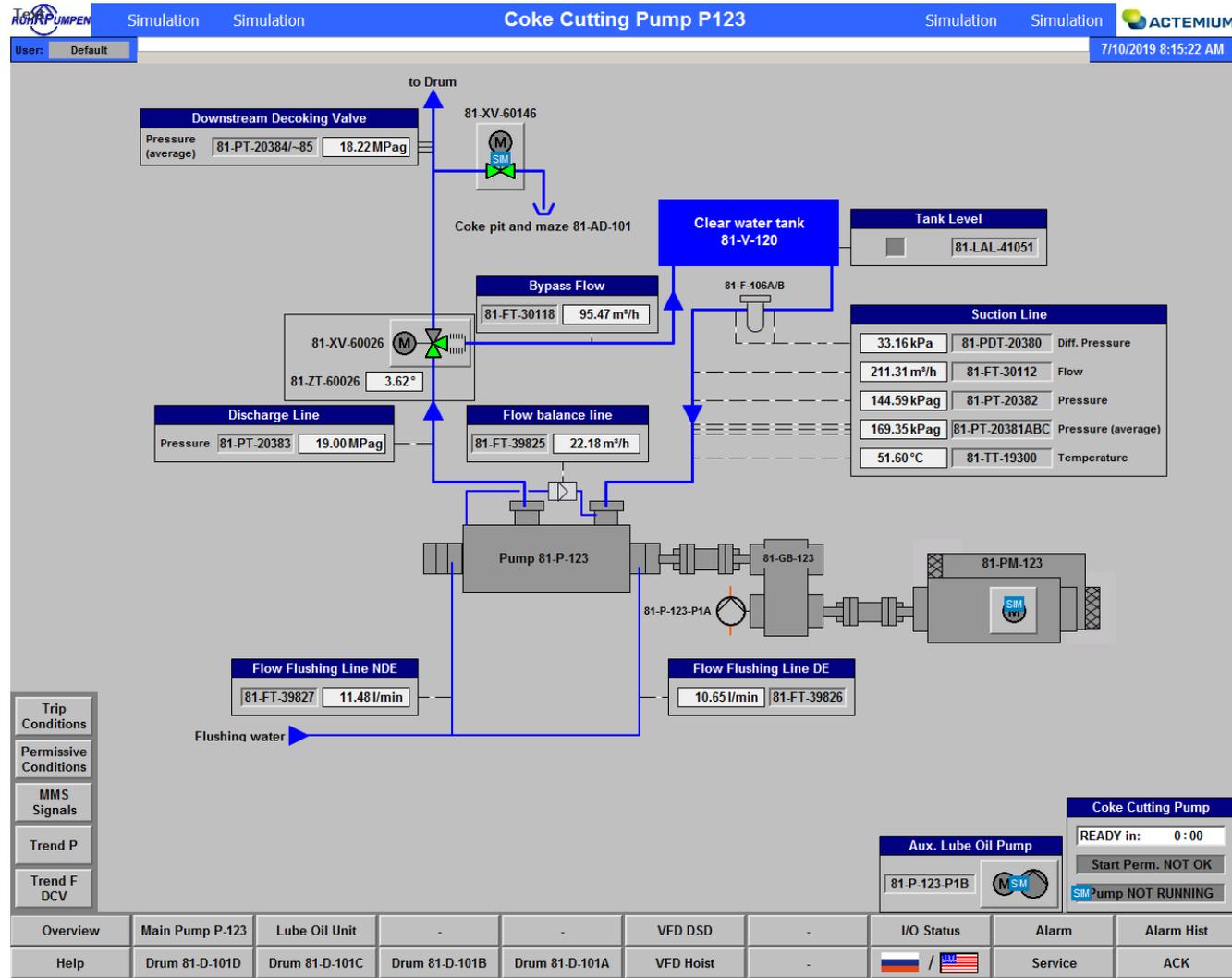
## Control and Process Visualisation





# Control System

## Control and Process Visualisation





# Control System

## Control and Process Visualisation

Simulation Simulation Help Simulation Simulation ACTEMIUM

User: Default 7/10/2019 8:22:41 AM

### Valves

- Closed
- Open
- Undefined Position
- Alarm
- Closing
- Opening
- Comm. Error
- Alarm not ack.

### Binary Indicator

- Signal OFF
- Signal ON
- Signal ON - Alarm condition
- Signal ON - Fault condition / Trip active
- Signal Fault - Alarm
- Alarm not ack.
- Comm. Error

### Drum

Not Selected Selected

In Operation Maintenance

### Motors

- Closed/Stopped
- Open/Running
- Alarm
- Comm. Error
- Simulation Mode
- Closing/Stopping
- Opening/Starting
- Alarm not ack.
- Maintenance

### Main Pump Info

Permissive Information

- Start Permissive OK
- Start Perm. NOT OK
- Start Perm. NOT OK
- Comm. Error

Status Information

- Pump NOT RUNNING
- Pump RUNNING
- Pump TRIPPED
- Pump in MAINTENANCE
- Pump STOPPING
- Pump STARTING
- Pump TRIPPED not ack.
- Communication ERROR

### Lines

- Help Line
- Oil Line
- Water Line

### Analog Value Indication

- 12.34% Analog Value with Eng. Unit
- 12.34% Trip
- 12.34% Trip not ack.
- 12.34% Alarm
- 12.34% Alarm not ack.
- 12.34% Comm. Error
- 12.34% Changeable Parameter/Setpoint

### Decoking Valve

- Bypass
- Prefill
- Full Flow
- Undefined Position
- Alarm
- moving to Bypass
- moving to Prefill
- moving to Full Flow
- Comm. Error
- Alarm not ack.

### Timers

READY in: 0:0 Timer

### Alarms & Trips List

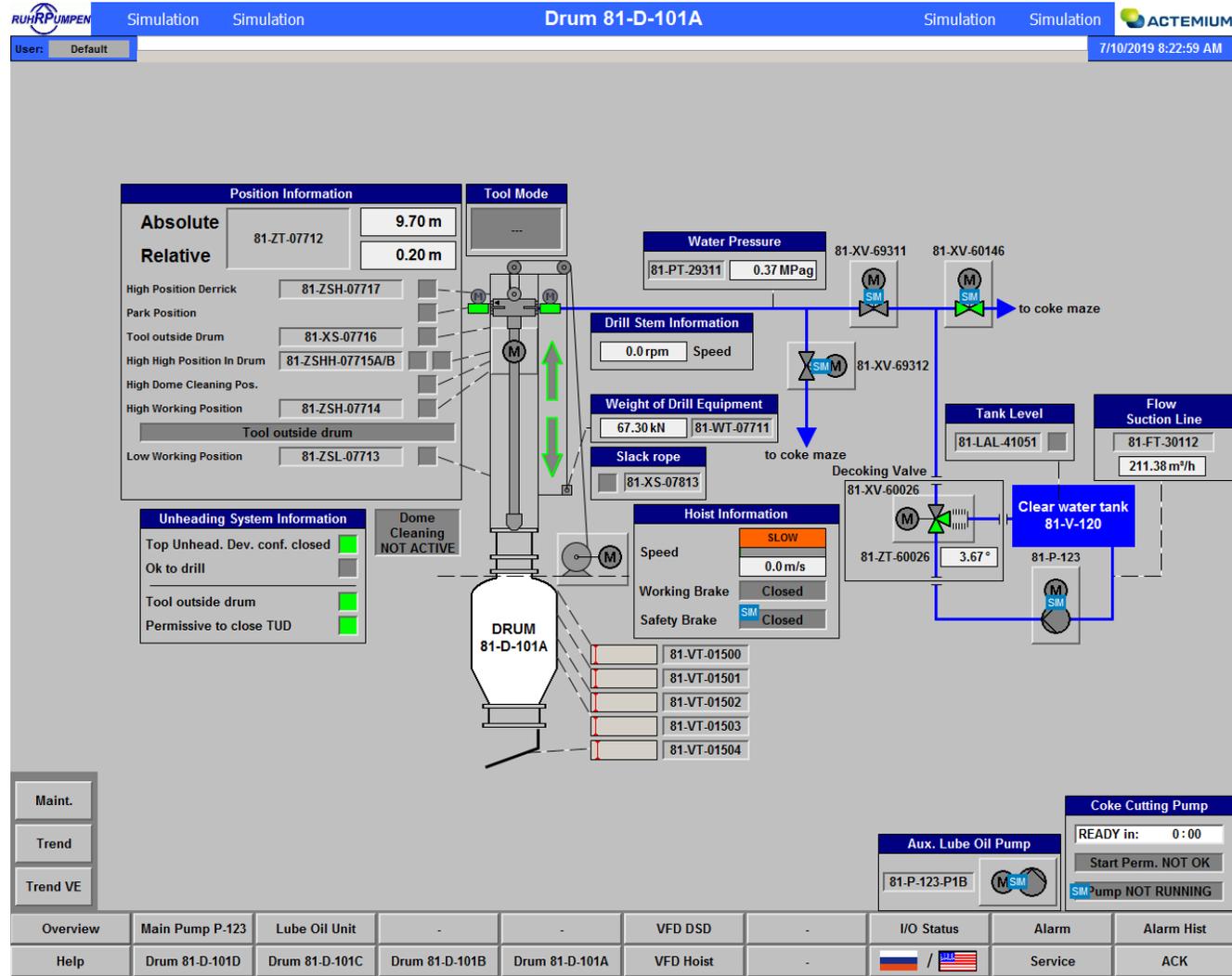
	c	c/g	c ack	c/g ack
Trip	Red	Red	Dark Red	White
Alarm	Yellow	Yellow	Orange	White
System	Blue	White	White	White

Overview	Main Pump P-123	Lube Oil Unit	-	-	VFD DSD	-	I/O Status	Alarm	Alarm Hist
Help	Drum 81-D-101D	Drum 81-D-101C	Drum 81-D-101B	Drum 81-D-101A	VFD Hoist	-	🇷🇺 / 🇺🇸	Service	ACK



# Control System

## Control and Process Visualisation



# A LINE 8x6x15 10 stage (BB5)



Fluid	Decoking Water
Operating data:	
Duty	250 m <sup>3</sup> /h @ 2,745 m
Speed	3,637 rpm
Power	2,618 kW

# A LINE 8" BB5

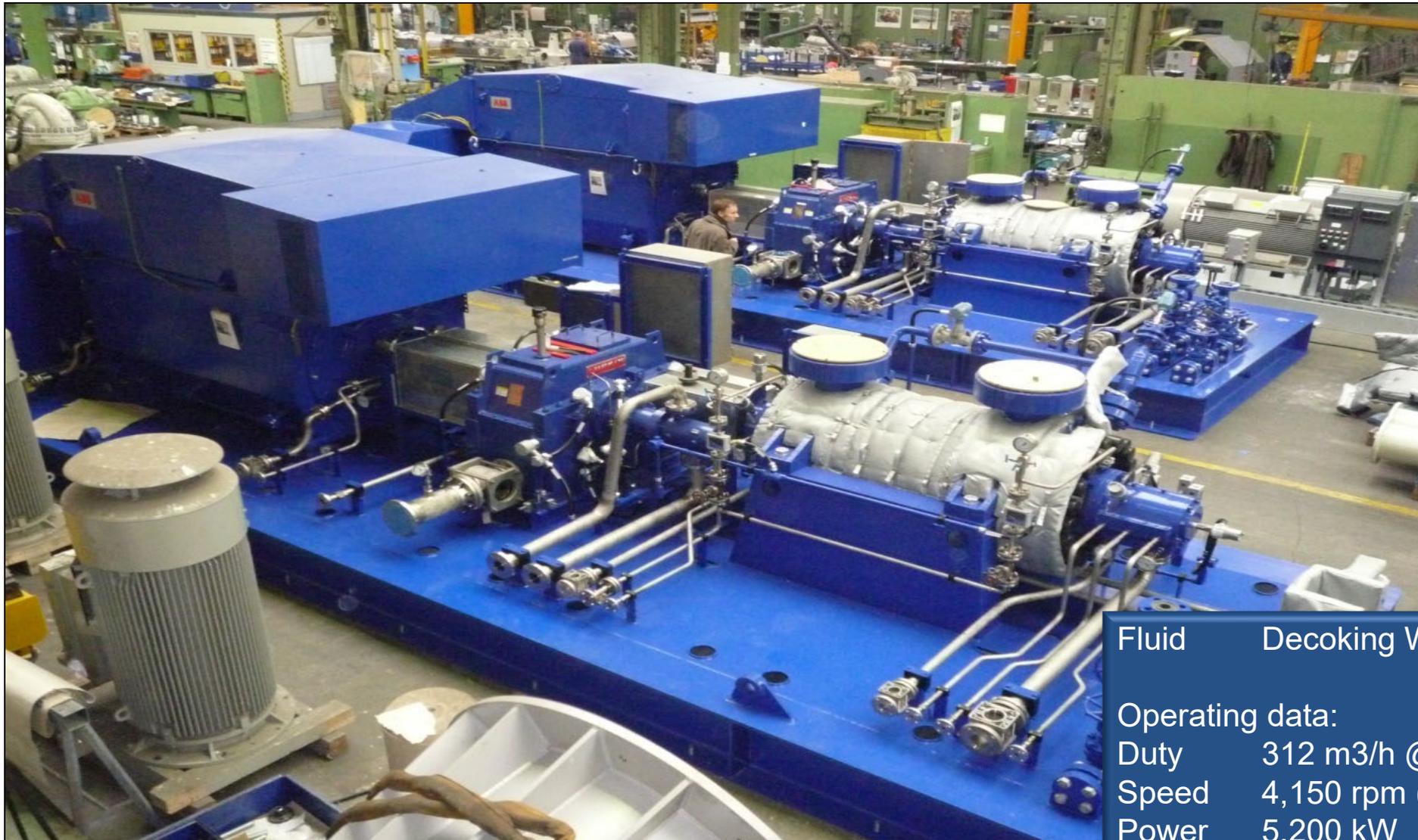
**3.2 MW HV Motor / API 614 Lube oil system / Control valves**

**Capacity 312m<sup>3</sup>/h / Head : 3587 m / Speed 2900 rpm**

**Pumped liquid : Water + abrasive solids liquid temperature 75 °C**



# A6" 10 stage (BB5)



Fluid      Decoking Water

Operating data:

Duty      312 m<sup>3</sup>/h @ 3,436 m

Speed     4,150 rpm (gear box)

Power     5,200 kW

# A LINE 8x6x15.5

3.2 MW HV Motor / API 614 Lube oil system / Control valves

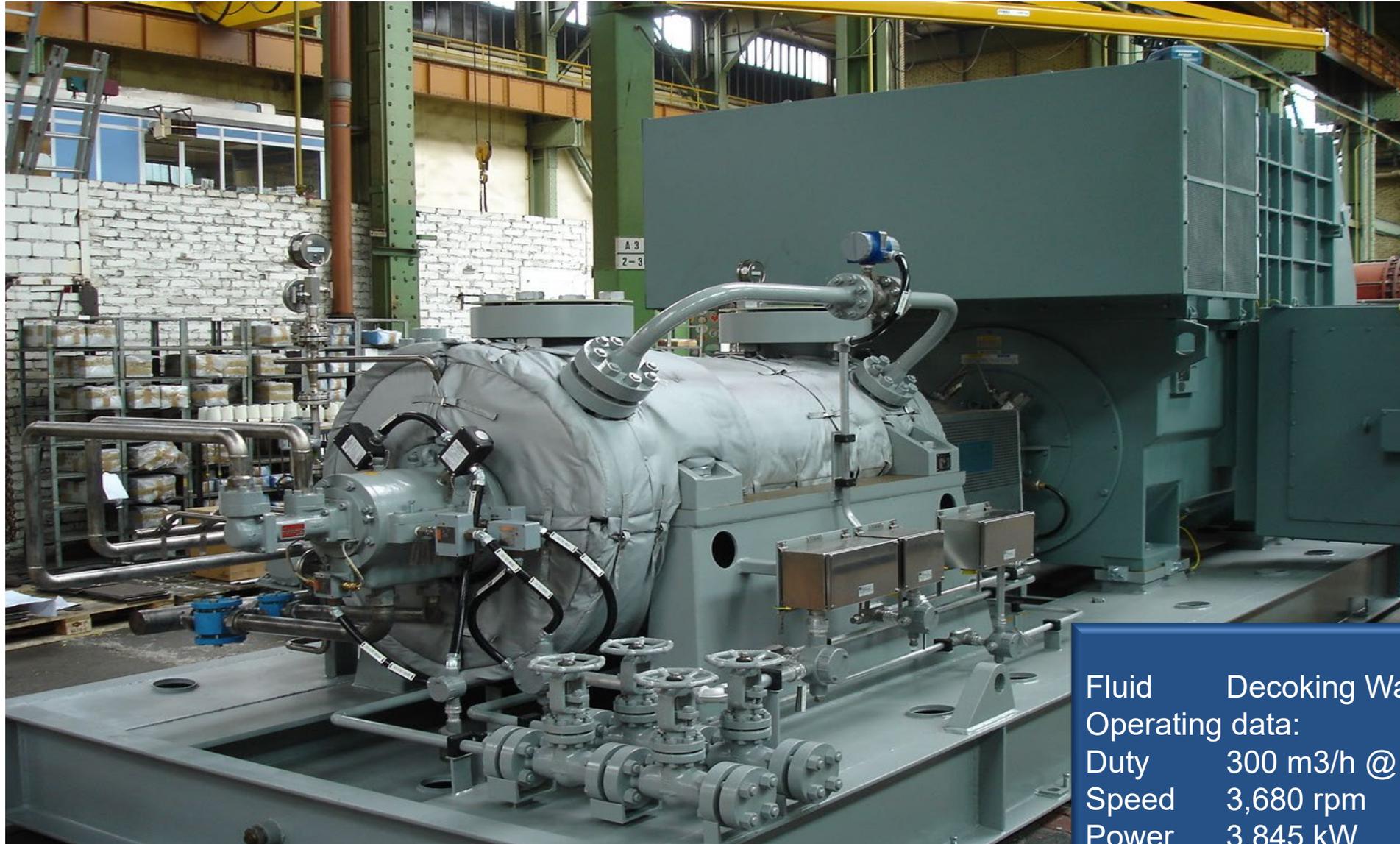
Capacity 272 m<sup>3</sup>/h / Head : 2850 m / Speed 2900 rpm

Pumped liquid : Water + abrasive solids liquid temperature 70 °C



Shown on string test test in RP factory :  
Full speed / load 3.2MW motor 2980 RPM

# A6" 12 stage (BB5)



Fluid	Decoking Water
Operating data:	
Duty	300 m <sup>3</sup> /h @ 3,300 m
Speed	3,680 rpm
Power	3,845 kW



## Coming Attractions 😊

### “Pumps for the Desalination Market”

Thur 27<sup>th</sup> April – 08.00 (UK GMT+1) (Eastern Hemisphere) & 17.00 (UK GMT+1) (Western Hemisphere)

*Aimed at Process and Mechanical Engineers and Consultant Engineers who specify pumping equipment as well as Applications & Sales Engineers selecting and quoting them.*

*This short course will look at the various pumps used in the Desalination Market worldwide*

*Future sessions :*

- Magnetic Drive Pumps for the Chemical Process and API Industries (Thursday 25<sup>th</sup> May)*
- Cryogenic Pumps (Thursday 22<sup>nd</sup> June (to be confirmed))*

The logo consists of a white circle with a stylized white symbol inside, resembling a triangle or a pump head. The word "RUHRPUMPEN" is written in a bold, white, sans-serif font across the middle of the circle.

# RUHRPUMPEN

*Specialist for Pumping Technology*

**Q & A**

[www.ruhrpumpen.com](http://www.ruhrpumpen.com)

[info@short-courses.ruhrpumpen.com](mailto:info@short-courses.ruhrpumpen.com)

# RUHRPUMPEN AT A GLANCE

**VERTICAL  
INTEGRATION**

**SALES  
OFFICES IN  
+35 COUNTRIES**

MANUFACTURING  
**FACILITIES**  
IN 10 COUNTRIES

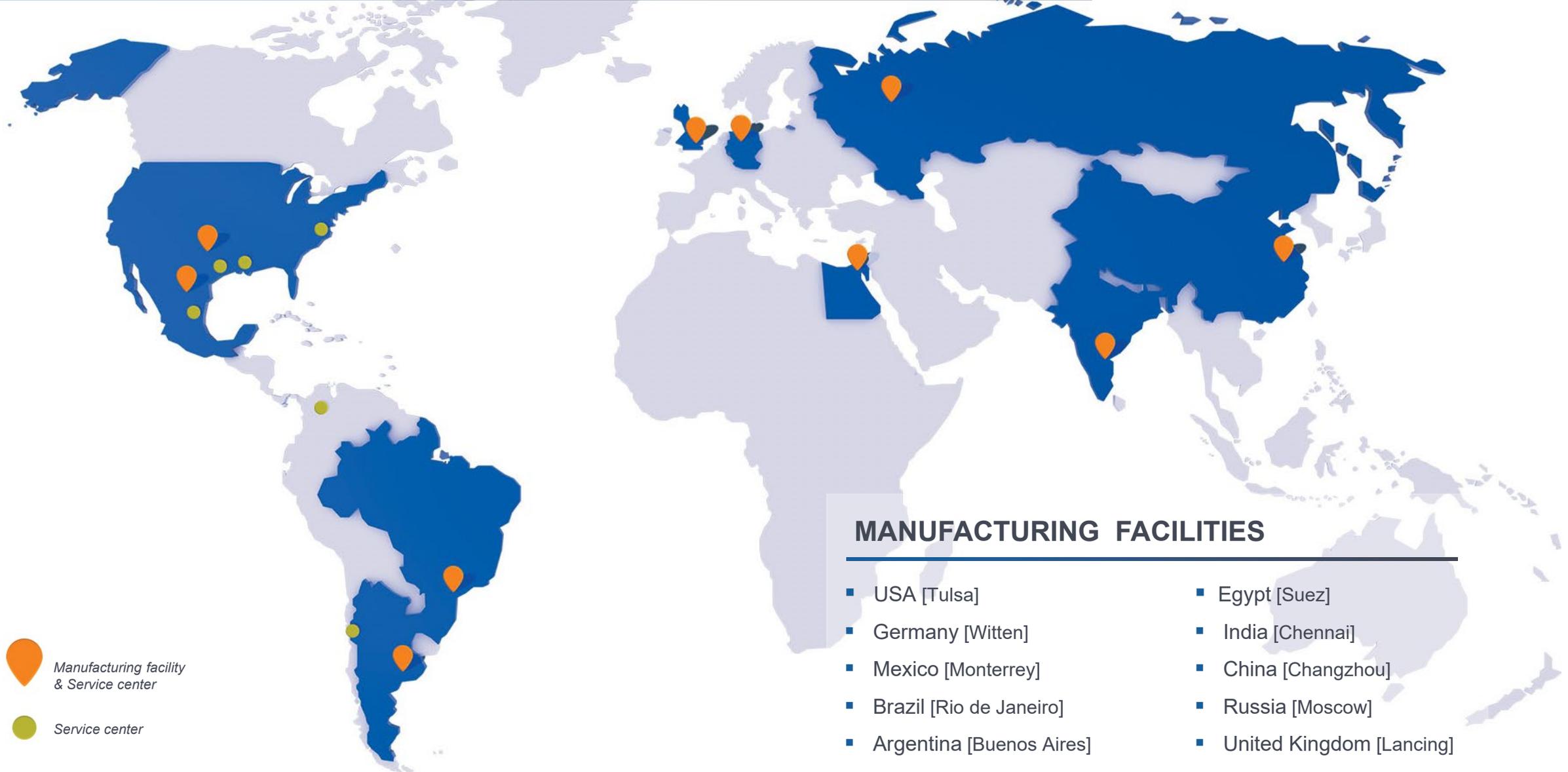
**+70 YEARS**  
OF EXPERIENCE

**+2,000**  
EMPLOYEES

**15 SERVICE  
CENTERS**

**+70,000 PUMPING SOLUTIONS INSTALLED WORLDWIDE**

# A GLOBAL COMPANY



# MARKETS WE SERVE

Our commitment to create innovations that offer reliable solutions to our customers allow us to provide a complete range of pump systems to support **core markets** as:





# OUR PUMP LINES

Ruhrpumpen offers a broad range of highly engineered and standard pumping products that meet and exceed the requirements of the most demanding quality specifications and industry standards.

Our pumps can handle head requirements as high as 13,000 ft (4,000 m) and capacities up to 300,000 gpm (68,000 m<sup>3</sup>/hr). Moreover, our pump designs cover temperatures from cryogenic temperatures of -310 °F (-196 °C) up to 752 °F (400 °C).

## Products include:

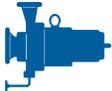
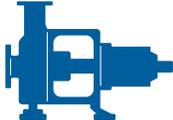
- Single Stage Overhung Pumps
- Between Bearings Pumps
- Horizontal Multi-Stage Pumps
- Vertical Multi-Stage Pumps
- Vertical Mixed Flow & Axial Flow Pumps
- Positive Displacement Pumps
- Full Range of Industrial Pumps
- Submersible Pumps
- Magnetic Drive Pumps
- Decoking Systems
- Packaged Systems
- Fire Systems





OUR PUMPS

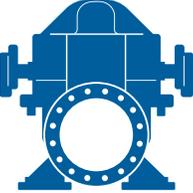
# OVERHUNG PUMPS

CATEGORY	RP MODEL	DESIGN STANDARD	
Sealless Magnetic Drive Pumps	<b>CRP-M / CRP-M-CC</b>	ISO 2858 & 15783 HI design (OH11)	
	<b>SCE-M</b>	API 685	
Foot Mounted OH1 and General End Suction Pumps	<b>IPP</b>	HI design (OH1)	
	<b>CPP / CPP-L</b>	HI design (OH1) ANSI B73.1	
	<b>CPO / CPO-L</b>	HI design (OH1) ANSI B73.1	
	<b>CRP</b>	HI design (OH1) ISO 2858 & 5199	
	<b>GSD</b>	HI design (OH0)	
	<b>SHD / ESK / SK / SKO SKV / ST / STV</b>	HI design (OH1)	
	<b>SWP</b>	HI design (OH3A)	
Centerline Mounted	<b>SCE</b>	API 610 (OH2)	
Vertical In-Line Pumps	<b>SPI</b>	API 610 (OH3)	
	<b>IVP / IVP-CC</b>	HI design (OH4 / OH5)	
	<b>IIL</b>	HI design (OH5) Dimensionally compliant with ANSI B73.2	
	<b>SPN</b>	API 610 (OH5)	





# BETWEEN BEARING PUMPS

CATEGORY		RP MODEL	DESIGN STANDARD	
1 and 2 stage	Axially split	<b>HSC / HSD / HSL HSR / ZW</b>	HI design (BB1)	
		<b>HSM</b>	HI design (BB3)	
		<b>ZM / ZMS ZLM / ZME</b>	API design (BB1)	
	Radially split	<b>HVN / J</b>	API design (BB2)	
		<b>RON / RON-D</b>	API design (BB2)	
Multi-stage	Axially split	<b>SM / SM-I</b>	API design (BB3)	
		<b>JTN</b>	API design (BB3)	
	Radially split <i>single casing</i>	<b>GP</b>	API design (BB4)	
	Radially split <i>double casing</i>	<b>A LINE</b>	API design (BB5)	





# VERTICAL PUMPS

CATEGORY		RP MODEL	DESIGN STANDARD	
Single casing	Diffuser	<b>VTP</b>	HI & API 610 (VS1)	
		<b>VCT</b>	HI & API 610 (VS1)	
		<b>HQ</b>	HI & API 610 (VS1)	
		<b>VLT</b>	HI & API 610 (VS1)	
	Volute	<b>DSV / DX</b>	HI & API 610 (VS2)	
	Discharge through column – Axial flow	<b>VAF</b>	HI & API 610 (VS3)	
Separate discharge line	<b>VSP / VSP-Chem</b>	HI & API 610 (VS4)		
Double casing	Diffuser	<b>VLT / VMT</b>	HI & API 610 (VS6)	
	Volute	<b>DSV / DX</b>	HI & API 610 (VS7)	
Submersible pumps		<b>SMF</b>	HI design (OH8A)	
		<b>VLT-Sub / VTP-Sub</b>	HI design (VS0)	





# SPECIAL SERVICE PUMPS

CATEGORY	RP MODEL	DESIGN STANDARD	
Pitot tube pumps	<b>COMBITUBE</b>	HI design	
Reciprocating pumps	<b>RDP</b>	API 674 ISO 13710	
Vertical turbine generator	<b>VTG</b>	HI design (VS6)	
Barge	<b>LS BARGE</b>	HI design	
Floating dock pumps	<b>ZVZ</b>	HI design	
	<b>LVZ</b>	HI design	
Cryogenic pumps	<b>SVNV</b>	-	
	<b>VTG Cryogenic</b>	-	
	<b>VLT Cryogenic VLTV</b>	-	
<b>Pre-packaged fire pump systems</b>	Fire systems incorporate pumps, drivers, control systems and pipework in a single container. They can be skid mounted, with or without enclosure and supplied with electric motor or diesel engine.	<b>NFPA-20-850</b> UL and FM approved components	

