State-Of-The-Art Delayed Coking Unheading Technology To Improve Safety During Operation

RefComm® Budapest 2017

IMI Z&J Germany

Reiner Mehr

Content Table I

Design Evaluation I

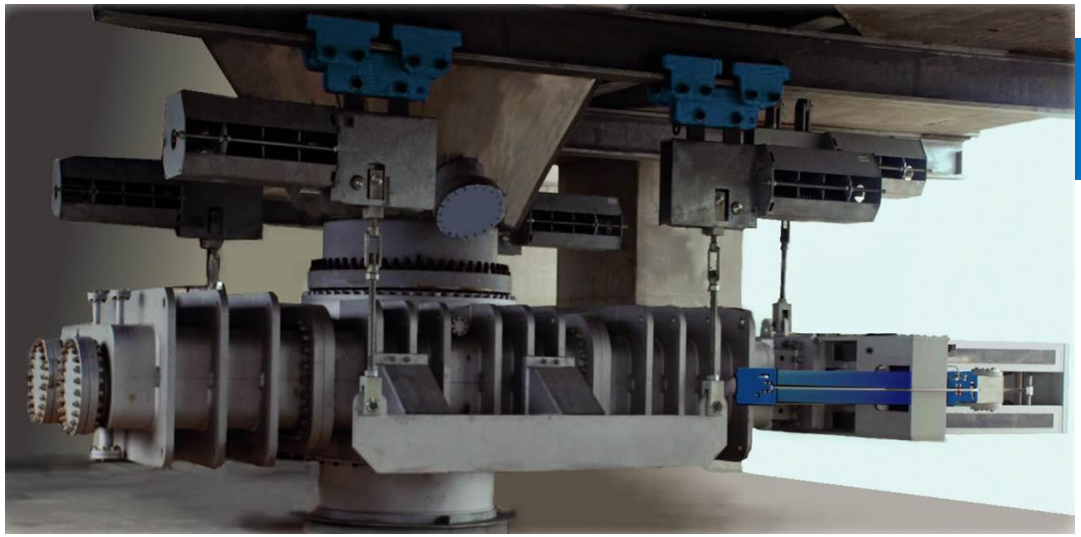
IMI Critical Engineering

IMI Z&J Unheading Technology

Design Evaluation

IMI Z&J

Design Evaluation II



2004 **Double Disc – Multiple Seal Automatic Unheading**

2001 **Totally Enclosed**

1990 **Swing Away**

1950 **Manual**

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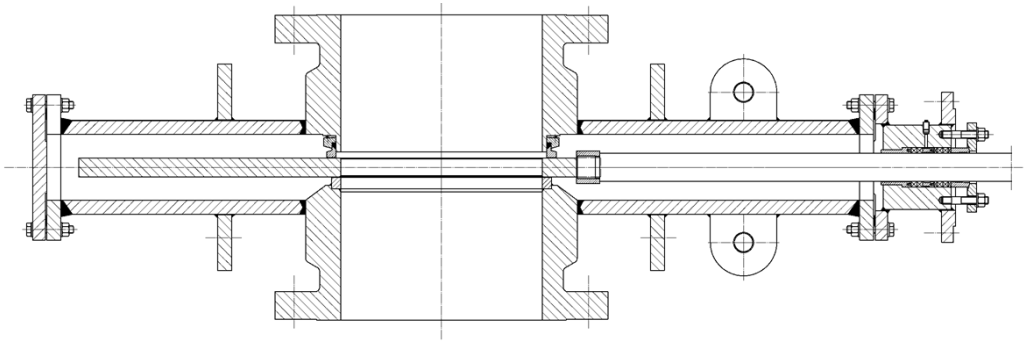
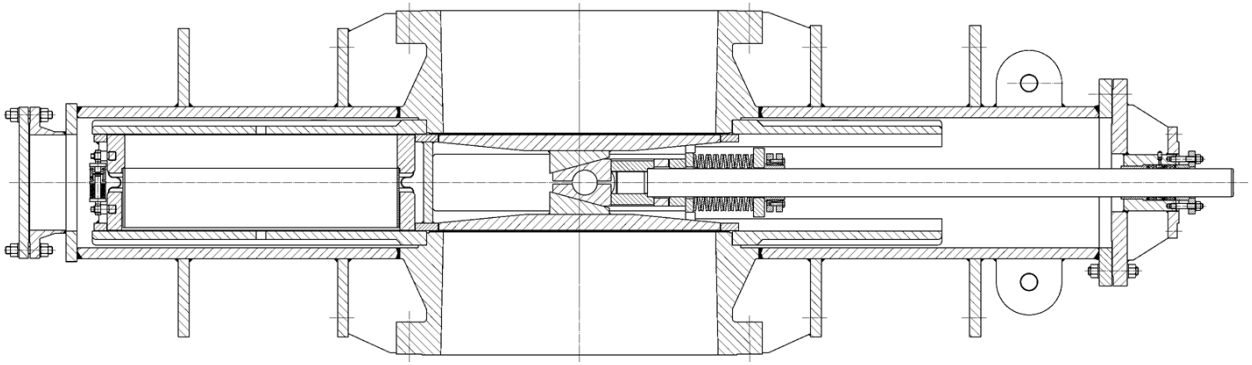
Design Evaluation III

Single Plate Design



Double Disc Design

Z&J‘s Unique Unheading Technology



Design Evaluation IV

IMI Critical Engineering

Rectangular Plate vs. Disc

Rectangular Plate

- Contact between plate & seat only by springs
- Commonly used in Ethylene service

Innovative Disc

- Double disc design with wedges
- Tightness created between discs & seats by split-wedge & springs in addition to spring loaded upper seat
- Extended life time

Patented Design

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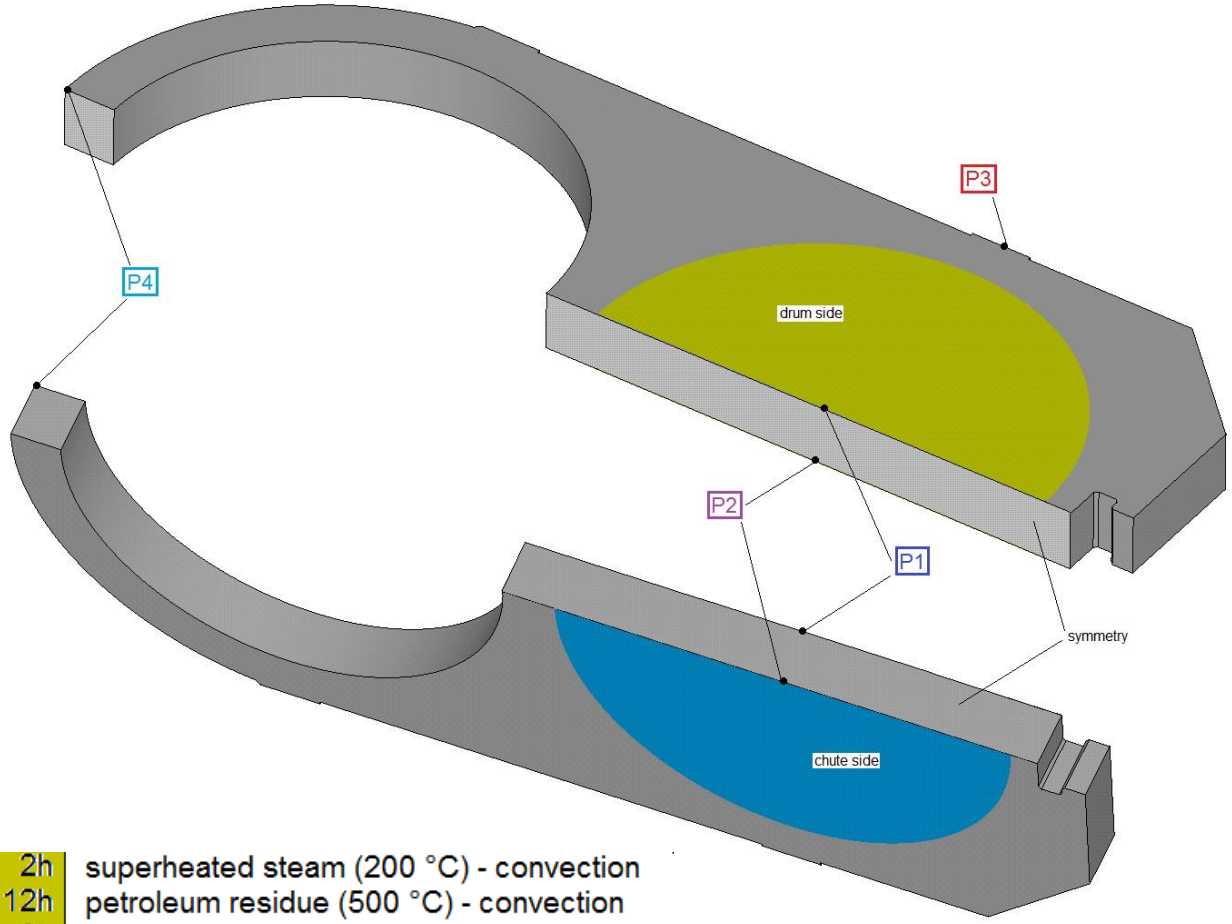
Design Evaluation V

IMI Critical Engineering

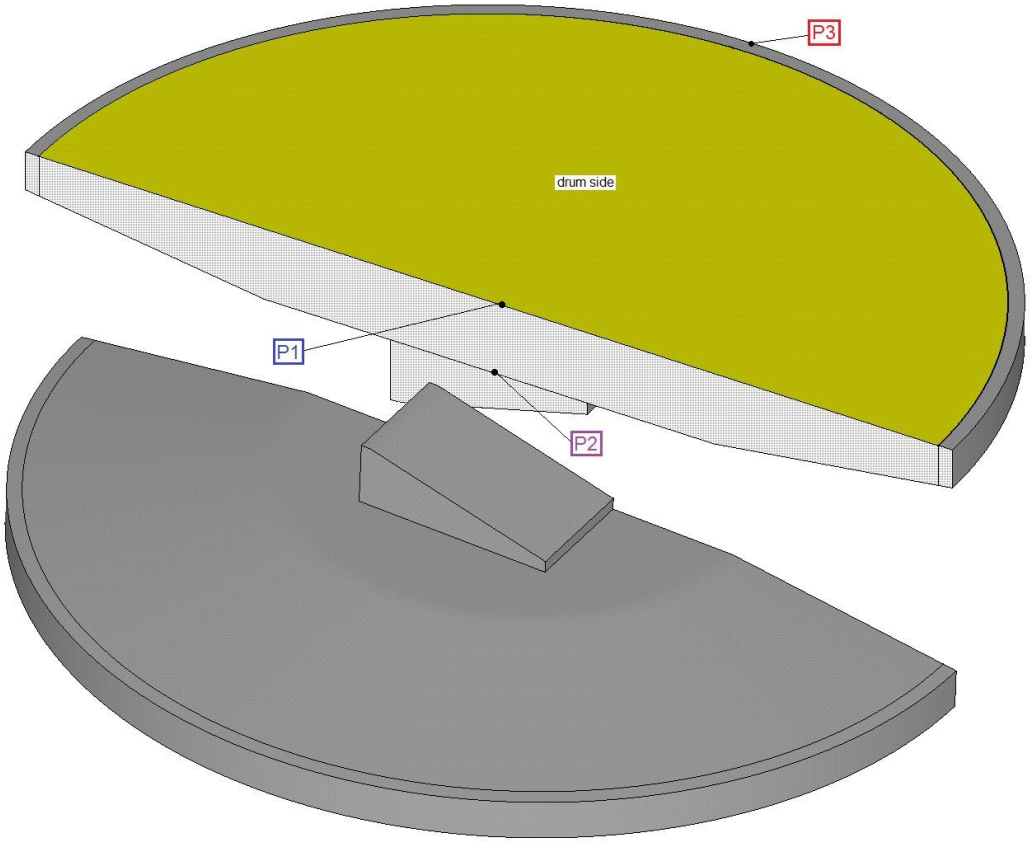
Calculation Model Rectangular Plate



warm-up	2h	superheated steam (200 °C) - convection
coking operation	12h	petroleum residue (500 °C) - convection
steamout	3h	superheated steam (200 °C) - convection
quenching	5h	cooling water (25 °C) - convection
body purge		superheated steam (200 °C) - convection
outside		environment (25 °C) - convection + radiation

Design Evaluation VI

Calculation Model Disc



warm-up	⇨	2h	superheated steam (200 °C) - convection
coking operation	⇨	12h	petroleum residue (500 °C) - convection
steamout	⇨	3h	superheated steam (200 °C) - convection
quenching	⇨	5h	cooling water (25 °C) - convection
body purge	⇨		superheated steam (200 °C) - convection

Design Evaluation VIII

Temperature Profile

A warm-up
B coking operation
C decoking operation

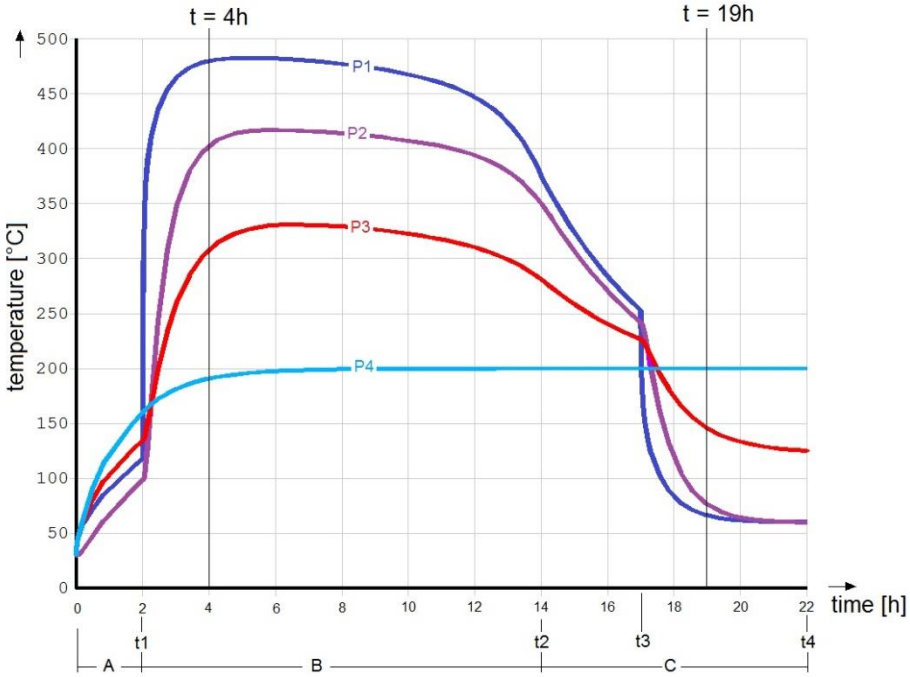
t1 end of warm-up
start of coking

t2 end of coking
start of steamout

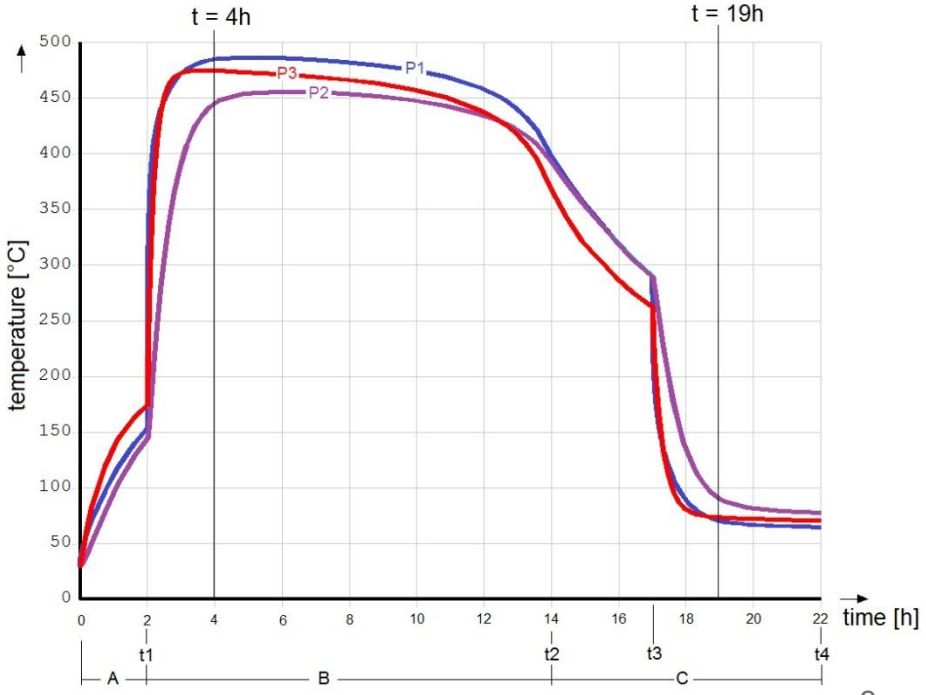
t3 end of steamout
start of quenching

t4 end of quenching
start of drain/unhead

Rectangular Plate

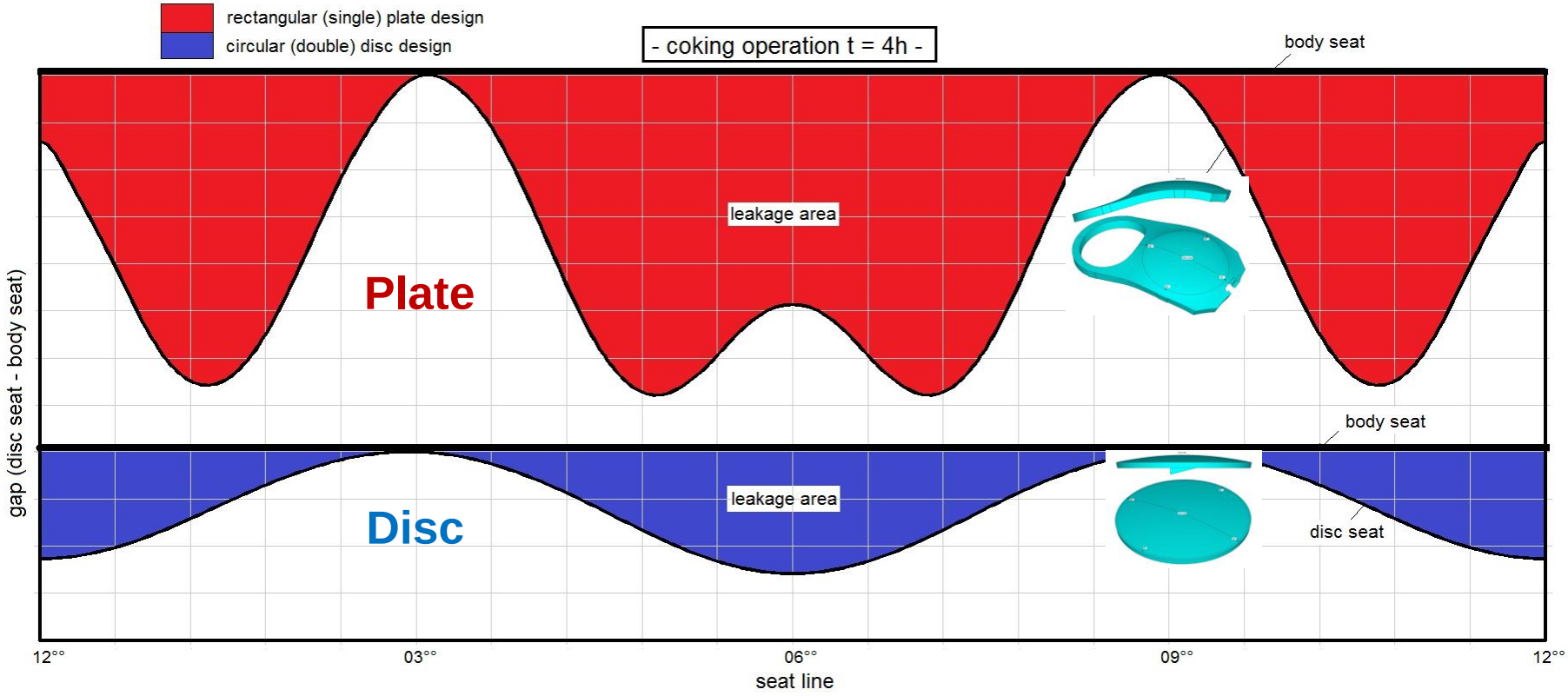


Disc



Design Evaluation XI

Deflection Diagram



➡ **Ratio of leakage area: 3 (!)**

Design Evaluation XII

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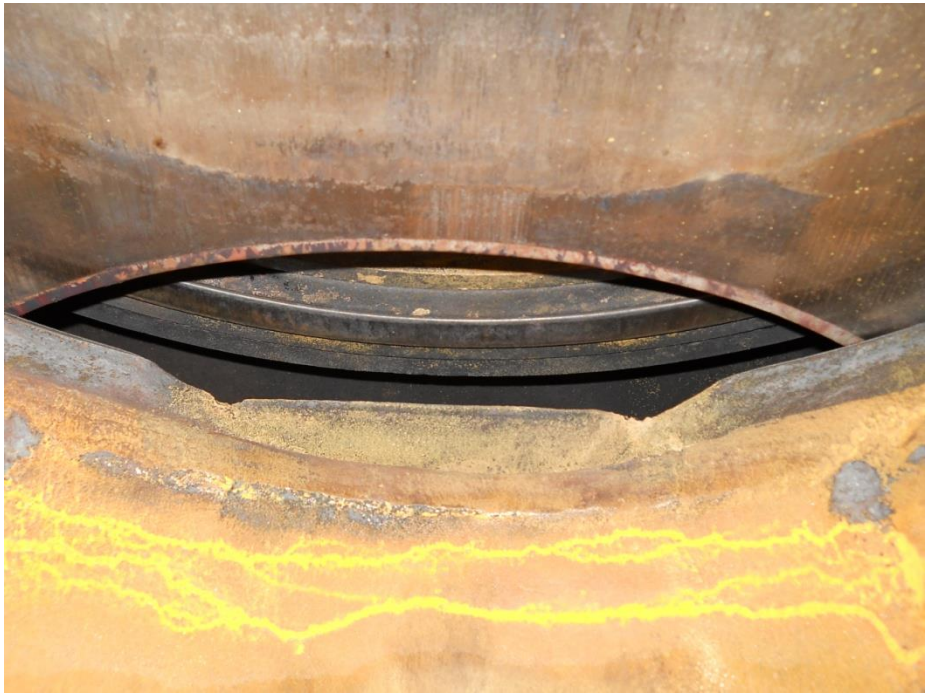
Rectangular Plate erosion due to excessive leakage



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Design Evaluation XIII

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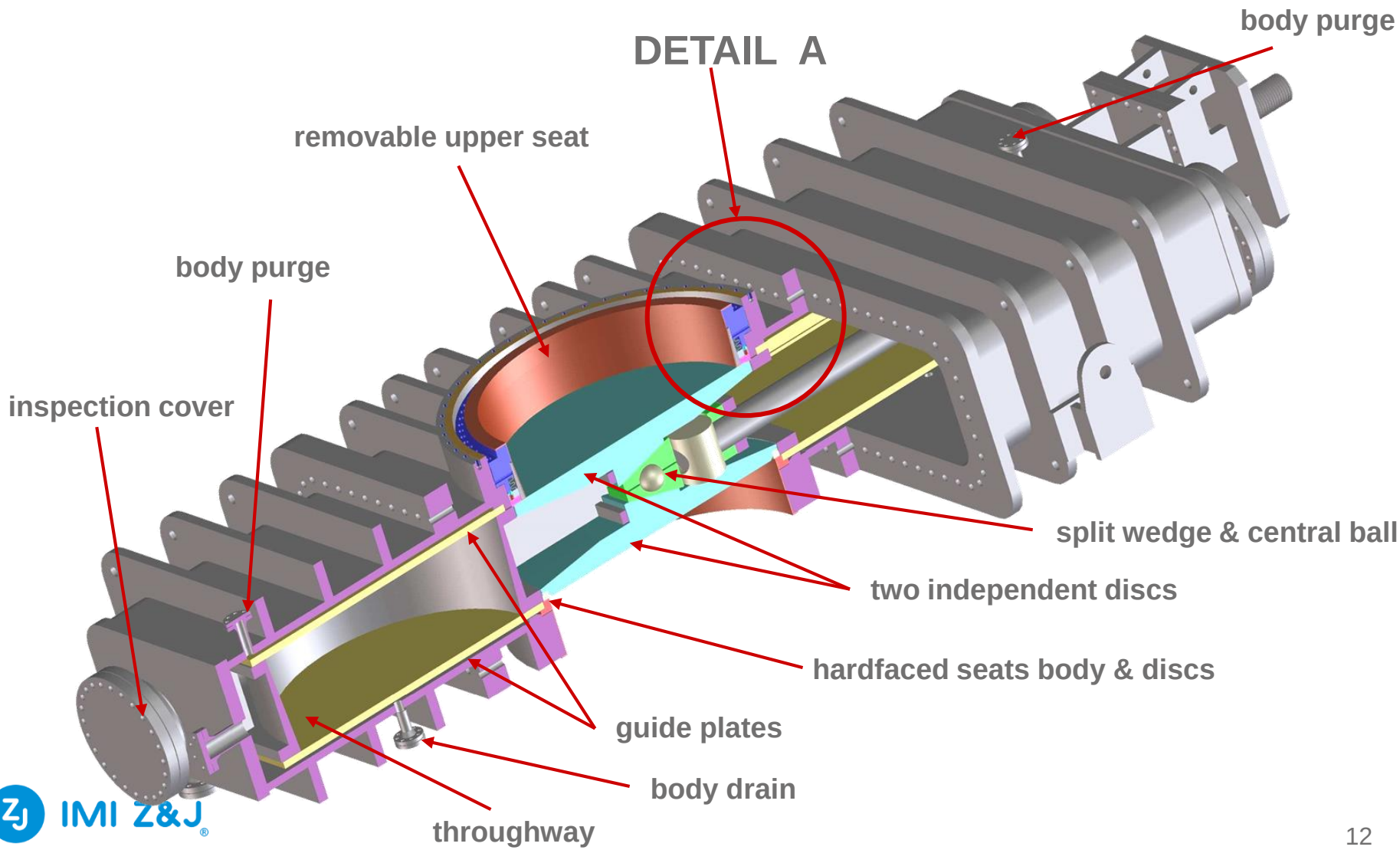
True *Double Block - Multiple Seal & Purge* Design



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Design Evaluation XIV

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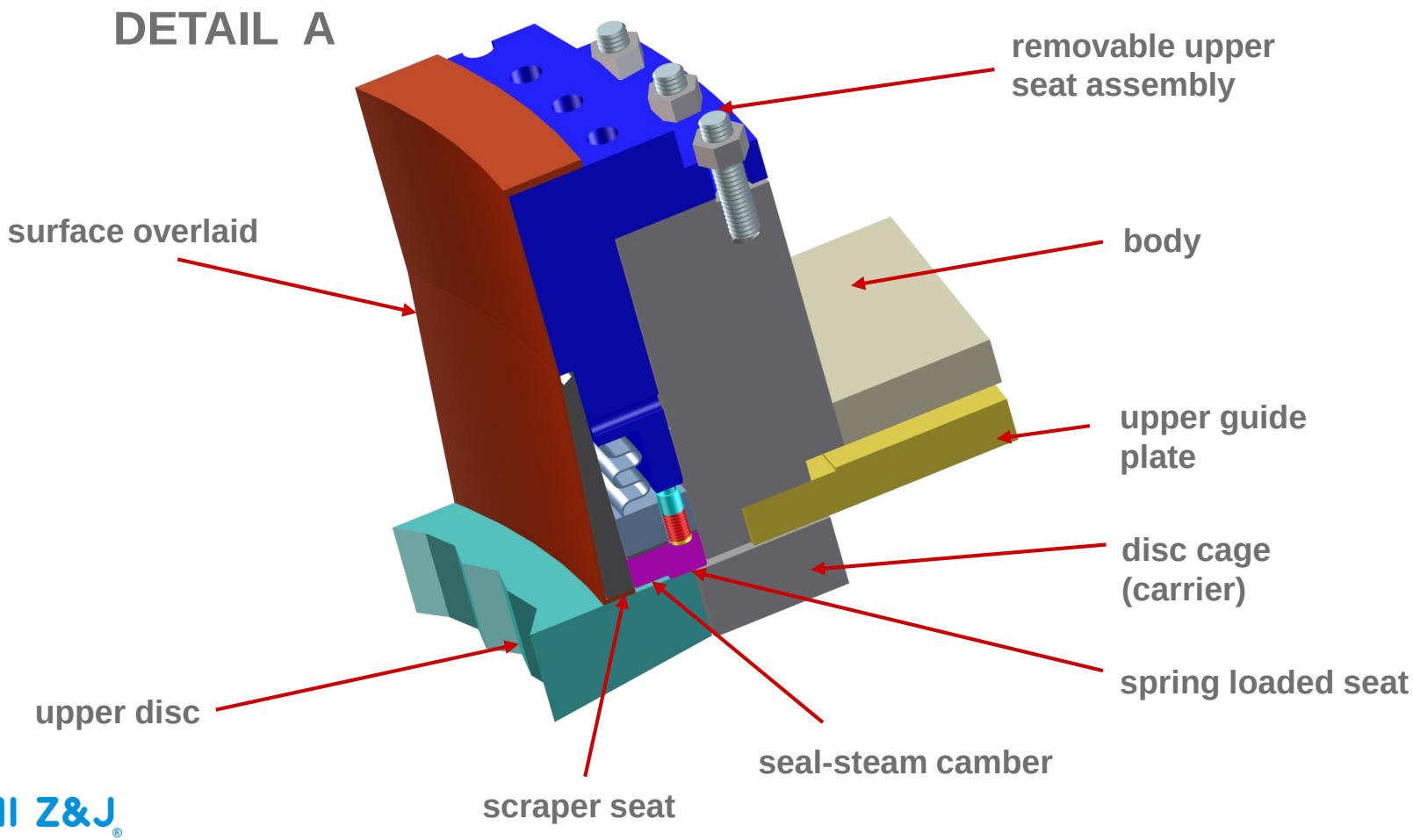
Removable Upper Seat Assembly - *Multiple Seal* Technology



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Design Evaluation XV

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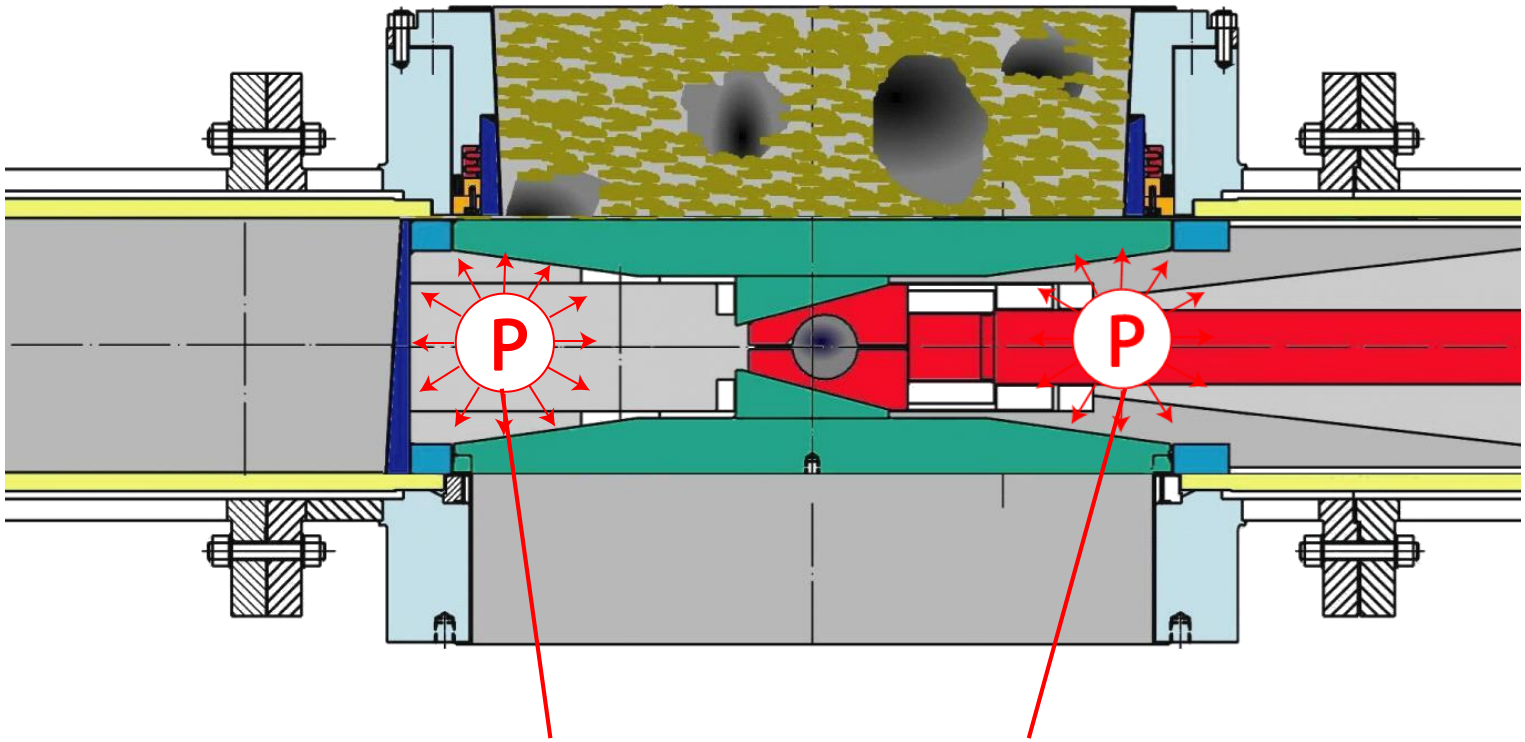
Double Disc Multiple Seal & Purge
and active mechanical seating



Positive steam pressure between the two discs

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Design Evaluation XVII
Sample calculation – Steam consumption

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Typical Steam Consumption Calculation per Drum
Comparing Single Disc with Double Disc Unheading Devices

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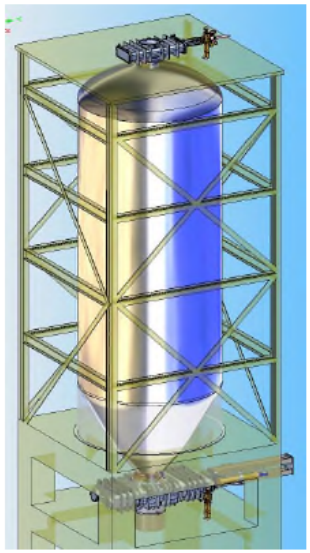

Cycle Time (coking plus drilling)	30	hours
Steam Price	13,00	€/T
Number of Drums	4	
Return of Investment	5	Year(s)

Change Parameters to Suit Actual Plant Conditions and Press Enter

Cost Savings if Double Disc is Used **1.601.377 €**

Please note that for Double Disc Design NO water cooling is required!
Water Cooling Consumption and System Cost, which are only required for Single Disc Design, are NOT included in this calculation! These costs have to be added on top!

date of issue Dec.04.2009

Page 1 of 2

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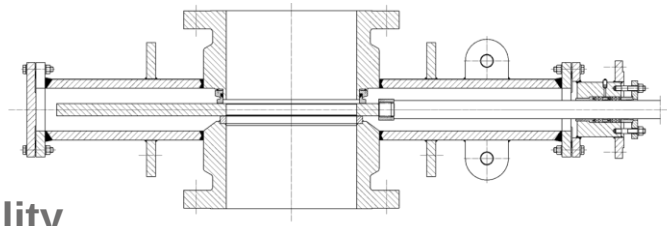
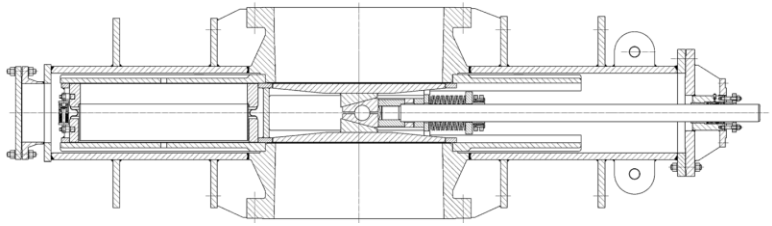
Conclusions and Prospects of Design Evaluation

Rectangular Plate



- Random temperature distribution
- Very sensitive to thermal distortion
- Areas of excessive leakage
- Apparently no true *double block* capability
- High steam consumption & energy costs
- High erosion & maintenance costs

Innovative Z&J Disc Design



- Equal temperature distribution
- Insensitive to thermal distortion
- Area of leakage 3 x smaller
- True *double block* capability
- Reduced steam consumption & energy costs
- Low erosion & maintenance costs
- Less downtime

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Compact Footprint Design I

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IMI Z&J Revamp Solution for Bottom Unheading

IMI Z&J Compact Footprint Design (CFD)

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Compact Footprint Design II

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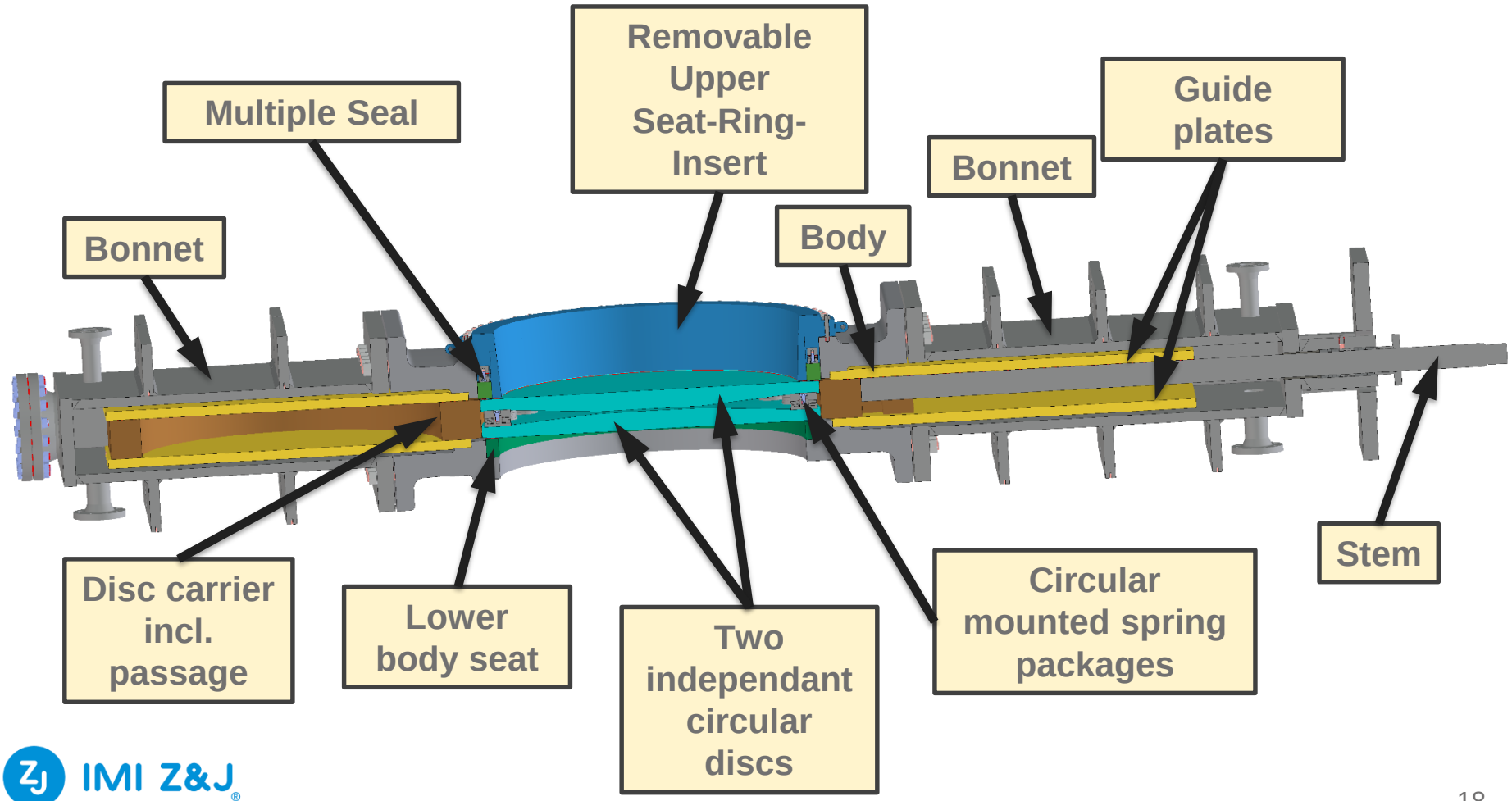
- General Assembly



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Compact Footprint Design IV

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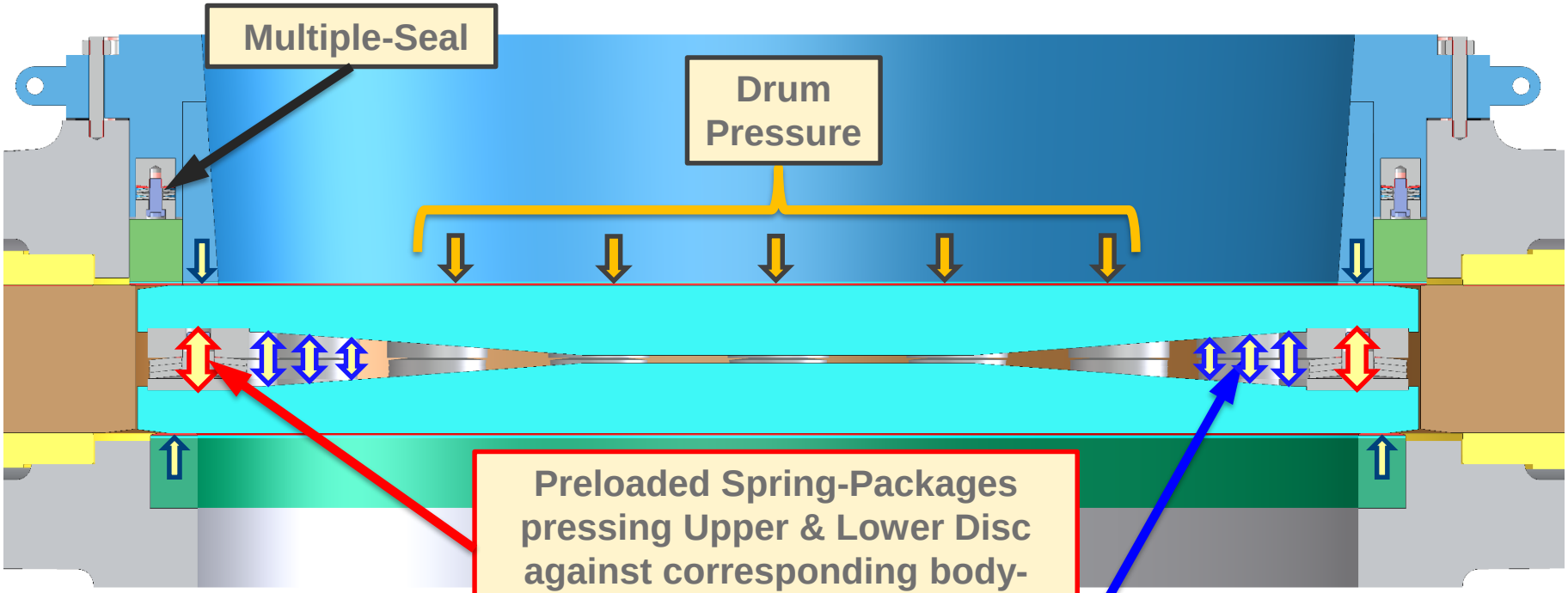
- Sealing Principle



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Compact Footprint Design V

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IMI Z&J Bottom Unheading Device and IMI Z&J Compact Bottom Unheading Device common features		
1. General		
Product Name	**IMI Z&J Bottom Unheading Device**	**IMI Z&J Compact Bottom Unheading Device**
Size NPS	NPS 60"	
Design	per ASME section VIII Div. 1, 2	
Actuator types	Electric or Hydraulic	
2. Conditions, Technical Performance		
Design		
Product Type	Double Disc Through Conduit	
Full Bore	Yes	
On-Off Service	Yes	
Body	Bonnet - Body - Bonnet	
Sealing System	Double Block & Purge	
Seating Force activation	Split-Wedge-Ball Arrangement	Preloaded Disc Arrangement
Multiple Seal	Yes	
Leakage Rate	API 598	
Maintenance		
On-Deck Maintanance System	Yes	
On-Deck Seat Replacement (upper Seat)	Yes	
On-Deck Disc Replacement	Yes	
3. Dimensions of Valve		
Weight incl. Actuator (Compact Electric)	135600 lbs / 61500 kg	88 000 lbs / 40 000 kg
Length	390" / 9900 mm	388" / 9850 mm
Width	115" / 2920 mm	101" / 2560 mm
Height	51" / 1308 mm	37" / 950 mm
Face-to-face	51" / 1308 mm	31" / 790 mm

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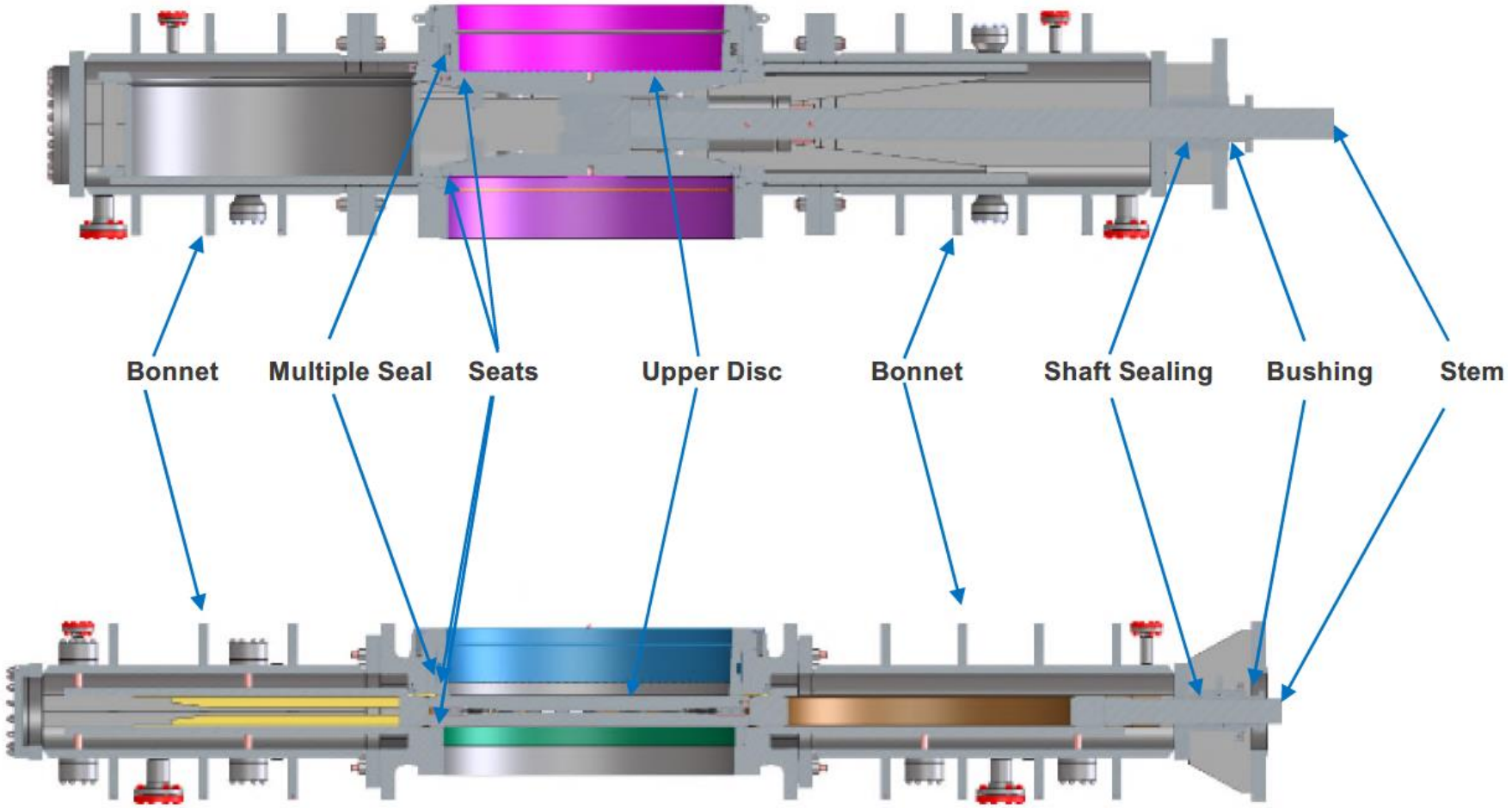
Compact Footprint Design VI



Compact Footprint Design VII

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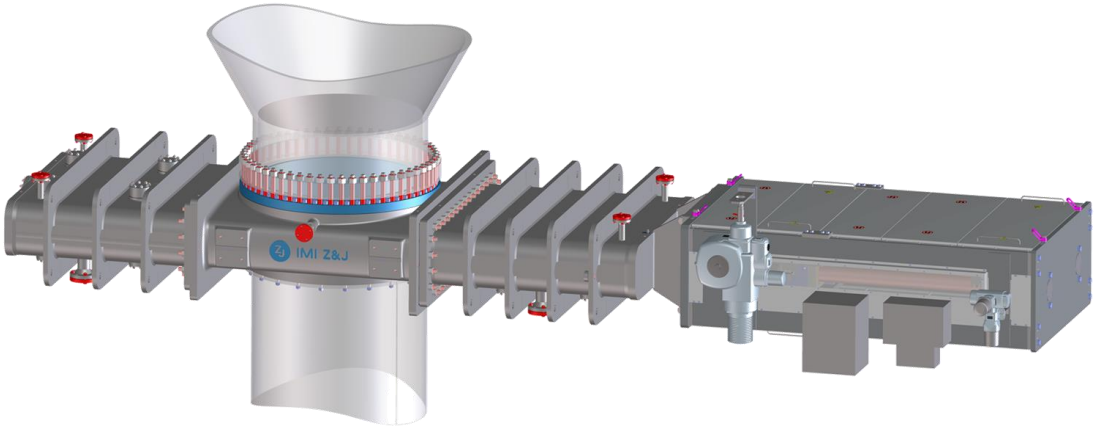
Z&J's Compact BUD Design

- Compact Footprint – Low weight
- Real Double Block and Purge Functionality
- => Reduced steam consumption => energy savings => safe environments
- => Less erosion => less maintenance => less downtime
- Easy Inspection / maintenance on deck – Valve remains connected to drum

Preferred choice for DC Revamp

- Easy to combine with / integrate into existing installations
- Easy to operate in combination with all existing feed systems



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Compact Footprint Design VIII

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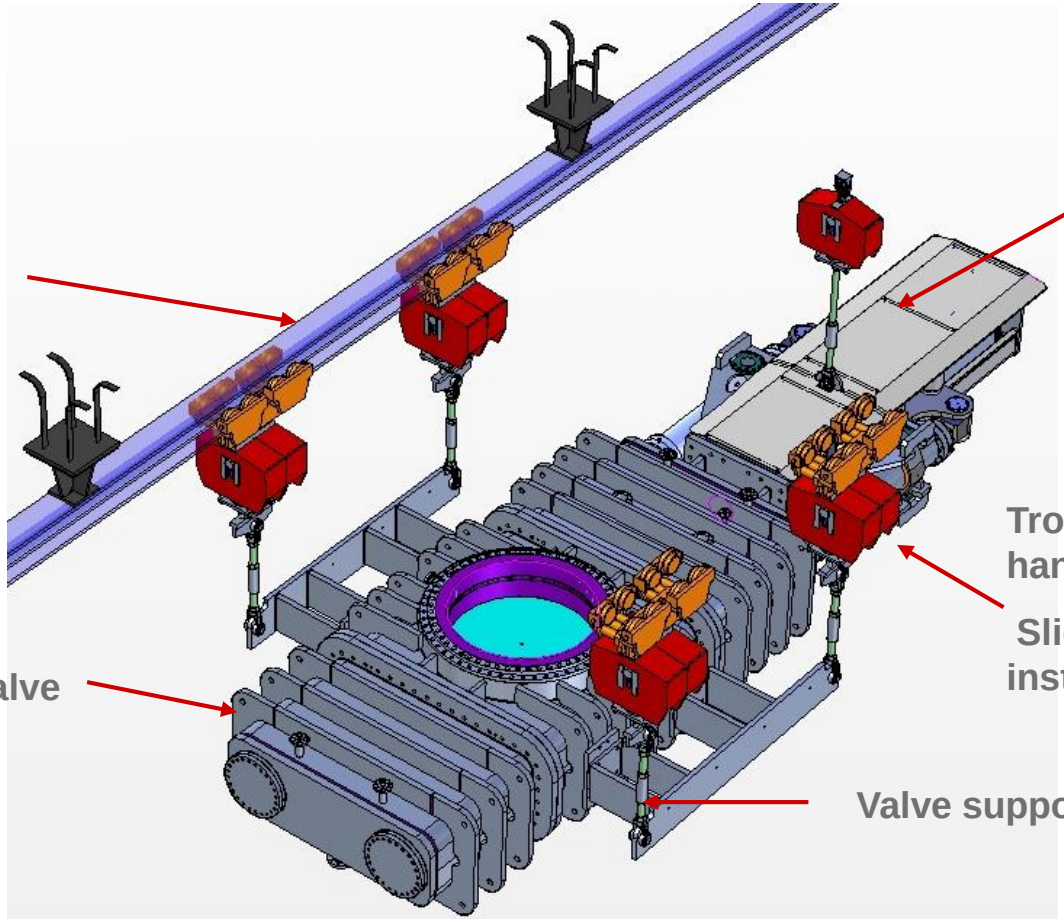
Site Installation I



Typical Site Installation – Compact Hydraulic Actuator

Site Installation II

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IMI Z&J Bottom Unheading Site Installation

Site Installation IV

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IMI Z&J Bottom Unheading in Operation

Maintenance I

Patented

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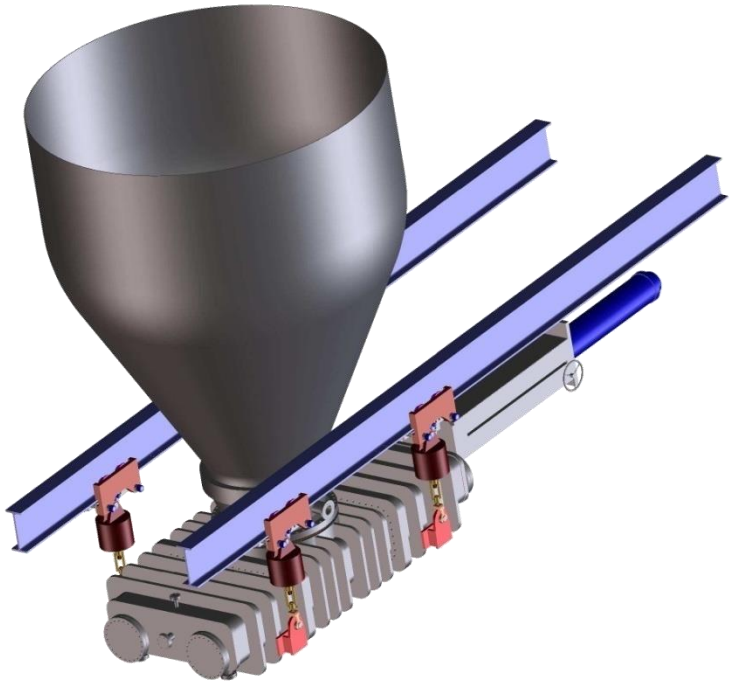
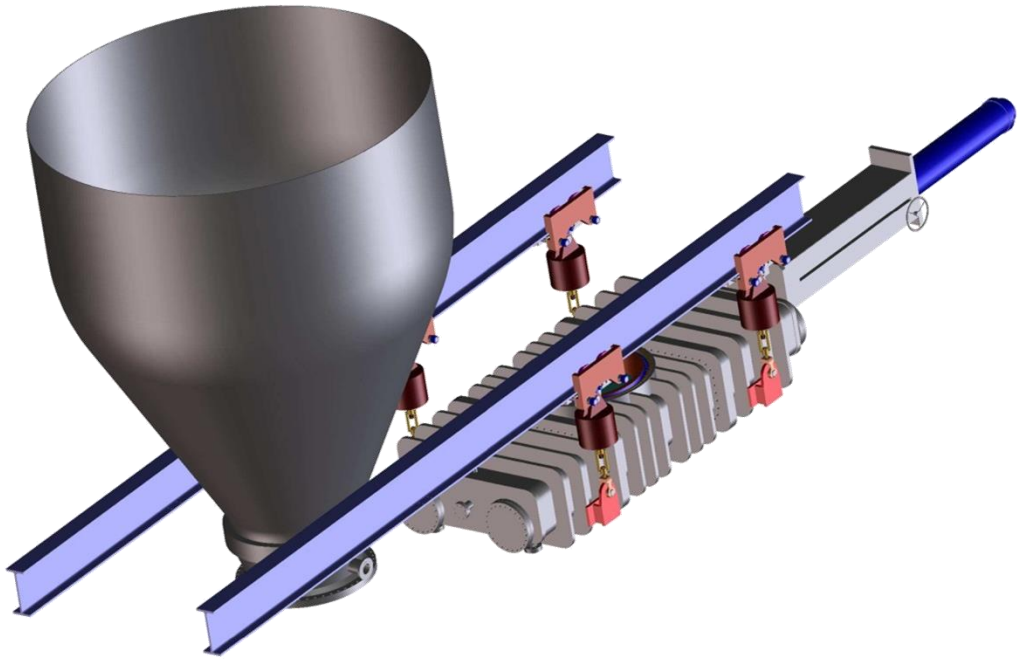
Operating position



Inspection position



Maintenance can be performed while unheading valve remains assembled. No need to remove valve bonnets!

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Maintenance II

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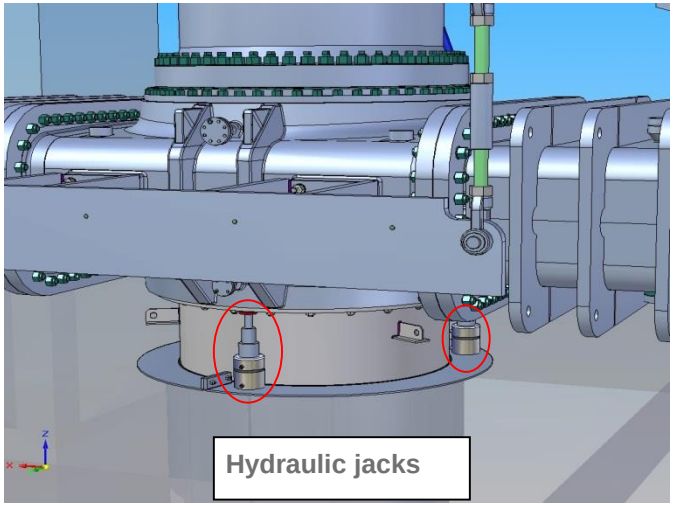
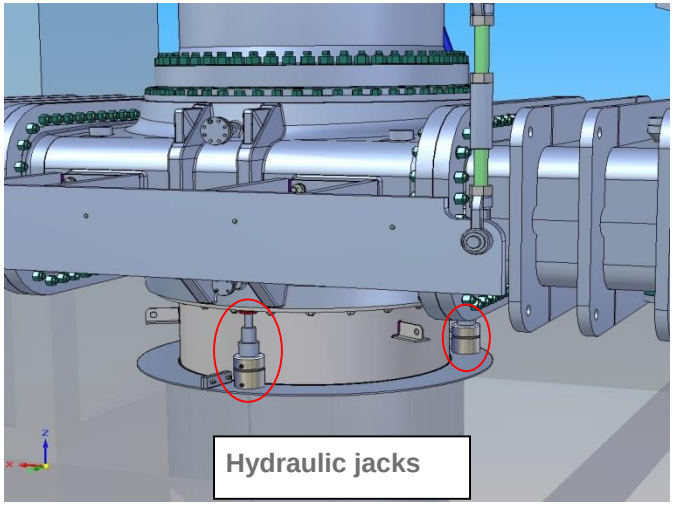
Operation Position -> Maintenance Position

- Remove all piping, tubing and wiring from the Bottom Unheading Valve and its actuator
- Block all constant hangers. For detailed information observe supplementary manual
- Support the discharge chute, for example by means of hydraulic jacks
- Remove bolting of chute
- Lower the chute and let it rest on wooden beams. Close the chute opening by means of cover / lid.
- Support the valve weight by means of equally arranged hydraulic jacks (only if unheading deck is able to bear the load) or chain hoist between I-beams and valve





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Maintenance VI

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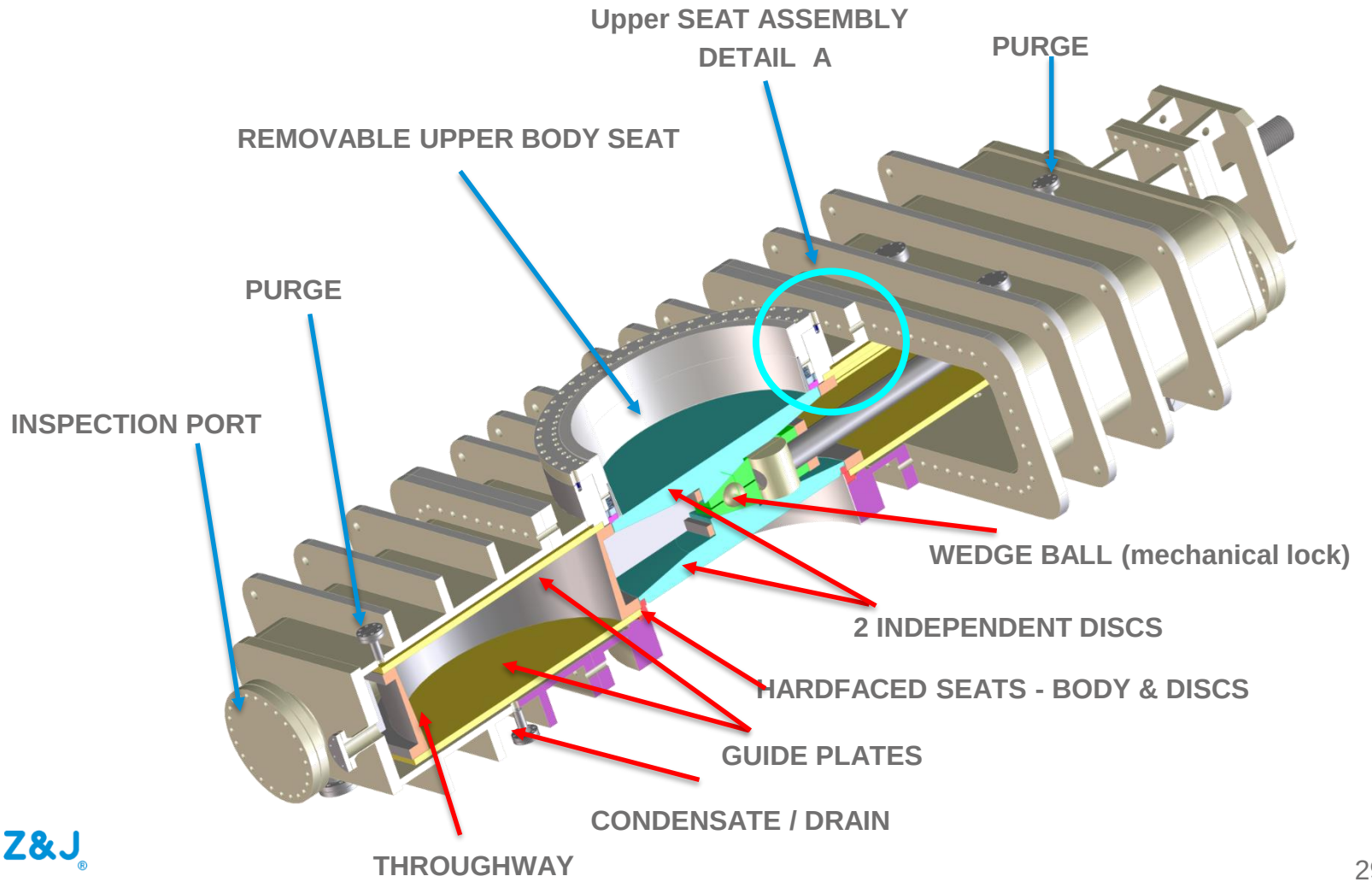
Displacement of Seat Ring Arrangement / Upper Disc



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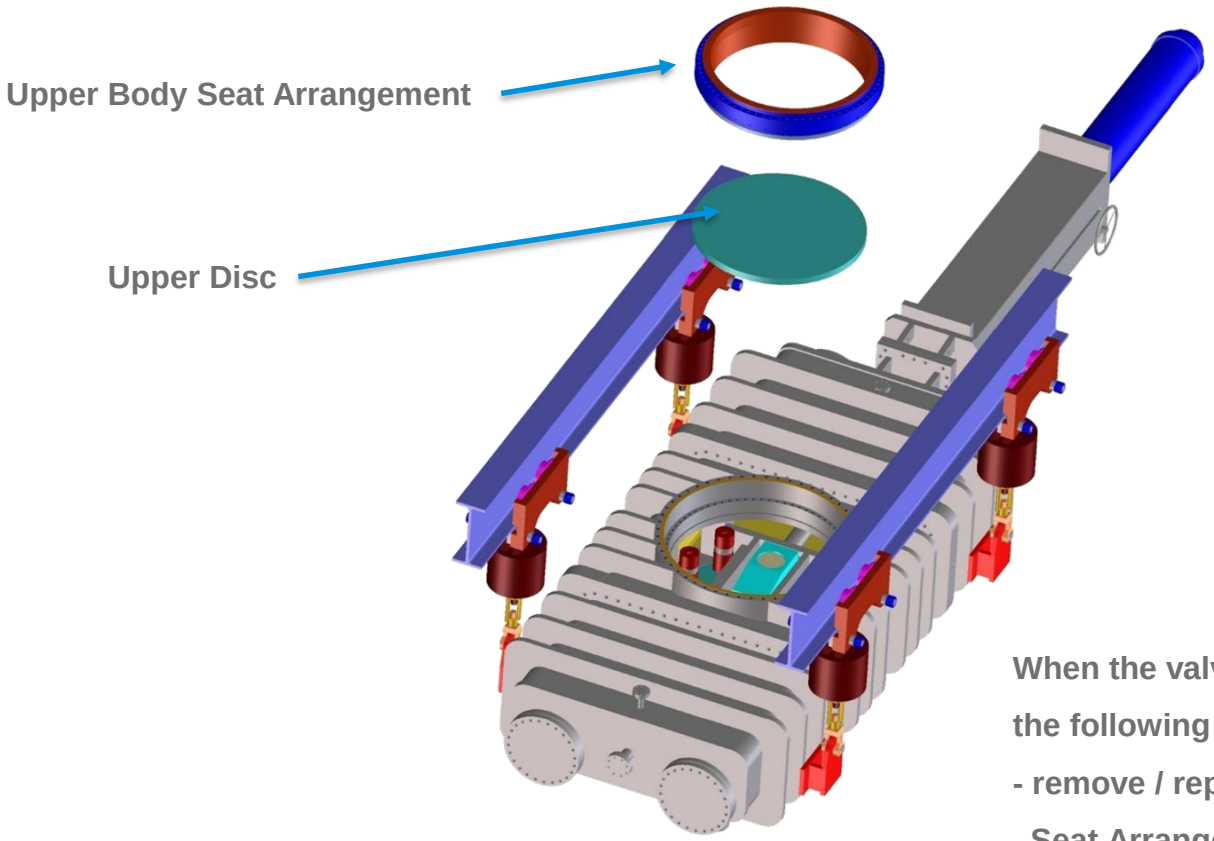
Maintenance VIII

Displacement of Seat Ring Arrangement / Upper Disc



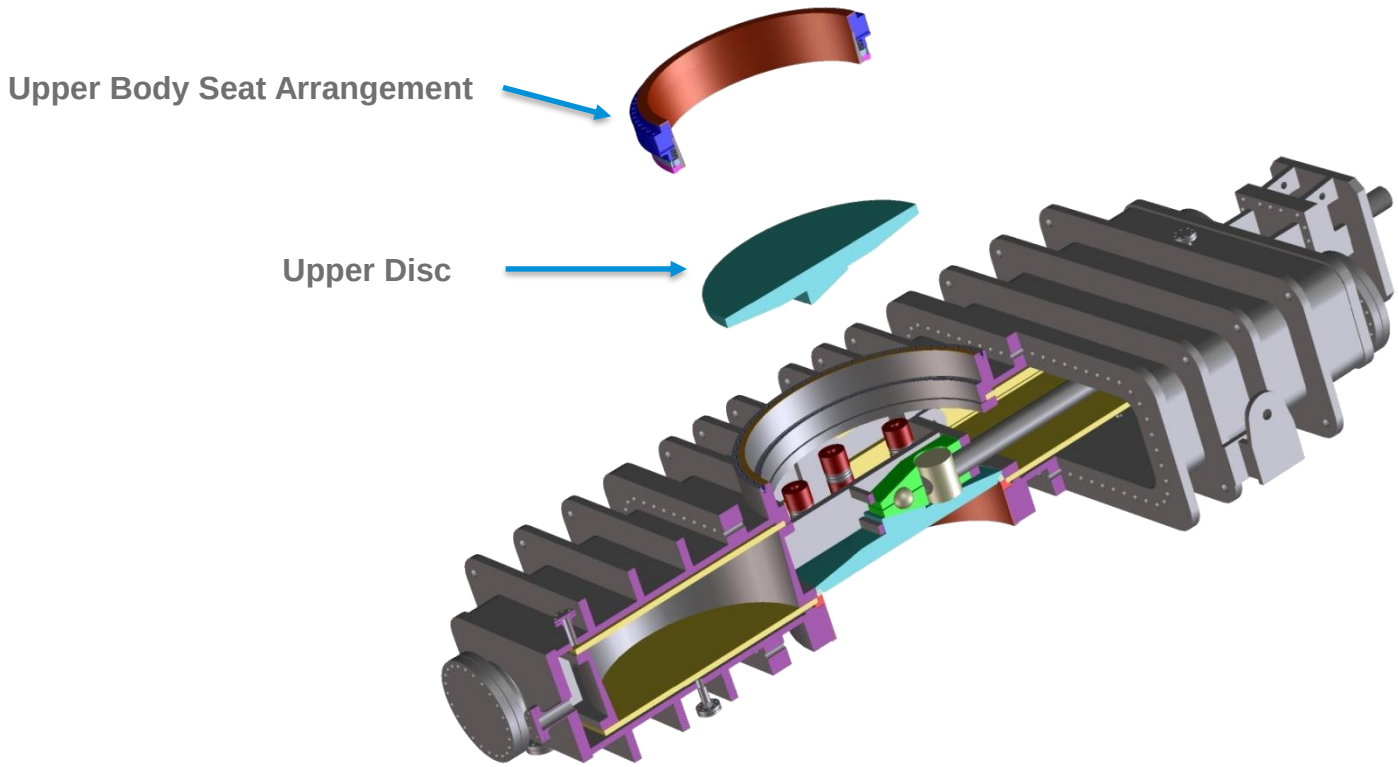
When the valve is located in service position the following can be performed:

- remove / replace the Upper Body Seat Arrangement
- remove / replace the Upper Disc

Maintenance IX

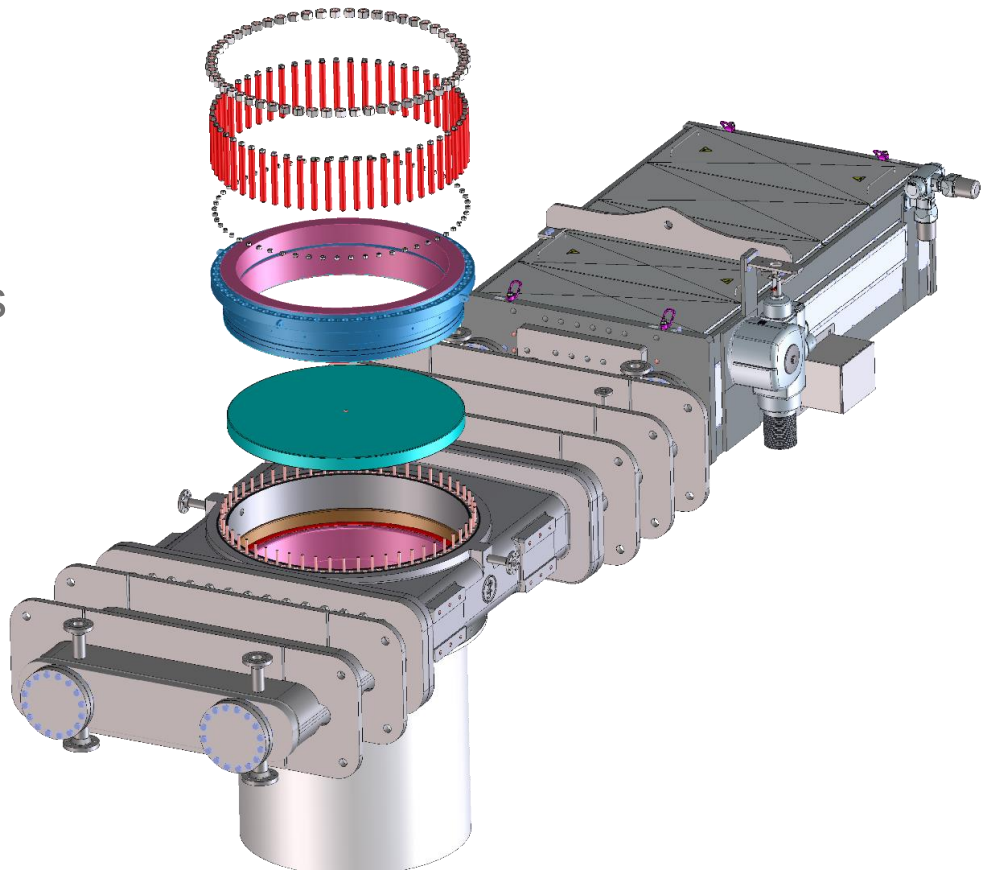
IMI Critical Engineering

Displacement of Seat Ring Arrangement / Upper Disc



Maintenance XV

- Maintenance
  - Easy access from top
    - Seat-Ring-Insert
    - Upper Disc
    - Lower Disc
  - Removal of bonnets is NOT required



TAR BP Oil Castellon, Castellon, Spain I

- End-customer: BP Oil Castellon
- Site: Castellon
- Country: Spain
- Installed equipment: 2 x 36“ TUD el. & 2 x 60“ BUD hyd.
- Commissioned: Nov. 2008 - Jan. 2009
- 1st TAR: May/June 2012 (TAR interval extended from 4 to 5-6 years)
- 2nd TAR planned: Oct. 2017 Results:
  - *Extremely low contamination*
  - *No scratches and cracks on sealing ring and disc*
  - *No exchange of any cup springs required (recommended to change only after appr. 8-10 years)*
  - *No repair works on purge system required*

TAR BP Oil Castellon, Castellon, Spain II

TAR BP Oil Castellon, Castellon, Spain III

TAR BP Oil Castellon, Castellon, Spain IV

TAR BP Oil Castellon, Castellon, Spain V

TAR BP Oil Castellon, Castellon, Spain VI

TAR Statoil, Mongstad, Norway I

- End-customer: Statoil Hydro
- Site: Mongstad
- Country: Norway
- Installed equipment: 2 x 36“ TUD el. & 2 x 60“ BUD el. (single spindle)
- Commissioned: 2012 (Nov.)
- 1st TAR: Sept./Oct. 2016
- 2nd TAR planned: 2021/2022 (TAR interval extended from 4 to 6 years)
- Results:
  - *Extremely low contamination*
  - *No scratches and cracks on sealing ring and disc*
  - *No exchange of any cup springs requried (recommended to change only after appr. 8-10 years)*
  - *No repair works on purge system required*
  - *On BUD spindle and drive nut were still in excellent condition (recommended to change only after appr. 5-6 years)*

TAR Statoil, Mongstad, Norway II

TAR Statoil, Mongstad, Norway III

Conclusions I

IMI Critical Engineering

Design

- ✓ Per ASME Section VIII Div. 1, 2

Leakage rate

- ✓ Full compliance with API 598

Safety

- ✓ Fully remote operation, no operator on deck during unheading
- ✓ True double block & purge - 2 independent discs provide individual sealing

Efficiency

- ✓ Cycle time reduction - optimized production output

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Conclusions II

IMI Critical Engineering

Environment

- ✓ Low to no emissions to atmosphere

Cost Savings

- ✓ Extremely low steam consumption
- ✓ Minimum downtime
- ✓ Lowest maintenance costs

Reliability

- ✓ Extremely low steam consumption
- ✓ Well proven design
- ✓ TARs show excellent results

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Company Key Data I
IMI plc Group

IMI Critical Engineering	IMI Precision Engineering	IMI Hydronic Engineering
(Formerly Severe Service)	(Formerly Fluid Power)	(Formerly Indoor Climate)

IMI Z&J

IMI Z&J Group - Product Lines

IMI Critical Engineering

More than135 years experience in specific valve design for severe service applications

Iron & Steel	Glass	Petrochemical & Refining	Controls	Service
Blast Furnaces	Glass Industry	Delayed Coking	Instruments & Controls	Service
		Ethylene		
		PDH / Catofin		
		FCC		









- ✓ **In-house Design, Engineering, Fabrication**
- ✓ **Certified Quality Management**
- ✓ **Extensive Testing Facilities**
- ✓ **Field & Shop Service**

IMI Z&J

THANK YOU!

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