ANDRITZ PUMPS

PIONEERING TECHNOLOGIES FOR IMPROVING ENERGY EFFICIENCY IN UTILITIES OF PAPER MILLS

PRAVEEN SINGH

PAPERTECH 2024: 10 - 11 SEPTEMBER 2024, HICC, HYDERABAD

ANDRITZ

ENGINEERED SUCCESS

ANDRITZ GROUP

INNOVATIVE TECHNOLOGIES FOR THE PLANET

A GLOBAL PARTNER FOR KEY INDUSTRIES THAT SHAPE THE WORLD

MARCH, 2024

ANDRITZ

ENGINEERED SUCCESS

NO CHALLENGE IS TOO BIG – A PIONEER IN LARGE-SCALE TECH SOLUTIONS WORLDWIDE

WHAT WE DO:

Developing large-scale, state-of-the-art engineering and service solutions

Elevating customer operations with state-of-the-art technologies

Supporting our customers´ operations with life-cycle services

Empowering our customers to drive the green transition

CLOSE TO OUR CUSTOMERS, IN MORE THAN 80 COUNTRIES

AROUND

30,000

EMPLOYEES WORLDWIDE

OVER

280

LOCATIONS

OVER

80

COUNTRIES

OUR STRATEGY: LONG-TERM PROFITABLE GROWTH

DECARBONIZATION

DIGITALIZATION

CUSTOMER SERVICE

LONG-TERM PROFITABLE GROWTH

- Grow revenue
- Grow profitabilty
- Grow service share

PUMPS

EFFICIENCY THROUGH PUMPING EXPERTISE

YOUR PATH TO HIGHEST ENERGY EFFICIENCIES, STRONG PROCESS KNOW-HOW, AND LOWER LIFE-CYCLE-COSTS

2024

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Basics for Pulp & Paper Production

Importance of energy efficient (pump) systems

- Reducing the ecological footprint in general
- Pulp & Paper production responsible for app. 2% of global industry emissions
- 150 – 350 centrifugal pumps per mill with total power consumption of 15 – 40 MW

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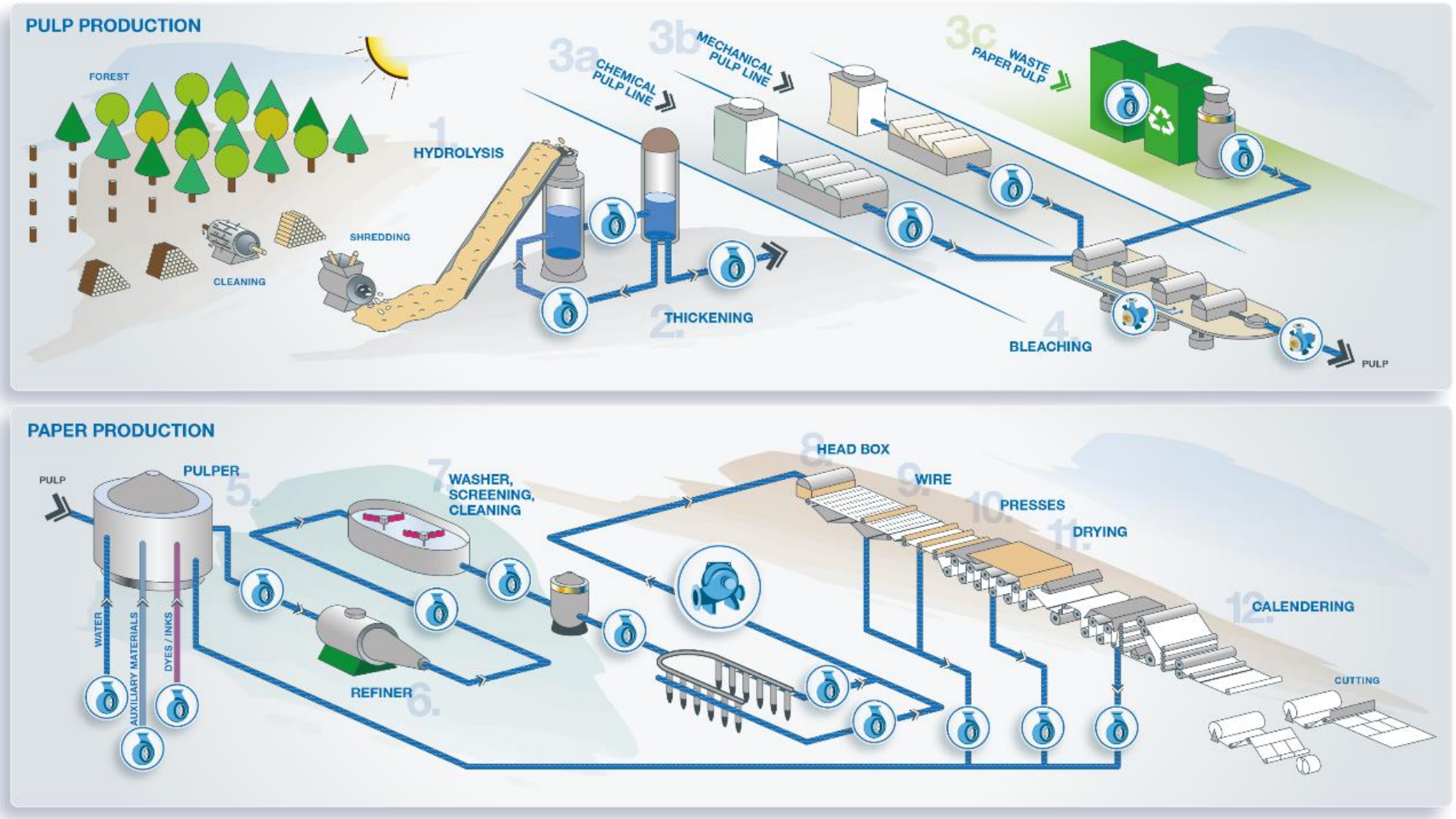
Pumps - Areas of application in the pulp and paper industry



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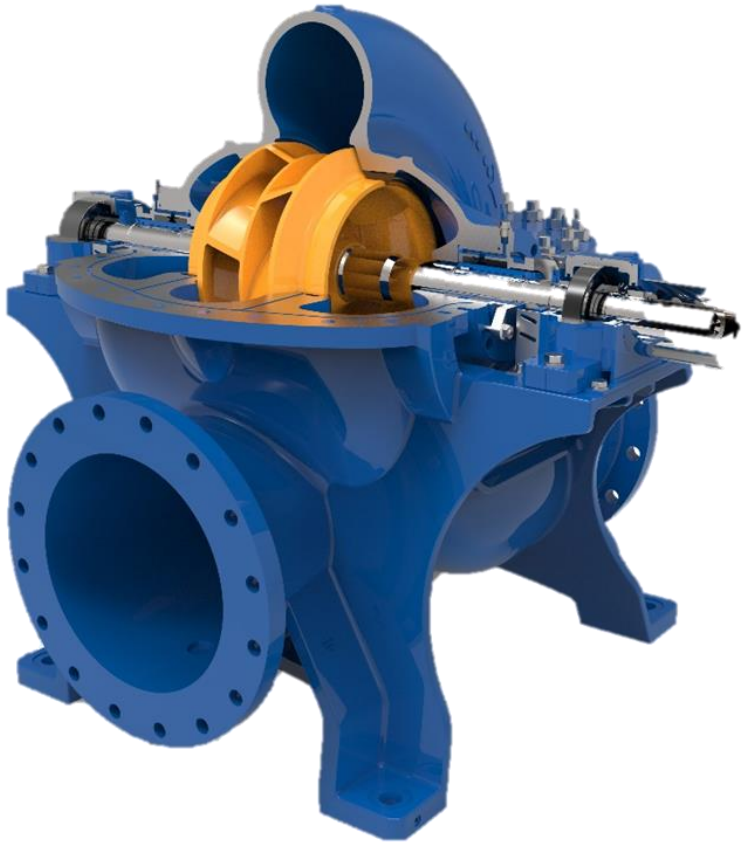
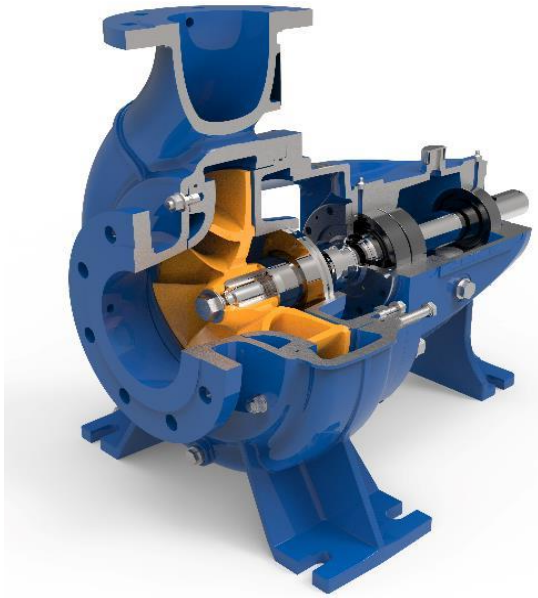
Pumps – Most important centrifugal pump types in Pulp & Paper industry



Double suction- / Split case pumps
Headbox feed- / Cleaner-pump



End suction-pumps
Process pumps

MC-Pumps
Medium consistency

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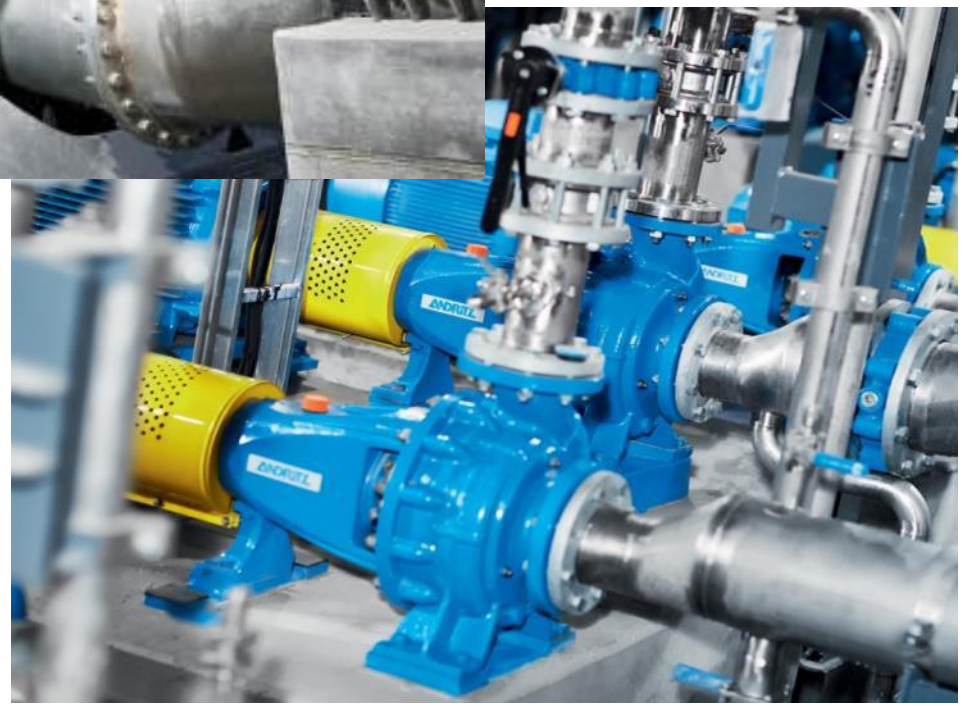
Pumps – Pump efficiency

State of the art pump efficiency

- Double suction pump (head box feed)
  => up to 93%

- Standard process pump
  => up to 91%



REDEFINING THE FUTURE:
UNLEASHING OUR INNOVATION ENGINE

139 MEUR
for R&D in 2023

370
new patent applications in 2023

6,510
patent protection rights

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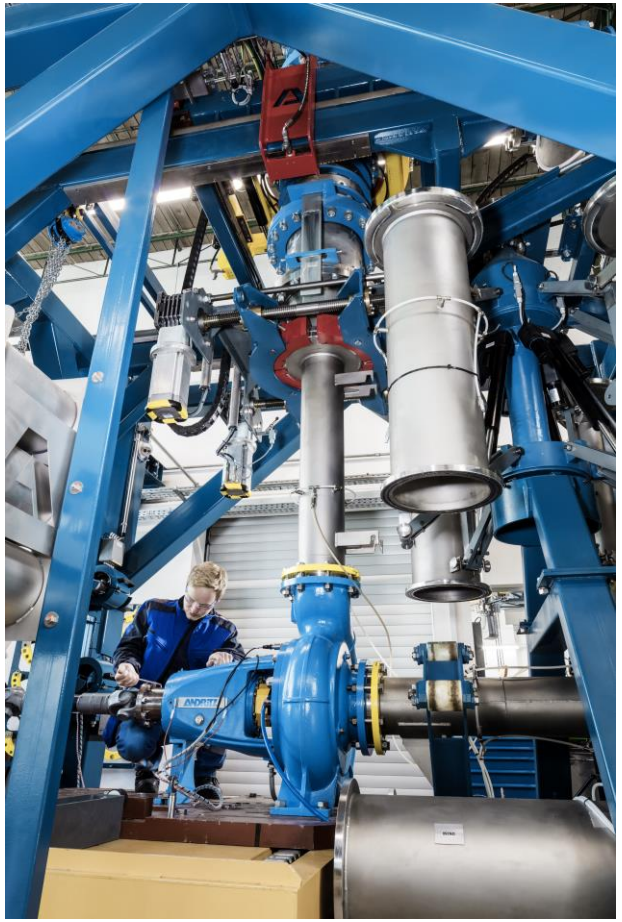
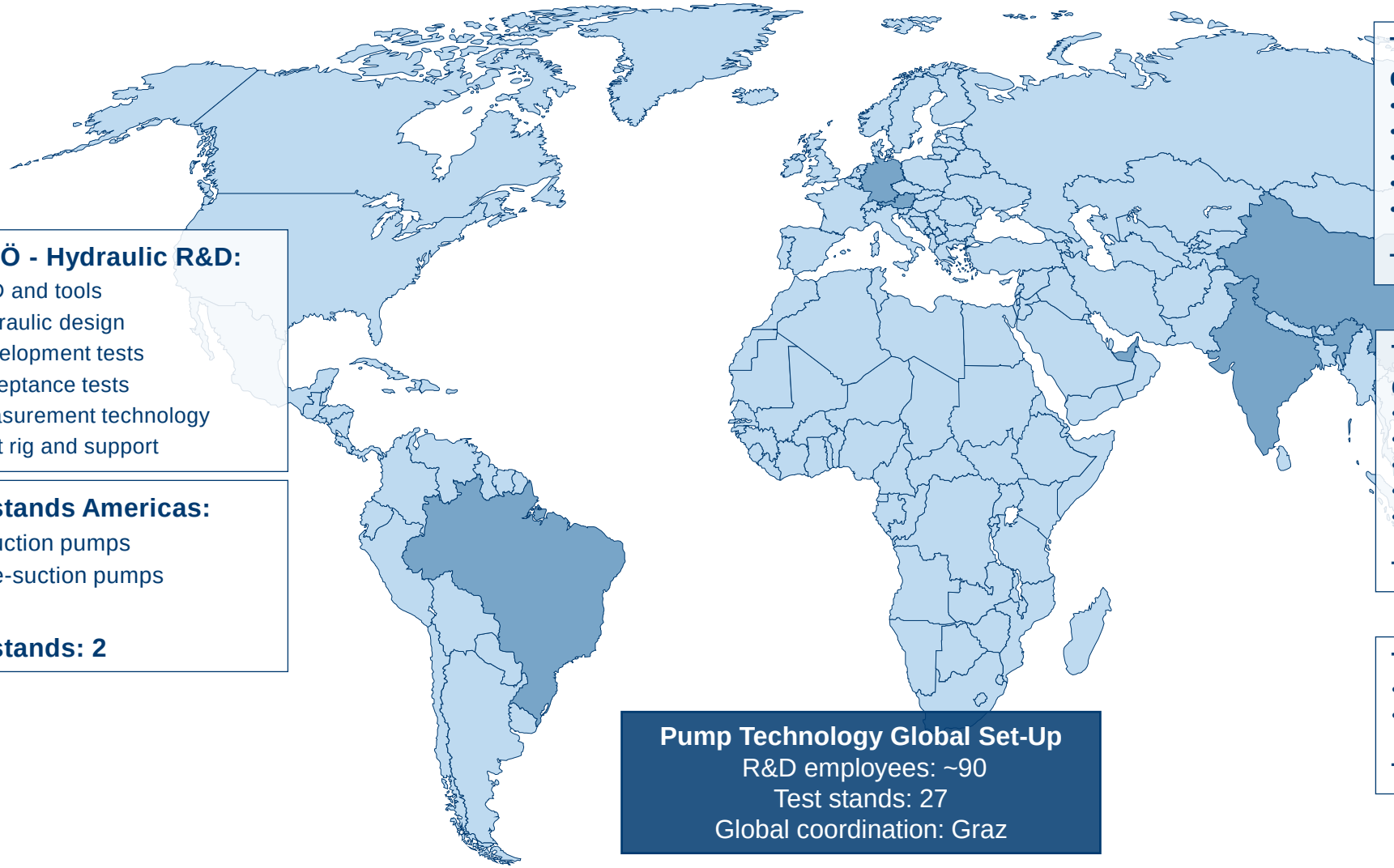
Pumps – Pump efficiency / pre-conditions

R&D + Test rigs => Necessary tools



WHERE INNOVATION MEETS PRACTICAL TESTING



ASTRÖ - Hydraulic R&D:
- CFD and tools
- Hydraulic design
- Development tests
- Acceptance tests
- Measurement technology
- Test rig and support

Test stands Americas:
End-suction pumps
Double-suction pumps

Test stands: 2

Pump Technology Global Set-Up
R&D employees: ~90
Test stands: 27
Global coordination: Graz

Test stands and product development PU Europe:
- End-suction pumps
- Double-suction pumps
- Multistage pumps
- Pumps for pulp and paper industry
- Submersible pumps and motors

Test stands: 14

Test stands and product development ST-PU Foshan:
- End-suction pumps
- Double-suction pumps
- Pumps for pulp and paper industry
- Multistage pumps
- Vertical line shaft pumps

Test stands: 9

Test stands India:
- End-suction pumps
- Double-suction pumps

Test stands: 2

ANDRITZ PUMPS

Data required for a right pump selection

(1) Medium Type
(2) Pump Flow (m3/h)
(3) Head (m)
(4) Consistency (%) or solid content (%)
(5) NPSH available (m)
(6) Air content (%)
(7) Density (kg/m^3)
(8) Temperature (^oC)
(9) Viscosity (cp)
(10) PH value
(11) Suction Pressure
(12) Frequency & speed
(13) Fixed speed or Variable speed control
(14) Any other information

ENERGY EFFICIENCY FOR PUMPS

Present Situation & Life Cycle Cost for pumps

- **The Hydraulic Institute**, an association of US pump manufacturers, in cooperation with **Europump, an association of national pump manufacturing associations in Europe**, has produced Pump Life cycle Costs: **A Guide to Life Cycle Cost Analysis for Pumping Systems**
- Not developed specifically for pumping systems, but a new standard was published in 2000 by the **International Organization for Standardization.**
- **ISO 15663,** Petroleum and natural gas industries – Life cycle costing, attests to the increased realization by industry of the need to consider the life time costs of ownership for equipment

The LCC equation, as defined in the HI/Europump Guide (HI 2001), is:

- LCC = Cic + Cin + Ce + Co + Cm + Cs + Cenv + Cd
- LCC = life cycle cost
- Cic = initial costs, purchase price (pump, system, pipe, auxiliary services)
- Cin = installation and commissioning cost (including training)
- Ce = energy costs (predicted cost for system operation, including pump driver,
- controls, and any auxiliary services)
- Co = operation costs (labor cost of normal system supervision)
- Cm = maintenance and repair costs (routine and predicted repairs)
- Cs = down time costs (loss of production)
- Cenv = environmental costs (contamination from pumped liquid and auxiliary
- equipment)
- Cd = decommissioning/disposal costs (including restoration of the local
- environment and disposal of auxiliary services).

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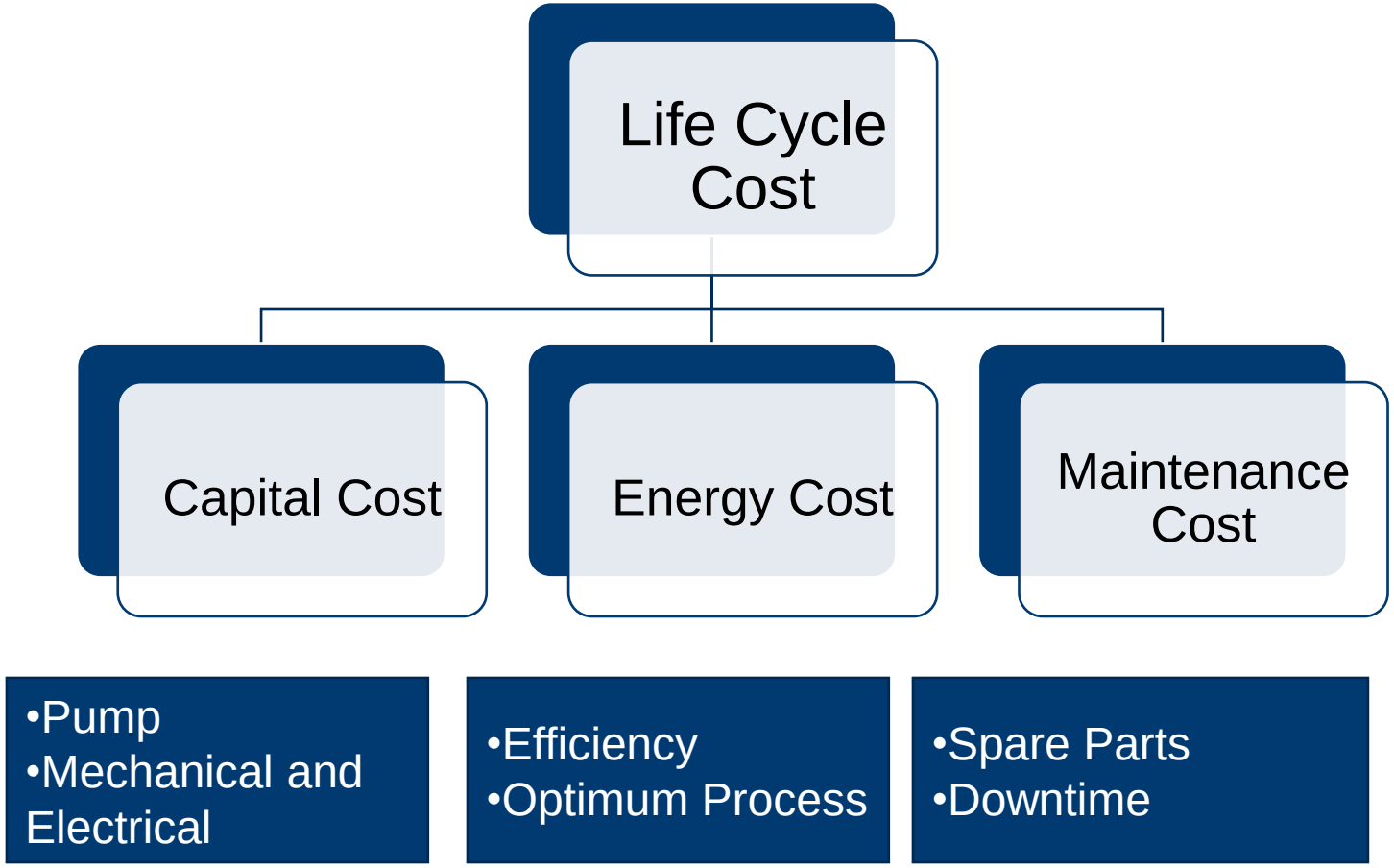
The concept of low life cycle



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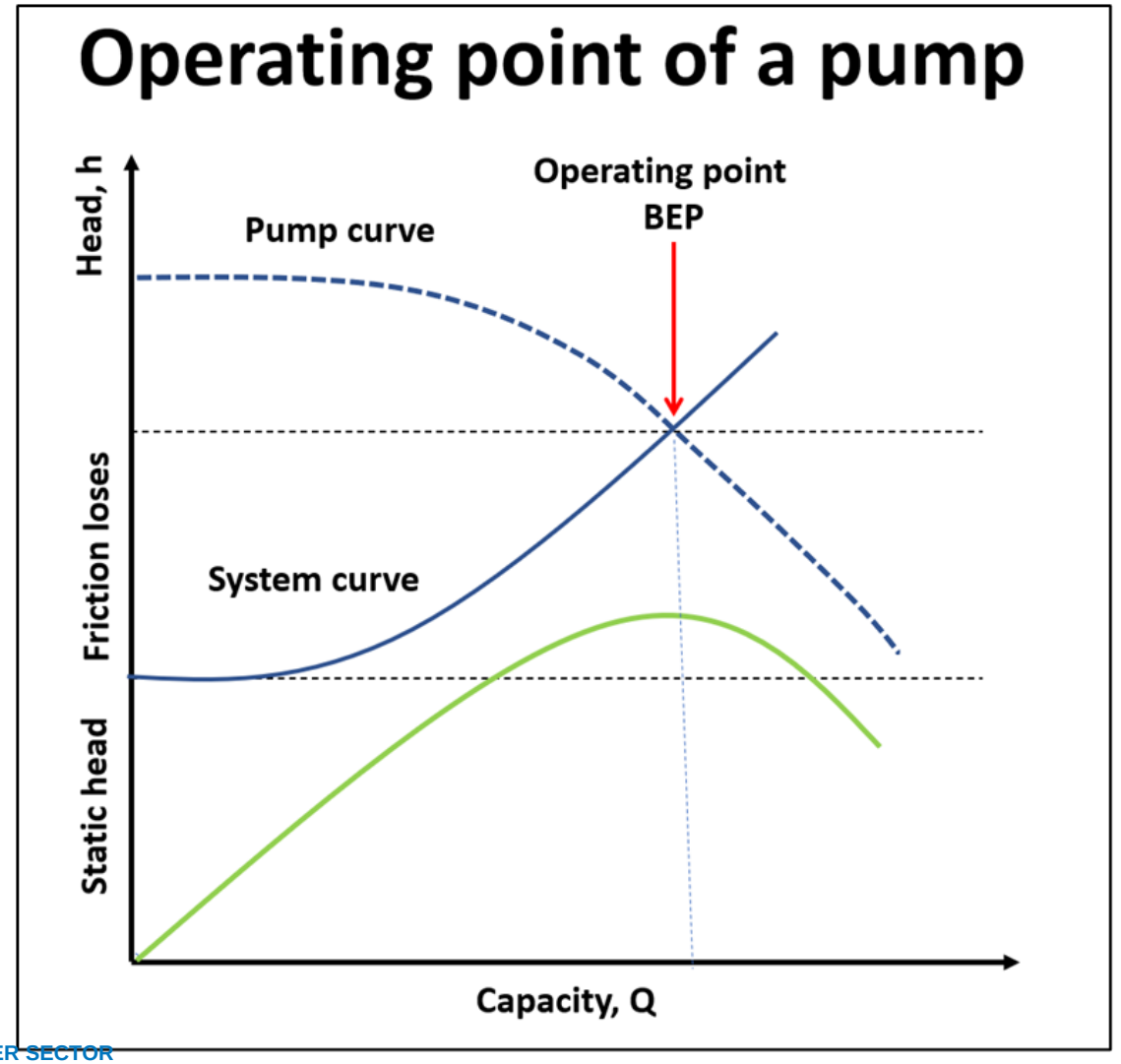
Pumps – Correct sizing

- Accurate calculation of operating data
- Do not include unnecessary reserves!
- Selecting a high efficiency pump
- Operating point at the optimum efficiency if possible
- Select the optimal impeller design
- Adjustment of impeller diameter or speed to operating point
- Use of suitable sealing systems



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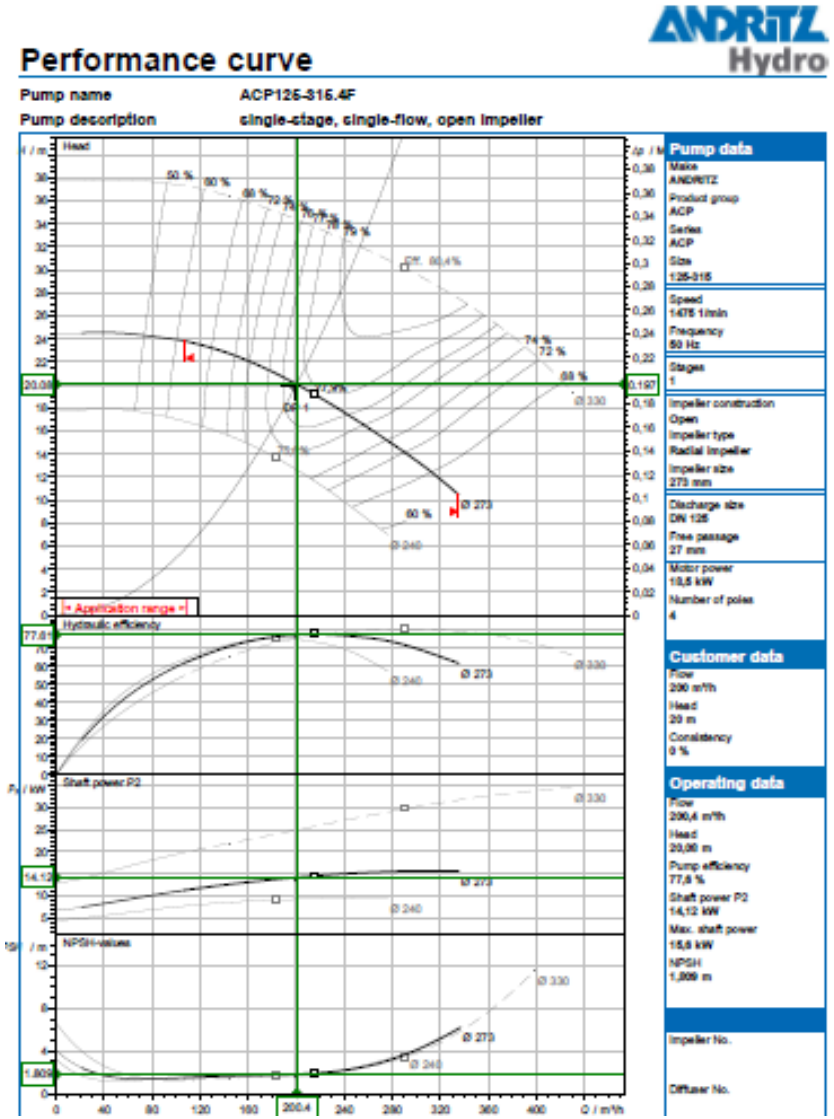
Pumps – Correct sizing

Off BEP/ operation rage – WHAT WILL HAPPEN ??

- Effect on hydraulic radial / axial load.
- Recirculation at suction / discharge.
- Noise levels
- Vibration levels
- Induced stresses
- Bearing life

Operation near to shut off head more pronounced effect!

- On noise / vibrations / stresses.
- Power input – heat generation.
- Vaporisation of liquid.



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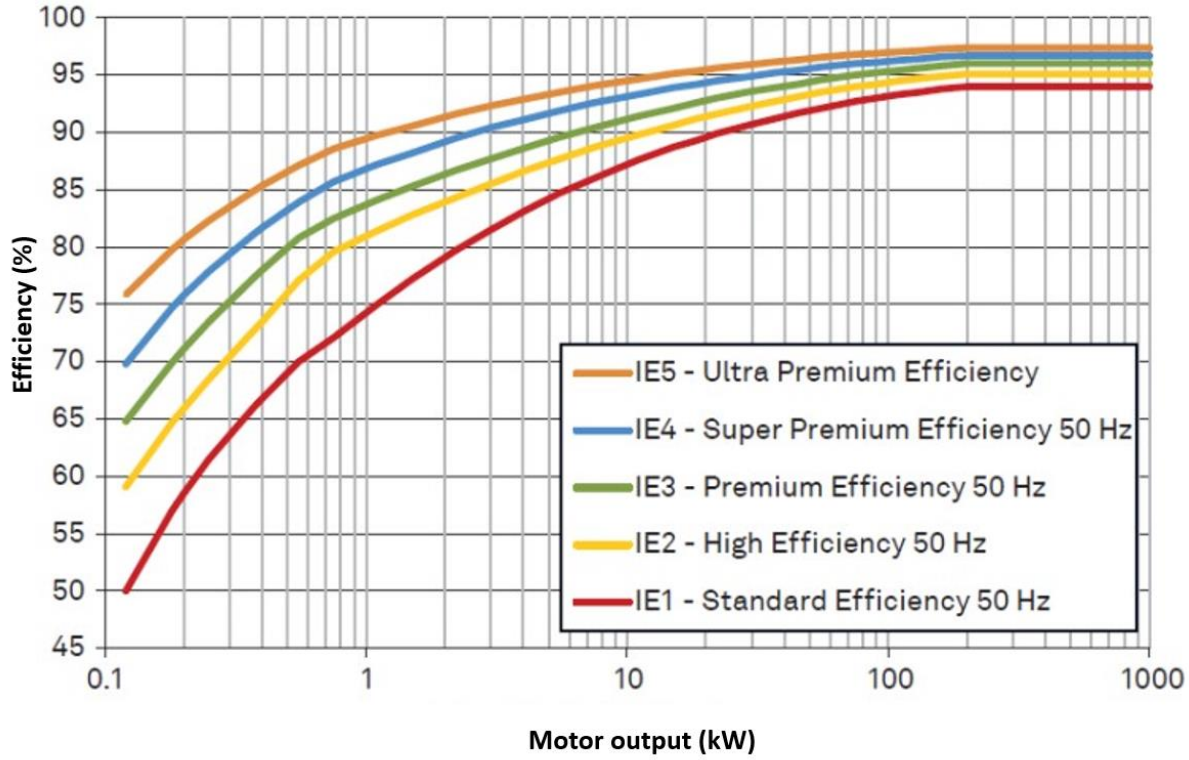
Pumps – Efficiency of electrical drive / motor

- **Use of motors with high (as possible) efficiency**
- **Higher costs paid back within a few months**

IE-Code for efficiency of electric motors: 4-pole, 50 Hz



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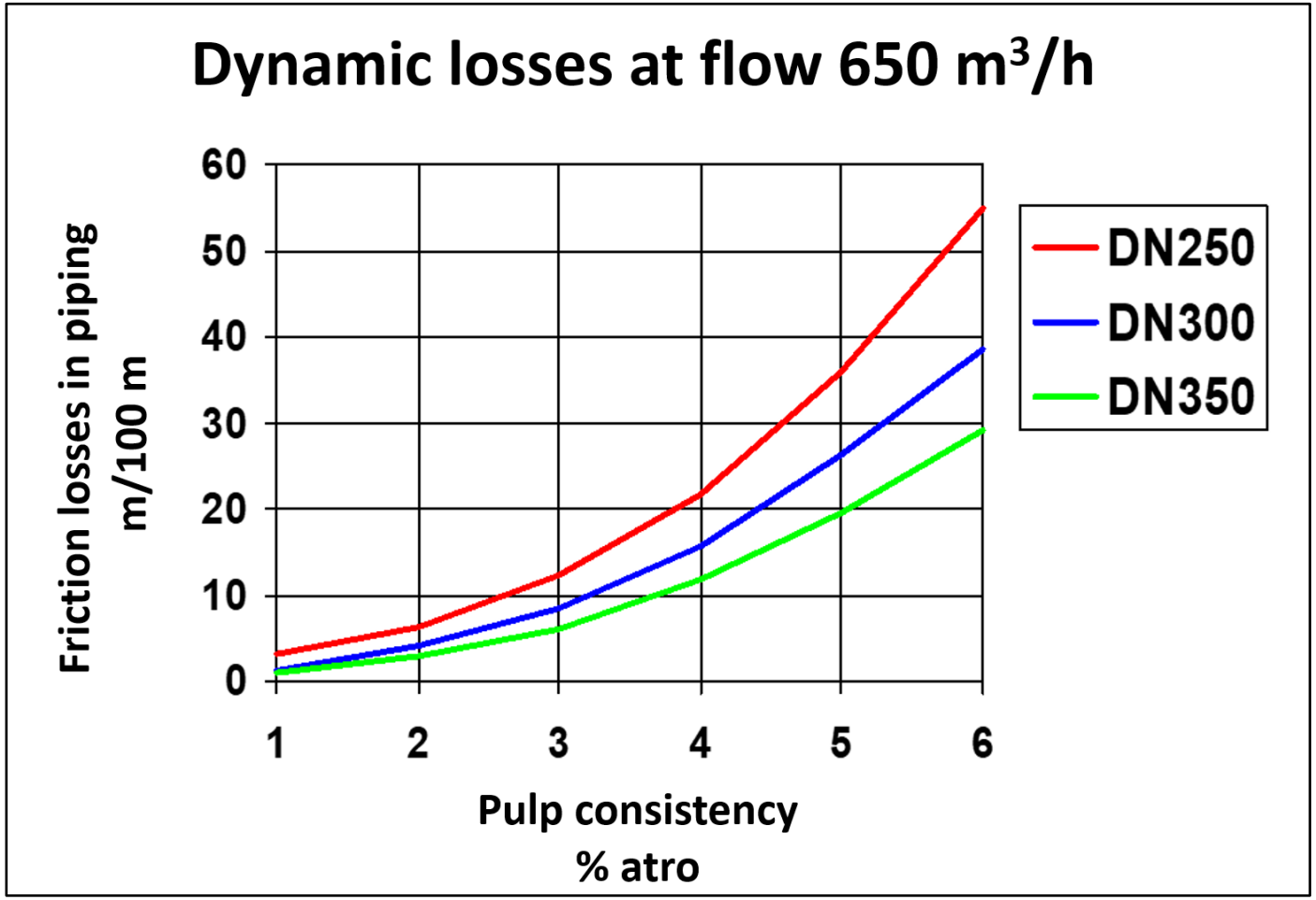
Pumps – Piping / gate valves / valves

Correct sizing of the pipeline

- Adhere to flow velocities as recommended for paper material
- Friction loss increases significantly with higher consistencies
- Surface roughness/material
- Take medium and air content into account



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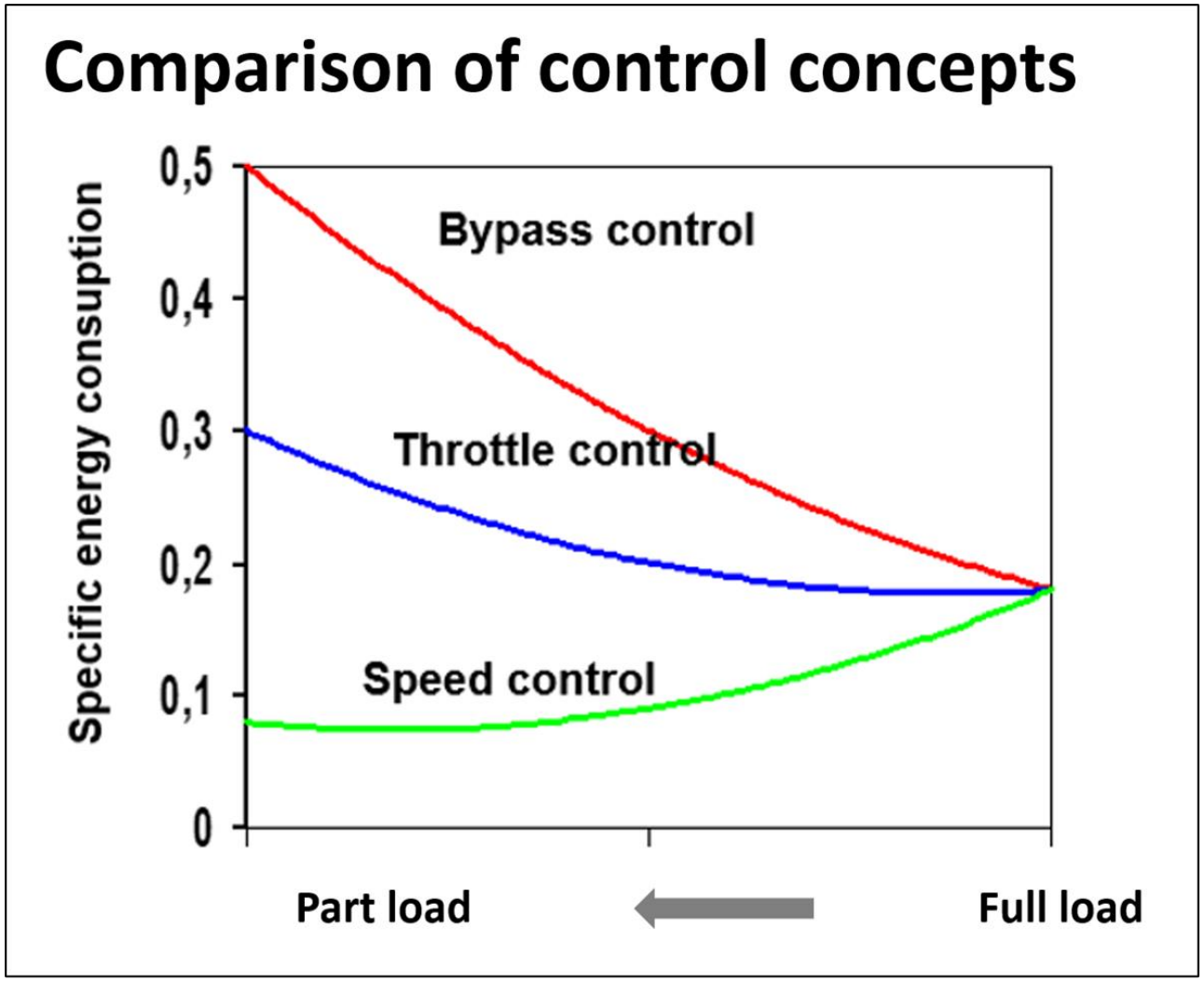
Pumps – Control concepts

Recommendations for control concepts in case of changing operation parameters

- Avoid by-pass control
- Avoid throttling via control valves
- Prefer speed control via frequency converter



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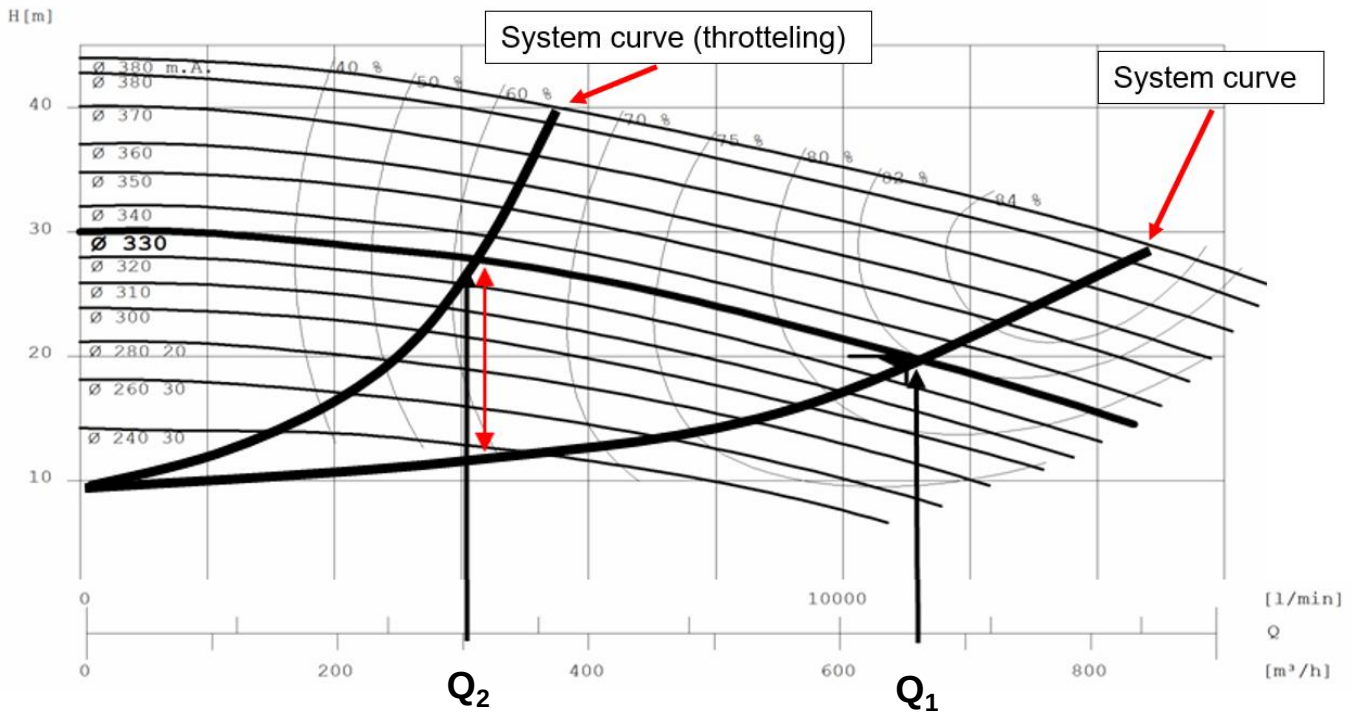
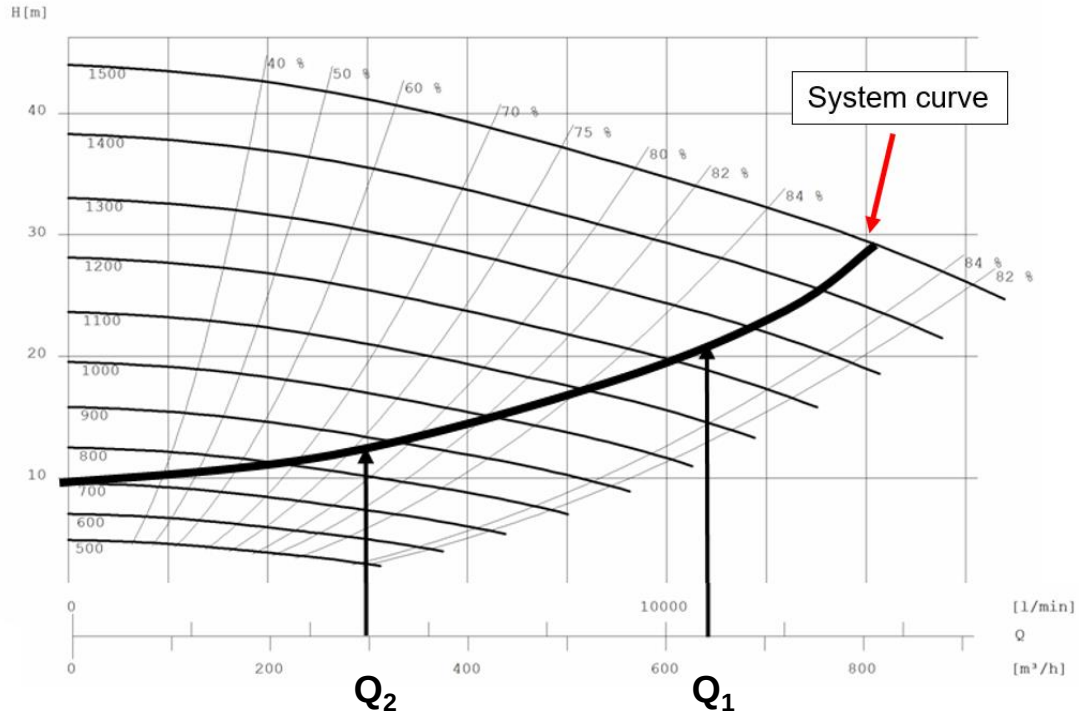
Pumps – Control concepts comparison

Throttling (fixed speed)



Q_2	300 m³/h	Q_1	650 m³/h
H	27 m	H	20 m
P_{Shaft}	37,5 kW	P_{Shaft}	44 kW

Frequency converter



Q_2	300 m³/h	Q_1	650 m³/h
H	13 m	H	20 m
P_{Shaft}	12,7 kW	P_{Shaft}	41,7 kW

Diff. 24,8 kW !!

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Pumps – Planning phase vs. system in operation

General aspects

- Consideration of energy efficiency aspect already in the planning phase is important

- Systems already in operation
  => possible energy savings through optimizations

- Main influencing factors
  - Wear / tear
  - Deviations between original planned and actual duty parameters

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Pumps – Wear / tear

Wear/tear due to corrosion / abrasion

- Replacement of worn parts
  => Check material design

- Option:
  Change of complete pump
  (modern design , higher efficiency)

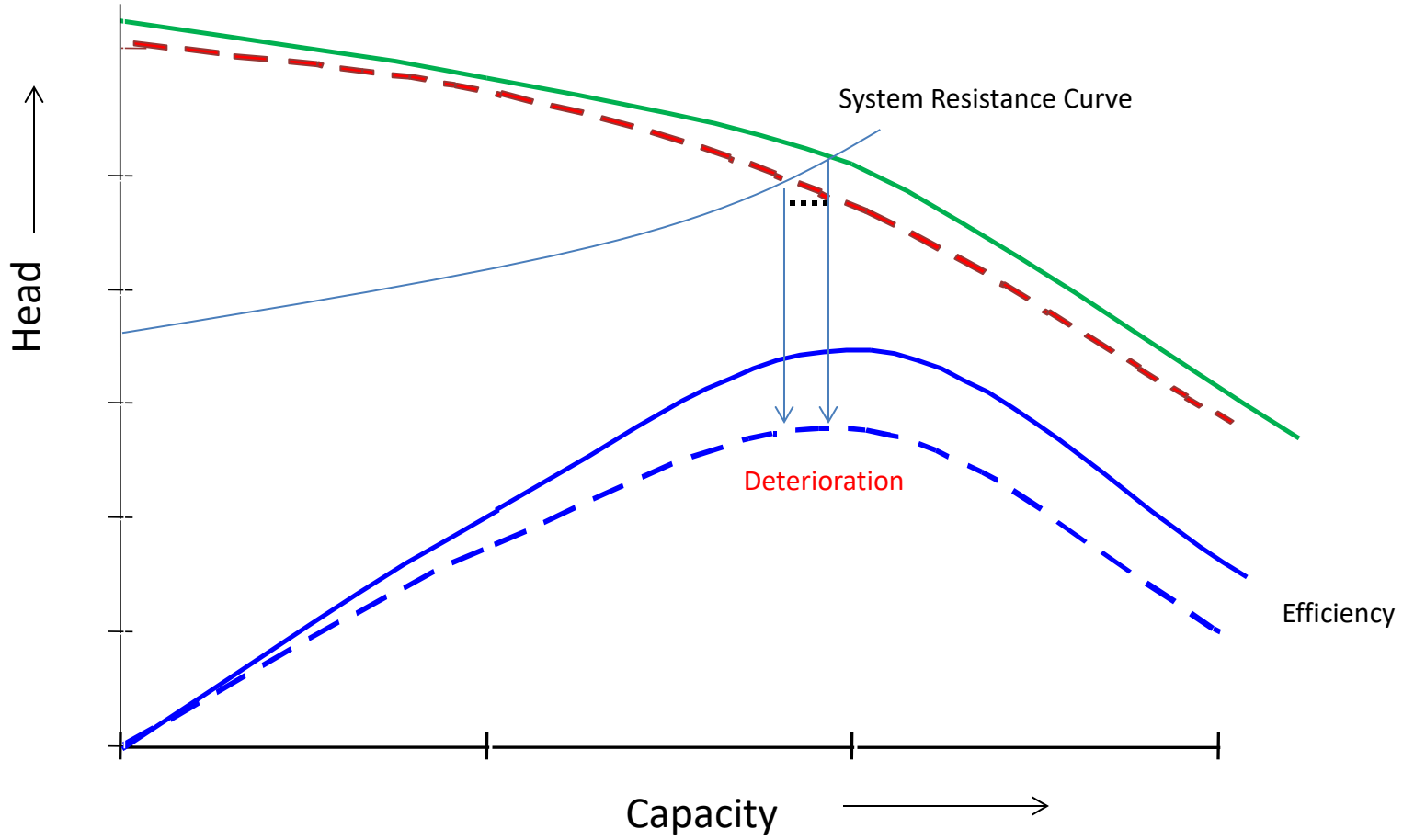
ANDRITZ PUMP PRESENCE IN INDIA

Hydraulic Deterioration – Identified Reasons

- Pitting corrosion, Stress corrosion, Inter-angular corrosion and Crevice corrosion
- Erosion of internal clearances
- Cavitation
- Oxidation – Increase in surface roughness
- Mechanical wear

ANDRITZ PUMP PRESENCE IN INDIA

Performance Deterioration of pump



PUMPS – WEAR / TEAR

Right Material for required application

Material Design	Impeller, front & rear lining	Volute casing, casing cover	Shaft	Bearing housing	Typical application
CD	Steel or AD060 (Duplex)	GG25	1.4021	GG25	Medium with little impurities; PH=6-8; Pressure<6bar; For example: flotation, waste or water treatment, clear water pumping
SD	Steel or AD060 (Duplex)	1.4008 (SS)	1.4021	GG25	Abrasive medium; High Pressure; For Example: all raw water or waste water application
DD	AD060 (Duplex)	AD060 (Duplex)	1.4462	GG25	Caustic and/or abrasive medium; High Pressure; For Example: all sea water applications, low life cycle cost pumping solution
DT	AT099 (Duplex)	AD060 (Duplex)	1.4462	GG25	Caustic and/or Highly abrasive medium; High Pressure; For Example: Effulent, slurry, sludge applications

PUMPS – WEAR / TEAR

Right Material for required application

Duplex Stainless Steel is both ferritic phase and austenite phase in solid solution, the advantages are :

- Excellent Stress corrosion resistance and Interangular corrosion resistance of chloride and sulphide in low stress
- Excellent Resistance to pitting corrosion and Crevice corrosion resistance, it is better than ANSI316
- Yield strength is two times than austenitic stainless steel 18-8

Material / Item	Duplex Stainless Steel 1.4460,1.4462	Austenite Stainless Steel 316，316L	Stainless Steel 304	Remark
Stress corrosion resistance and Intergranular corrosion resistance of chloride and sulphide in low stress	**Excellent**	**Normal**	**Bad**	1.4460,1.4462 contain upper Cr and other alloy, general corrosion resistance is excellent
Resistance to pitting corrosion	**Excellent**	**Normal**	**Bad**	Pitting Corrosion-PREN：1.4460=34, 316L=25
Crevice corrosion resistance	**Excellent**	**Good**	**Bad**	1.4460,1.4462 Yield strength is two times than 316，316L.
General	**Excellent**	**Good**	**Bad**	
Weldability	**Good**	**Good**	**Good**	

PUMPS – WEAR / TEAR

Right Material for required application

O-Ring Material Selection:

Standard (ph=7)	*Examples:*	*water, stock...*
	NBR 70 SHOR A	Up to 100 °C

Acid: (ph<7)	*Examples:*	*sulpher acid, magnesium bisulphite,...*
	EPDM 70 *SHOR A*	Up to 140 °C (150 °C)
	Viton 80 *SHOR A*	140 - 180 °C

Base: (ph>7)	*Examples:*	*soda lye/caustic soda, white liquor, black liquor,...*
	EPDM 70 *SHOR A*	Up to 140 °C (150 °C)
	Kalrez (*Perflur, AFCAS*)	140 - 180 °C

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Pumps – Impeller

Choose Right Impeller For Right Application!

- Fully-open impeller with 3-4 blades
  for a large free passage
- Semi-open impeller with 4-8 blades
  for high pressures
- Closed impeller with 4-8 blades
  for high efficency
- Special design impellers
  for low pulsation or non-newton fluids (with fluidizer)

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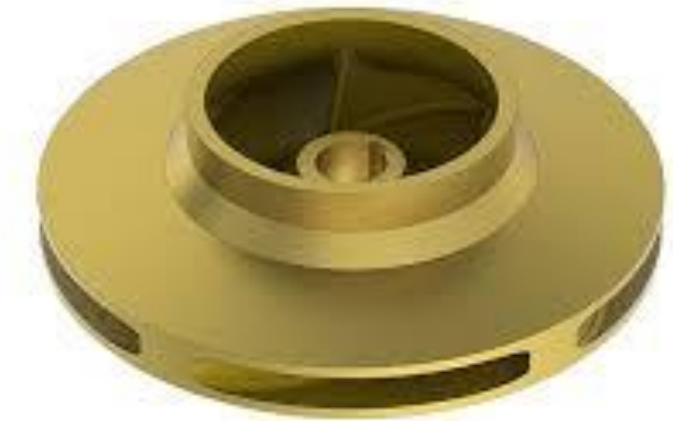
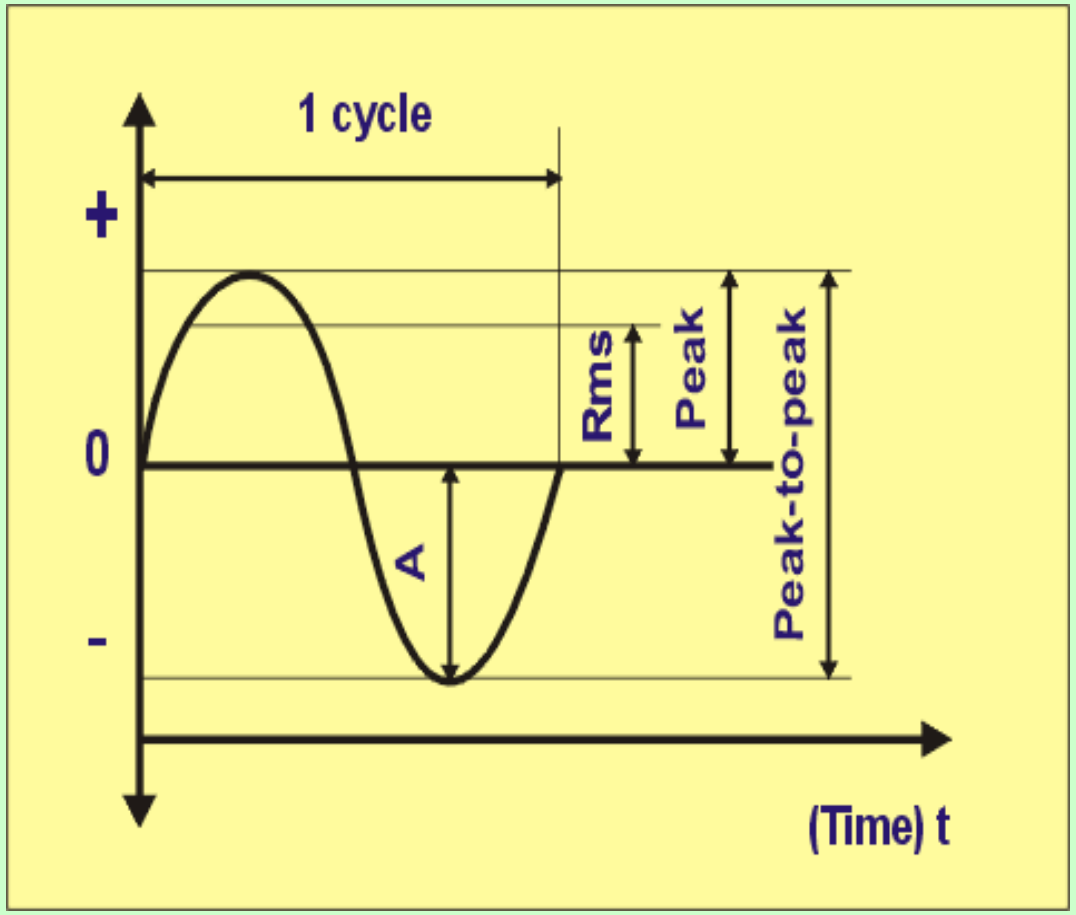
Pumps – Impeller



Single Flow/suction

Double Flow/suction

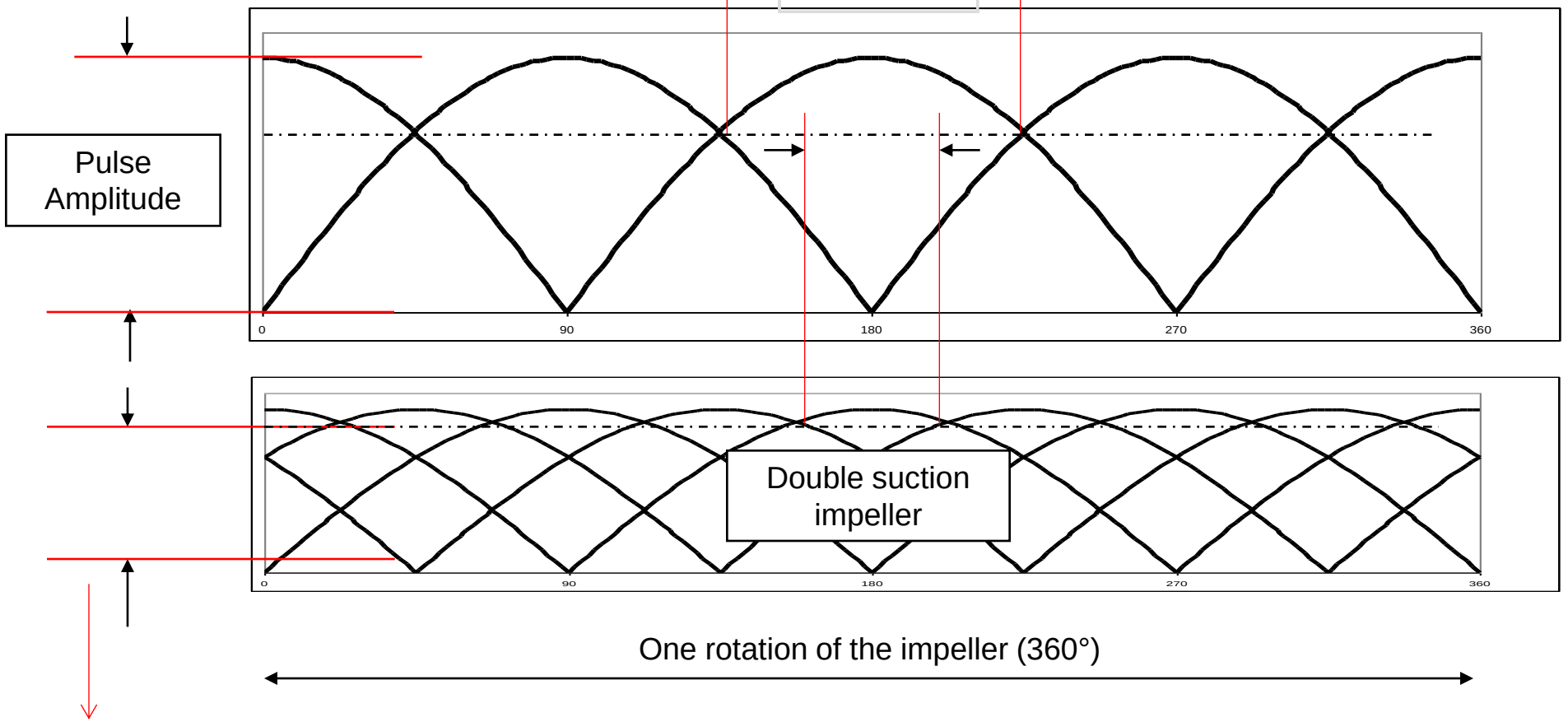
PAPER & BOARD MACHINE APPROACH SYSTEMS

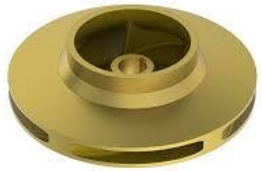


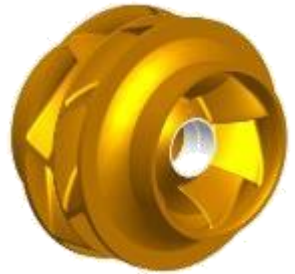
Frequency	=	Hz
Amplitude A	=	Pa, mbar, inchWH
Rms (root-mean-square)	=	peak / √2
Peak-to-peak	=	rms x 2 √2
1 mbar	=	100 Pa
1 inchWH	=	250 Pa

HEAD BOX FEED PUMP - COMPARISON OF SINGLE SUCTION VS. DOUBLE SUCTION IMPELLER

$$f = \frac{n \times z}{60} \text{ Hz}$$







RMS = Root mean square

n = revolutions per minute (rpm)
z = no of vanes

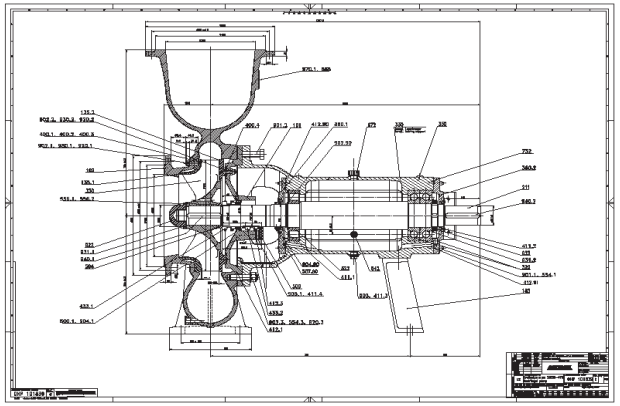
SPECIAL FEATURES

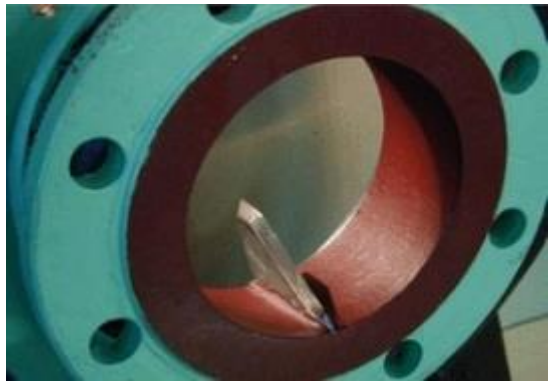
Special Treatment

- For the right pump selection following criterias important:
  - Large free passages to avoid clogging
  - Low pump speed for less wear

- Suitable pump types:

  - ACP-pumps (fully open impeller) with cutting knife in the volute casing and grooves in the front liner !





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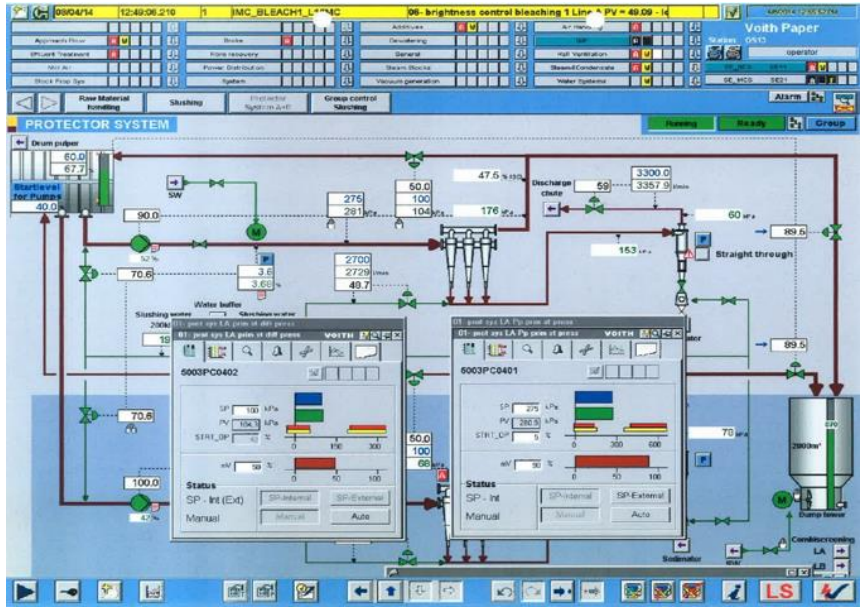
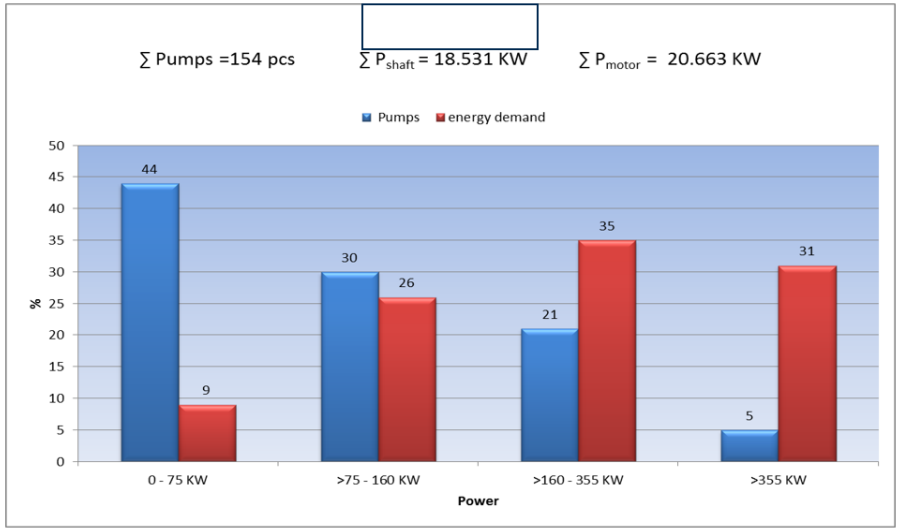
Pumps –Evaluation of systems in operation

Procedure for existing systems to achieve savings effect

- Exchange of information with the operator
  (system data for pressure, speed, current, volume flow…)
- Grouping of pumps according to performance sizes
- Select measuring method (water / pulp…)
- Define measurement periods with the operator
- Process analysis
  (pump, motor, VFD, control, valve positions and trends)





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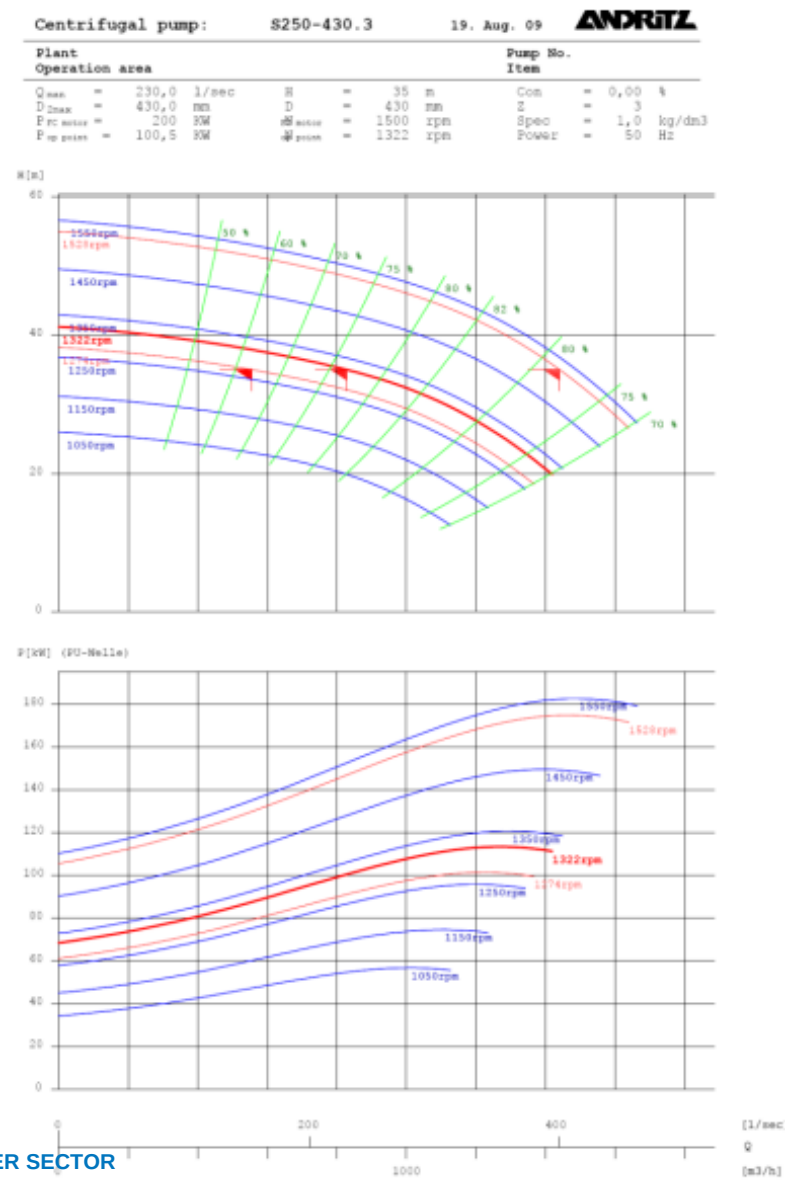
Pumps –Evaluation of systems in operation

Practical example of energy optimization of a paper machine for newsprint based on recycled fibers

Analysis:
Significant deviation between engineering and operation

Optimization suggestions:
New pump type S 250-430 with VFD
=> VFD installation required

Impact with 8.000 operating hrs. per year:
Minimum savings at full load => 1,760,000 kWh/a
Savings in normal operation => 2,400,000 kWh/a



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Pumps –Motor selection guidelines

Fixed Speed Drive:

(1) Motor Power < 18.5kw, Motor margin normally 20-30%;

(2) Motor Power ≤ 55kw, Motor margin normally 15-20%;

(3) Motor Power > 55kw, Motor margin normally 10-15%

Variable Speed Drive:

Select variable frequency drive if water demand is not stable! Have to consider the maximum and minimum speed factor excluded above margin

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Cost of selecting a big pump?

The Expense of selecting big pumps:

(1) Higher first Investment;

(2) Higher power consumption;

(3) Faster Pump worn;

(4) Violent Pump & Pipe vibration and noise;

(5) Higher maintenance cost;

Solution:

(1) Decrease impeller dia if possible;

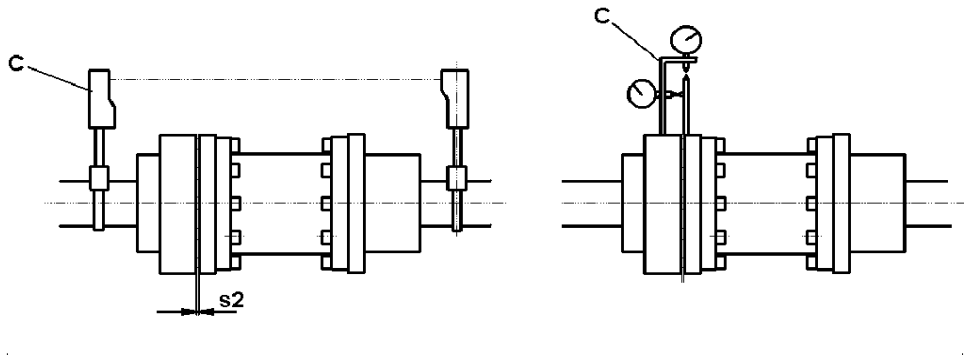
(2) Change as smaller pump if necessary

(3) Speed control!

COUPLING

Coupling steel diaphragm type as standard

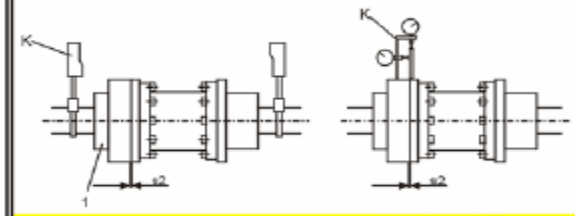
- Before pump start up (or after dismantling), the coupling alignment have to be done:
- The alignment can be done by dial indication device or laser device;
- The tolerance of coupling alignment acc. to pump manual



Coupling type 联轴器型号	H	10	16	25	40	63	100	160	200	250
s2	[mm]	5-6	5-6	5-6	6-7	6-7	6-7	6-7	6-7	7-8
Max.offset(axial,radial) 最大偏差(轴向,径向)	[mm]	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.25	0.3

Laser alignment device 激光调整装置

Dial indication device(0.01mm accuracy) 刻度指示装置(0.01mm 精度)



During alignment rotate pump and motor shaft together, measuring with coupling enganged.
在调对时将泵与电机轴随着所测试的联轴器一起转动。

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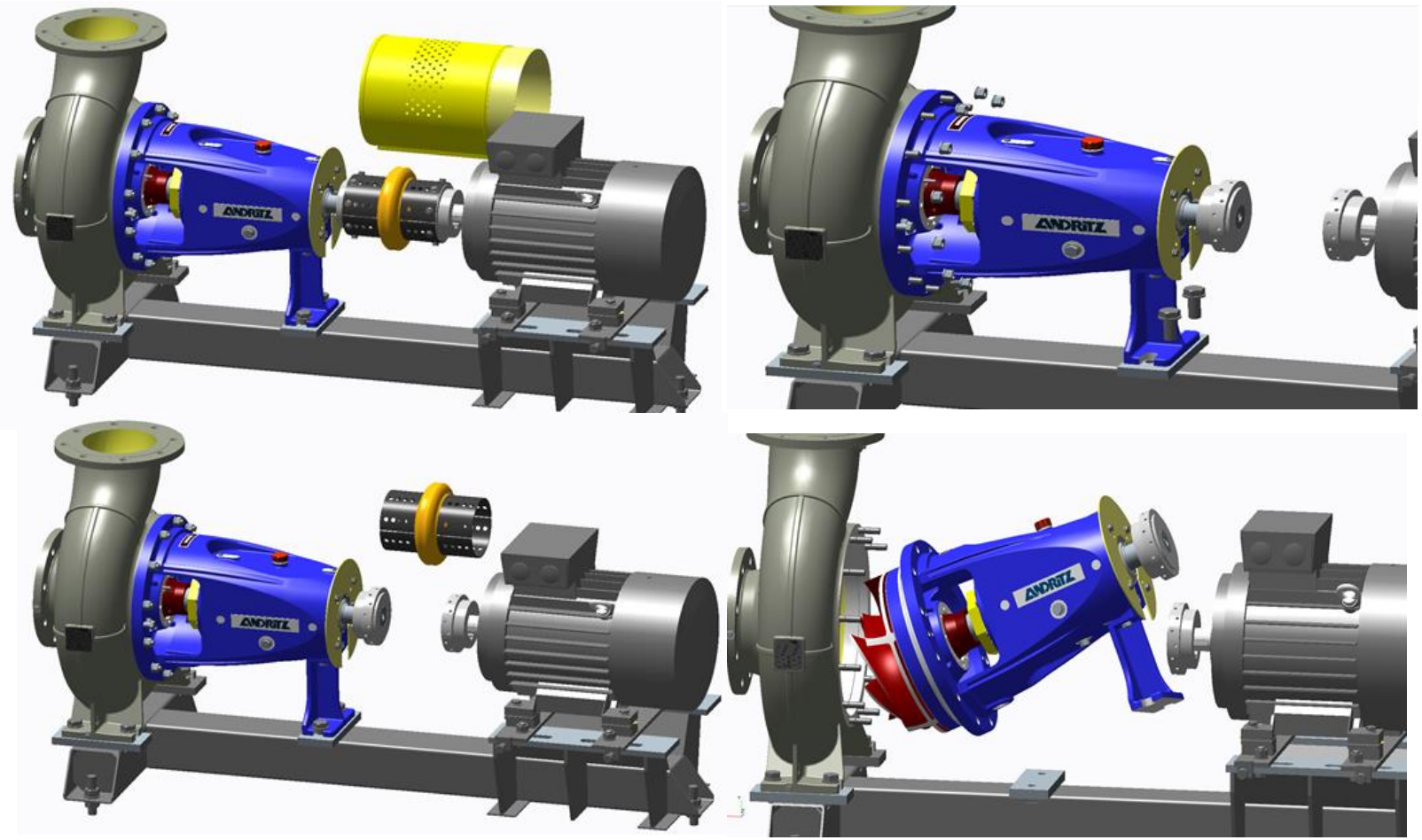
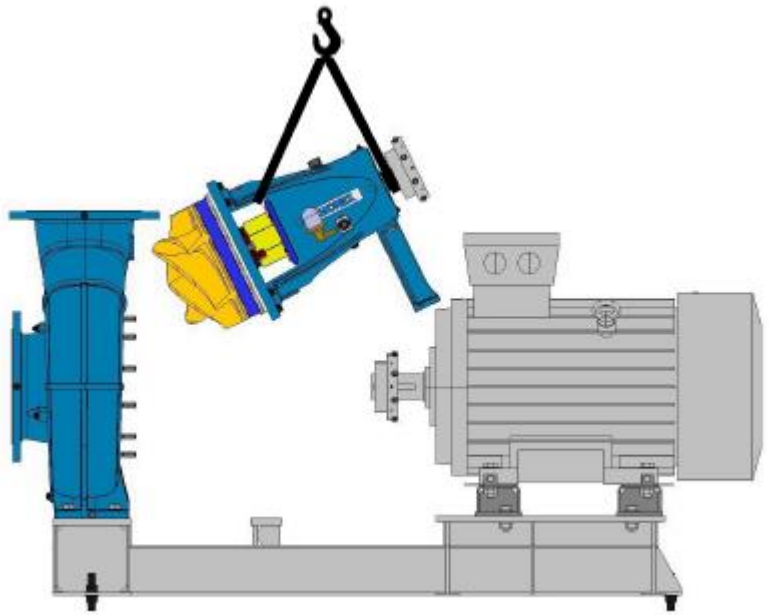
K:Coupling alignment device K:联轴器调整装置

MAINTENANCE

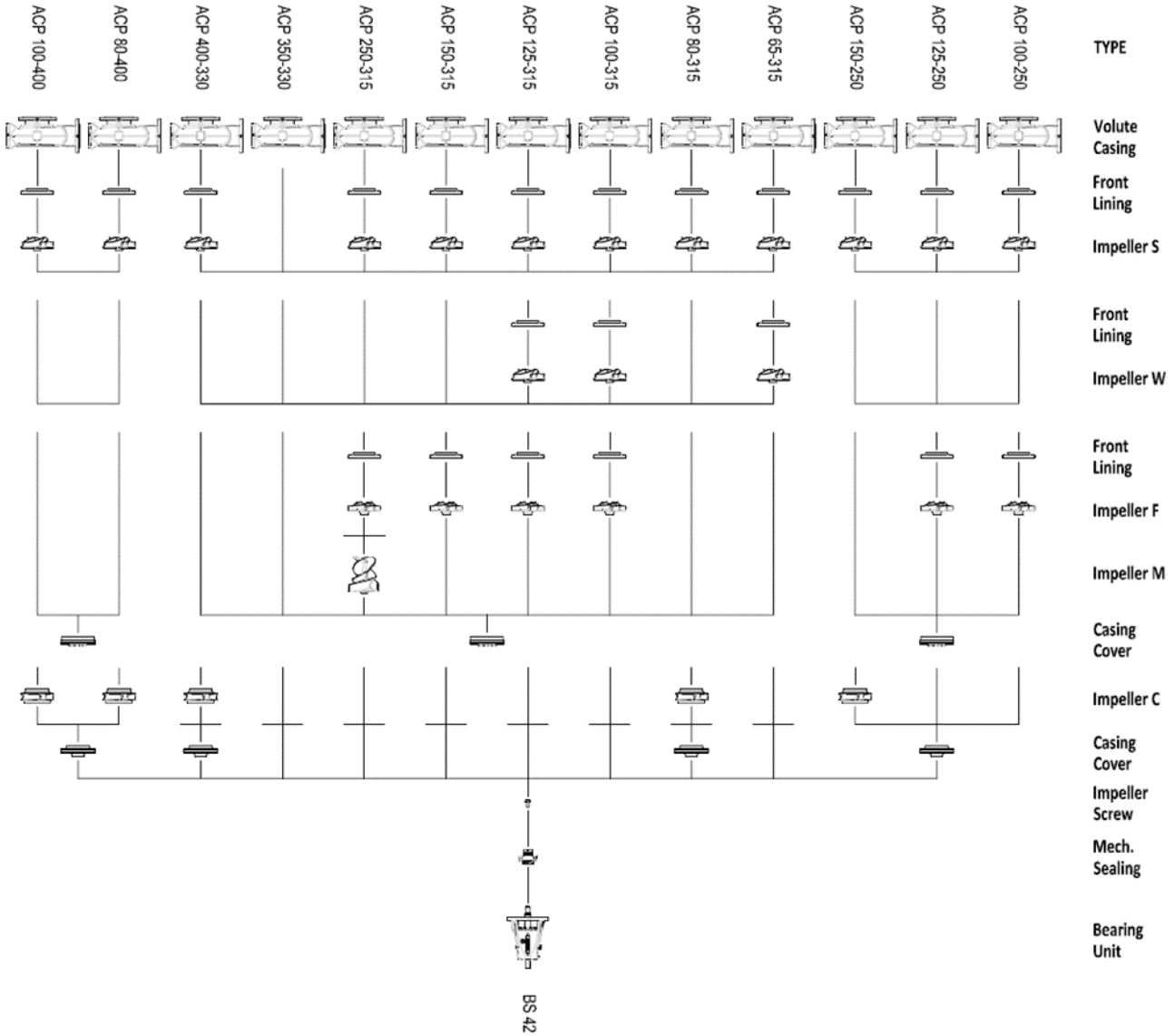
Disassemble in four steps





MODULER DESIGN

ACP series



ANDRITZ ACP SERIES PUMP

Pump types

ACP pump types

nq	ACP	BS
7	32-250	32
	40-315	32
11	32-200	24
	40-250	32
	50-315	32
	80-400	42
14	32-160	24
	40-200	24
	50-250	32
	65-330	32
	65-315	42
	100-400	42
	100-480	48
	100-500	60
	125-625	75
18	50-200	24
	65-250	32
	80-315	42
21	32-125	24
	40-160	24
	65-200	32
	80-250	32
	100-330	32
	100-315	42
	100-315HD	48HD
	125-400	48
	150-480	60
	150-500	75
	200-625	100

nq	ACP	BS
30	40-125	24
	50-160	24
	80-200	32
	100-265	32
	100-250	42
	125-315	42
	125-315HD	48HD
	150-400	48
	200-480	60
	200-500	75
	250-625	75
	300-700	100
46	50-125	24
	65-160	32
	100-200	32
	125-265	32
	125-250	42
	150-315	42
	200-400	60
	250-480	60
	350-650	75
	400-700	100
58	65-125	24
	80-160	32
	150-250	42
	250-315	42
	300-400	60
	350-480	75
	450-550	75
	500-650	100

nq	ACP	BS
74	350-330	42
110	400-330	42
	600-555	75
	700-640	100
	800-730	100
	900-800	100

Status 22.02.2017 acc. to ACP selection tool

PULP MILL FIBERLINE PROCESSING

Andritz centrifugal pumps matching the entire process

Process-Stage Fiberline	Cooking	Brown stock washing	Oxygen, Screening , Stage	Bleaching D0	Bleaching EOP Stage	Bleaching P Stage
Media, Applications	Black Liquor	Pulp	Pulp, c=4%	Filtrate, pH 3-5	Filtrate pH 10	Filtrate pH 10
	Condensate	Filtrate, pH10	Filtrate, pH10	water		Condensate
ACP-ISO PUMPS	✓	✓	✓	✓	✓	✓
AD, SAT PUMPS		✓				
ACP PUMPS	✓	✓	✓	✓	✓	✓
S PUMPS	✓	✓	✓	✓	✓	✓
ACP CL, PN25 PUMPS	✓					

PULP MILL CHEMICAL RECOVERY PROCESSING

Andritz centrifugal pumps matching the entire process

Process-Stage Chemical recovery	Evaporation	Recovery Boiler	Recaust.& lime kiln
Media, Applications	Black liquor	Black liquor	Green liquor
	Condensate-Water	Condensate-Water	Lime mud-Milk Slurry
		Green liquor	White liquor
ACP-ISO PUMPS	✓	✓	✓
SAT PUMPS	✓	✓	✓
ACP, S PUMPS	✓	✓	✓
ACP-HW PUMPS			✓
MP PUMPS		✓	
PP PUMPS			✓ (X-Filter)

ANDRITZ PUMP PRESENCE IN INDIA

Century Paper Mills, Lalkua, Uttarakahnd

Process Pumps
Stock Pumps
Water Pumps
Fan Pumps
Caustisizig Plant Pumps

Qty.: More than 250pcs

Year of supply: 2009 and still continue

Pumps are working satisfactory

CENTURY
PULP & PAPER

ANDRITZ PUMP PRESENCE IN INDIA

JK Paper Mill, Raigadha, Orissa

Process Pumps
Stock Pumps
Water Pumps
Fan Pumps
MC Pumps
Chip Pumps
MP (multistage)

Qty.: More than 280pcs

Year of supply: 2011

ANDRITZ PUMP PRESENCE IN INDIA

ITC Paper Mill, Badrachalam, Triveni & KOVAI

Process Pumps
Stock Pumps
Water Pumps
Fan Pumps
MC Pumps
Chip Pumps
MP (multistage)

Qty.: More than 260pcs

Year of supply: up to now

Pumps are working satisfactory

SINA MASS OKI PROJECT

OKI 2.2 mt/y Chemical Kraft pulp project

Project Overview

- **Country**: Indonesia;
- **Pumps:** 596 sets pump including 33 pcs of VLSP for a pulp mill in Sumatra island;
- **Contract Value**: USD 17,600,000

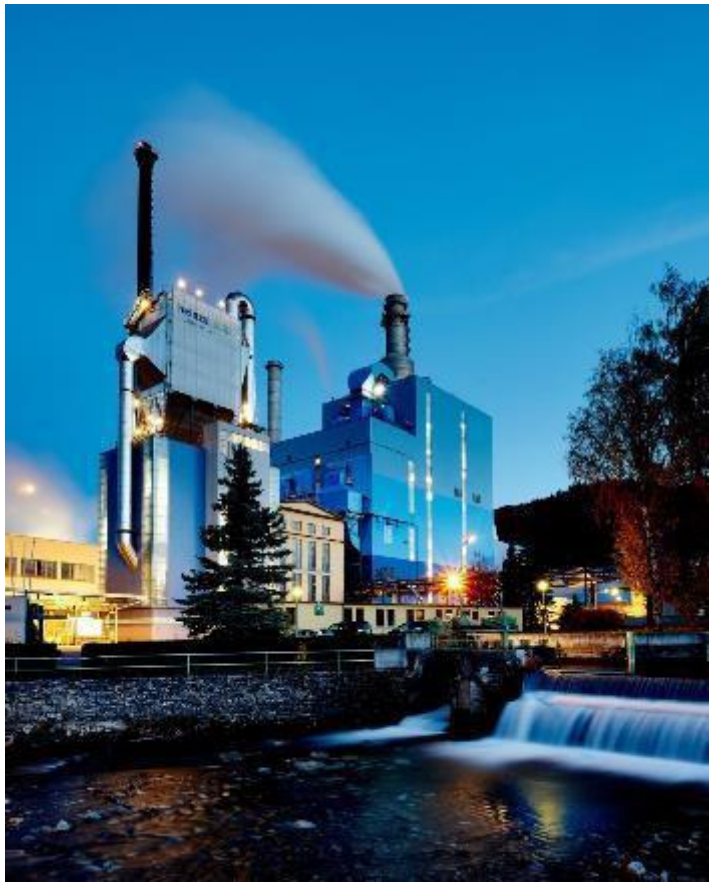
Benifit:

- Significant contract sales volume and reference in Standard process pump area.
- Full set of process pumps for the biggest pulp plant in the world covering all the mill areas.

ZELLSTOFF PÖLS AG

Pöls (Austria)

PM2 paper machine:	new 2012
Production capacity:	80,000 t p.a.
Length of machine:	100 m
Working width:	5,4 m
Max. speed of production (28/m²):	1,000 m/min



Products:

- Kraft paper bleached - basic weight range 28-120 g/m²
- High-quality printing & writing paper, packaging & special paper

ANDRITZ pumps supply:

- All 42 process pumps (stock pumps, water pumps, high-pressure pumps, fan pumps)

PM5 MODERN KARTON

Turkey

PM5 paper machine:	new 2015
Production capacity:	400,000 t p.a.
Working width:	8.01 m
Max. speed of production:	1,500 m/min.

Products:

- Packaging paper

ANDRITZ supply:

- 143 process pumps (the stock preparation system, stock supply, headbox feed, dewatering, and water circuit, and ending with waste water treatment)
- Headbox pump
- Medium-consistency pump

UPM PULP LINE

Fray Bentos, Uruguay

Application:	Green field pulp mill with ~400 process pumps + MC-pump
Type:	Medium-consistency pump with SMARTSEP
Mill capacity:	Up to 3,500 admt/d
Pressure:	Up to 25 bar
Consistency:	Up to 14%
Temperature:	Up to 140° C
Speciality:	7 to 15% of energy savings with ANDRITZ MC pump

SHANDONG SYMBOL

Shandong (China)

PM2 paper machine	new 2012
Production capacity	80,000 t p.a.
Length of machine	100 m
Working width	5,4 m
Max. speed of production (28/m²)	1,000 m/min.

Products:

- Kraft paper bleached - basic weight range 28-120 g/m²
- High-quality printing & writing paper, tissue paper, packaging & special paper

ANDRITZ pumps supply:

- 138 process pumps

MONDI SYKTYVKAR

Russia

Application: Pulp and paper mill modernization

Type: Medium-consistency pumps

Mill capacity: Up to 2,000 admt/d

Pressure: Up to 25 bar

Consistency: Up to 16%

Temperature: Up to 90° C

Speciality: 7 to 15% of energy savings with ANDRITZ MC pump

FIBRIA JACAREÍ PULP PLANT

Brazil

Application: Pulp mill modernization

Type: Medium-consistency pumps

Flow rate: Up to 2,000 admt/d

Pressure: Up to 25 bar

Consistency: Up to 16%

Temperature: Up to 90° C

Speciality: Higher pumping capacity with already existing motor; energy savings of over one-third.

References P&P

Jass / Schwarza (Germany)

S80-265	7
S125-265	1
S100-350	10
S125-350	12
S150-330	8
S125-400	7
S150-400	7
S200-380	10
S150-470	1
S200-470	2
S250-430	13
S250-470	12
S500-600	7
SP600-700	4

∑ =101

FP40-700	1
FP50-600	1
FP60-500	1
FP80-600	1
FP100-300	1

∑ =5

SF150-330	2

∑ =2

REFERENCES P&P

Montes del Plata (Uruguay) 2013

ACP200-400.7CL	1
ACP300-700.3	1
ACP400-700.5	7
ACP400-700.7	9

∑ = 18

ISO50x32-160	7
ISO50x32-200	6
ISO65x40x200	2
ISO65x40-250	4
ISO65x40-315	4
ISO65x50-160	1
ISO80x65-160	3
ISO80x50-200	8
ISO80x50x250	3
ISO80x50-315	3
ISO100x65-200	2
ISO100x65-250	1

∑ = 44

SP65-250	2
SP65-315	12
SP100-250	10
SP100-315	4
SP100-500	15
SP125-315	1
SP150-315	6
SP150-400	3
SP150-450	6
SP200-400	10
SP200-450	3
SP200-550	3
SP200-550CL	1
SP250-500	2
SP300-600	14
SP300-600CL	4
SP350-500	2
SP450-550	4
SP600-700	9

∑ = 111

HP25-73.A/19	2
HP100-230.1/3	2
HP32-135.1/11	1

∑ = 5

KS701.800SH	4
KS800-850	4

∑ = 8

REFERENCES P & P

Montes del Plata (Uruguay) 2013

S80-265	9
S100-265	3
S100-350	11
S125-350	8
S150-330	6
S125-400	9
S150-400.3	9
S150-400.6	1
S200-380.3	5
S200-380.6	2
S150-470.3	6
S150-470.6	7
S200-470.3	9
S200-470.6	6
S250-430	14
S350-470	2
S500-600.3	17
S500-600.6	3

∑ = 127

FP40-700.12	2
CP200-400.10	1
VP100-350.10	1
PP650-1000	2

SAT80-265.3	1
SAT100-265.3	1
SAT125-350.3	8
SAT125-400.3	3

∑ = 13

AD 80-265.3	3
AD100-350.3	4
AD125-350.3	2
AD125-400.3	5
AD200-470.3	4

∑ = 18

HP25-73.A/19	2
HP100-230.1/3	2
HP32-135.1/11	1

∑ = 5

REFERENCES P&P

Tamil Nadu BM4 (India) 2014

S3-80-265.3	2
S3-100-265.3	1
S3-100-350.3	4
S3-125-350.3	2
S3-200-380.3	1
S3-250-430.3	1
S3-350-470.3	2
S3-500-600.3	1

∑ =14

ISO50X32-200.5	2
ISO65X40-250.5	2
ISO65X50-160.6	1
ISO80X50-315.5	1
ISO80X65-160.5	3
ISO100X65-200.6	3
ISO100X65-315.6	2

∑ = 14

FPS40-200.12	1
FP40-400.12	3
FP50-500.12	1
FP200-470.3	1

∑ =6

ACP65-315.8	2
ACP100-250.4	5
ACP100-250.5	3
ACP100-315.6	2
ACP125-250.3	5
ACP125-250.5	4
ACP125-315.4	8
ACP125-315.5	4
ACP125-400.6	1
ACP150-315.3	4

∑ = 38

ACP150-315.5	4
ACP150-400.4	1
ACP200-400.3	2
ACP200-400.5	2
ACP200-400.7	1
ACP200-500.4	3
ACP250-315.3	3
ACP250-315.6	4
ACP300-400.3	5
ACP300-400.6	2

∑ = 27

MP65.2-6.6	2
VP100-350.3	4
VP125-350.3	1

∑ = 7

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