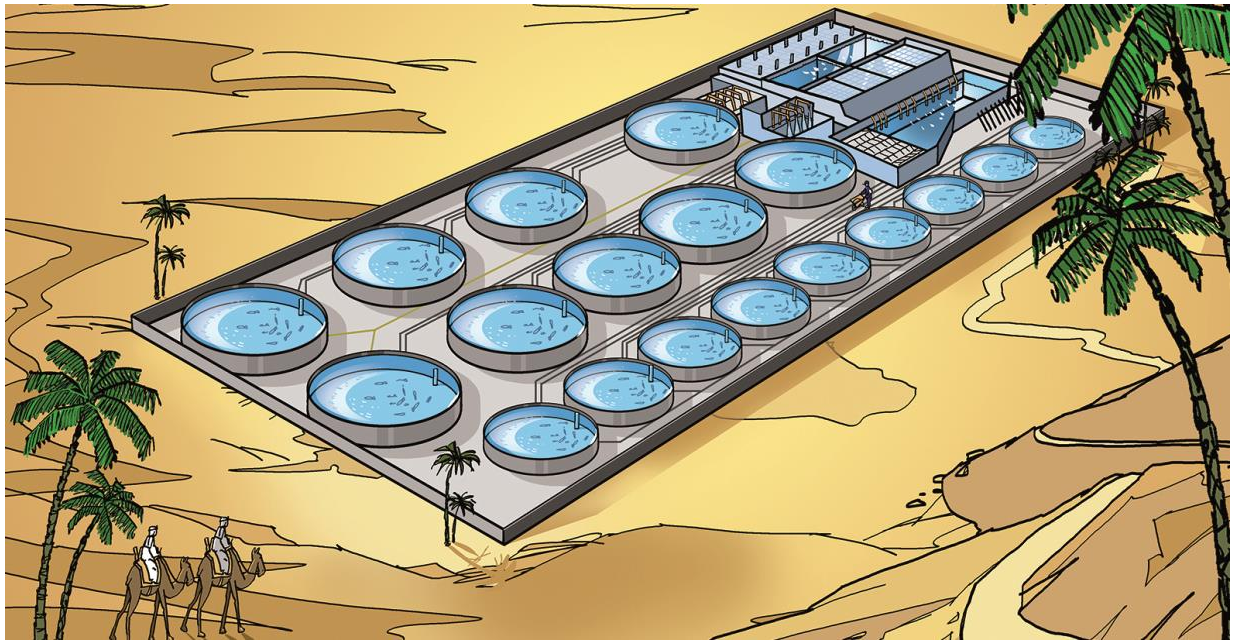
Energy efficiency in RAS
Pump solutions for saltwater RAS

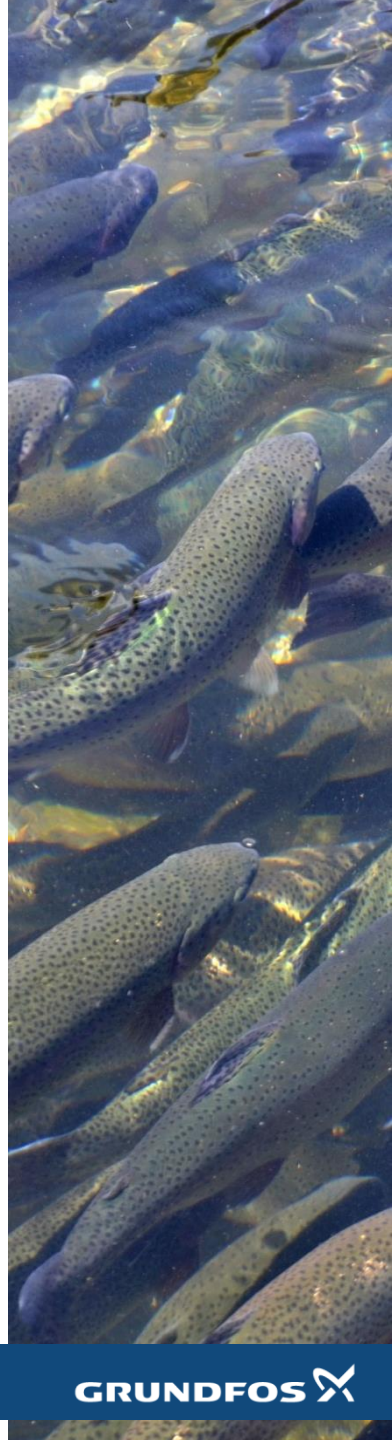
be think innovate

GRUNDFOS

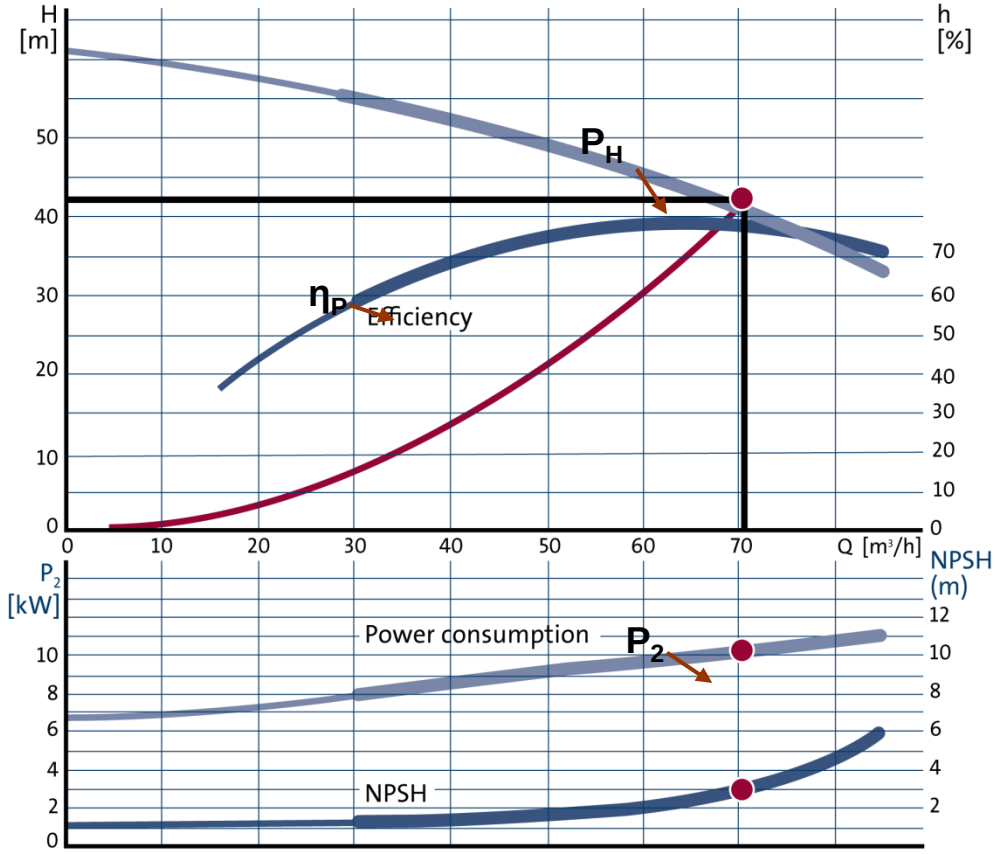
Energy Focus points for pumps in RAS

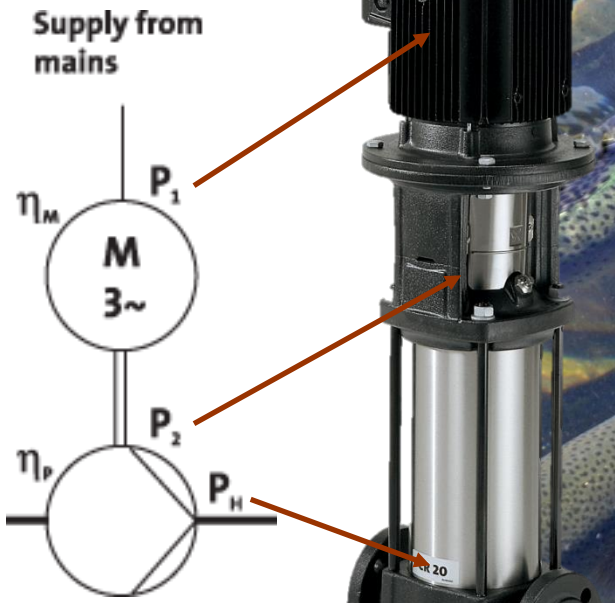
- Head loss
  - Static Head, (GEO)
  - Friction loss, (pipes, bends, etc.)
- Turbulence
- Corrosion
- Controls and Monitoring
- Pump selection





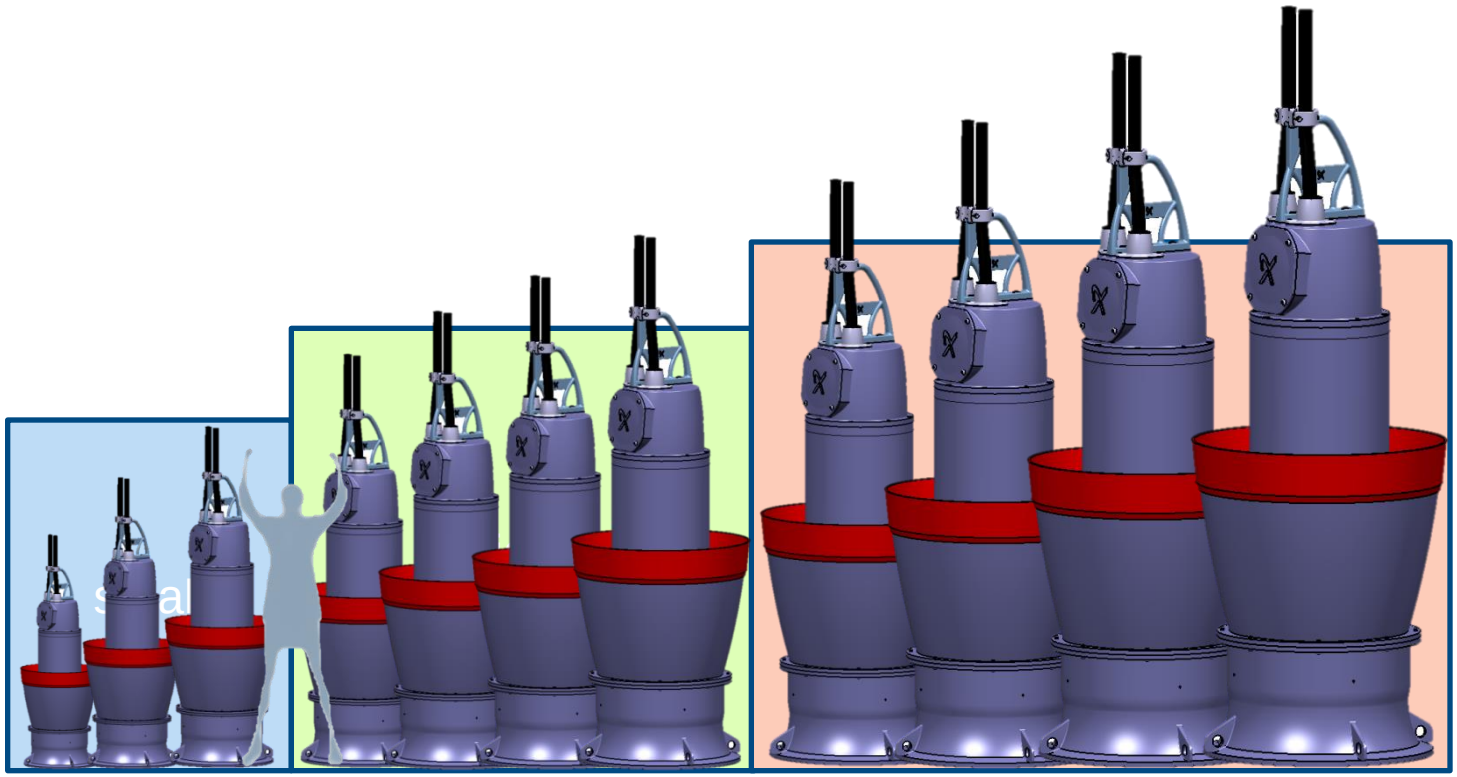
Pump versus dutypoint



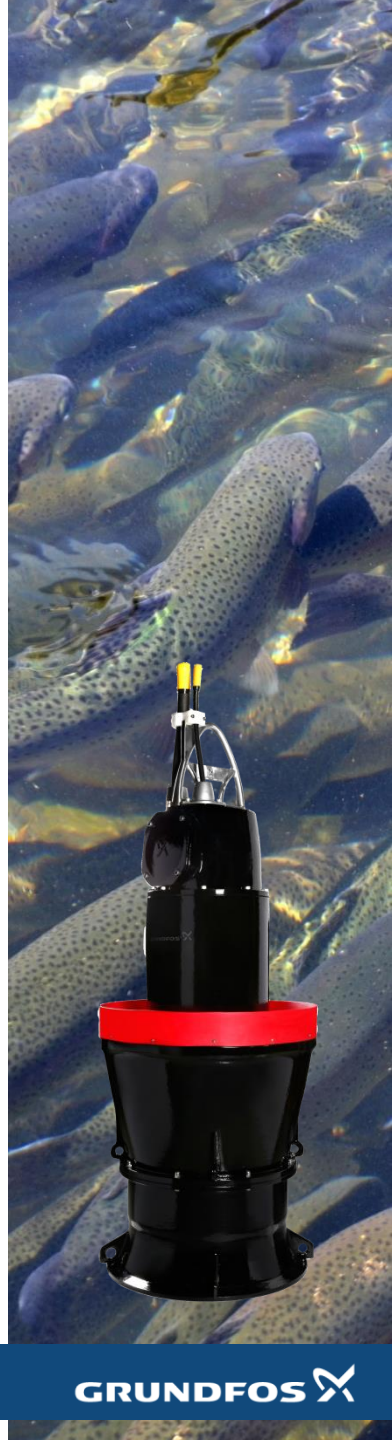


Range overview – by column size

smartdesign



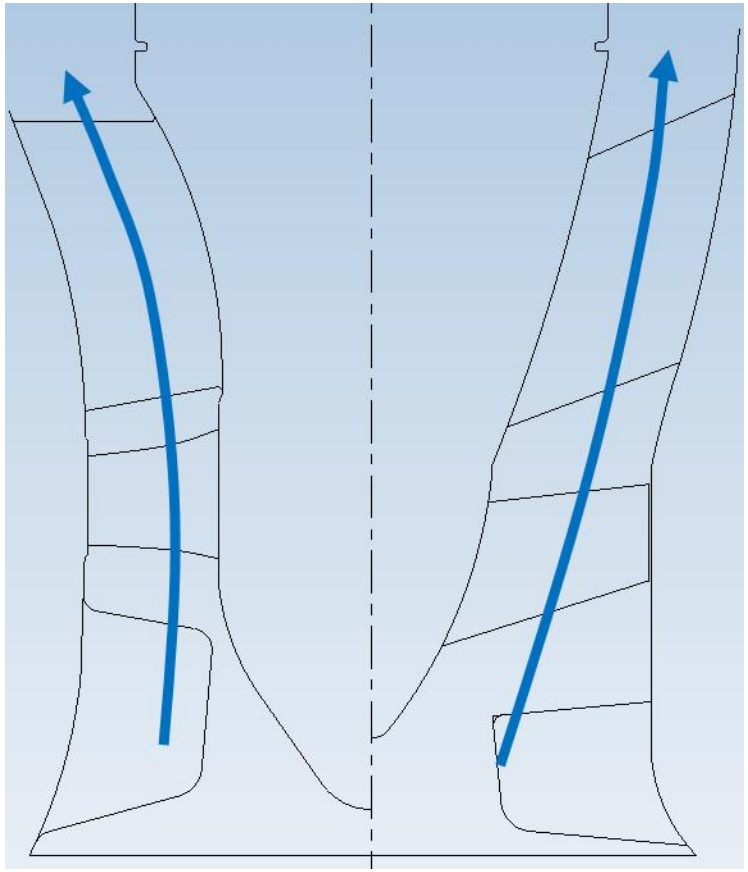
500, 600, 700	800, 900, 1000, 1200	1400, 1500, 1600, 1800, (2000, 2200)



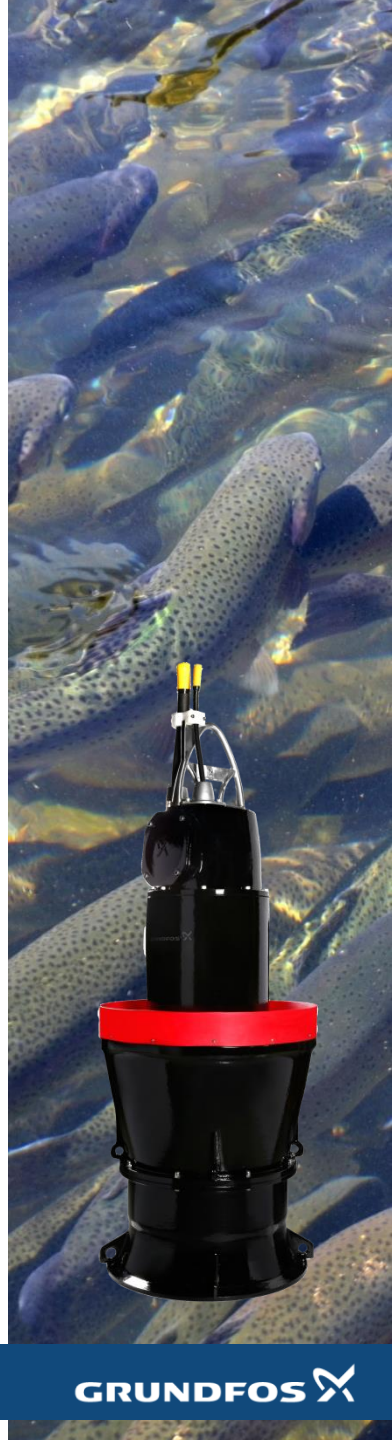
High hydraulic efficiency

smartdesign

Typical design



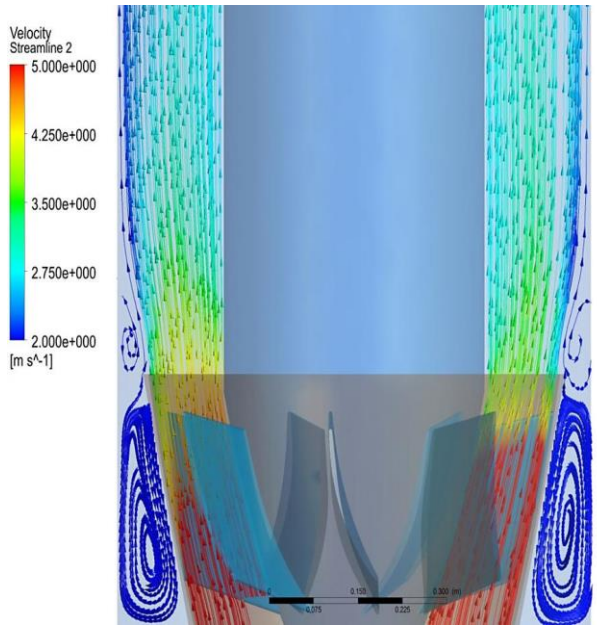
Grundfos KPL

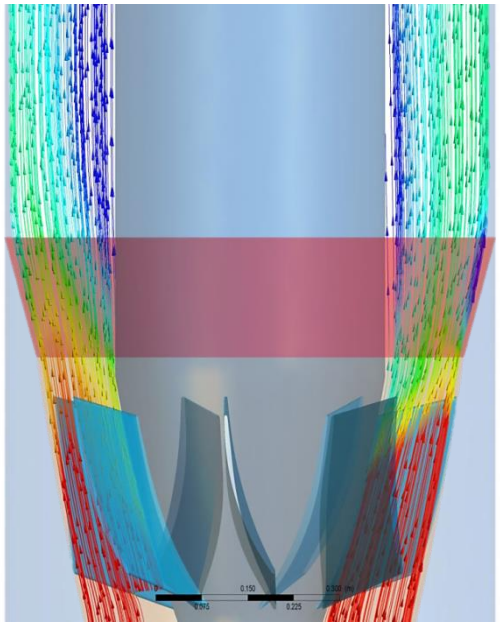


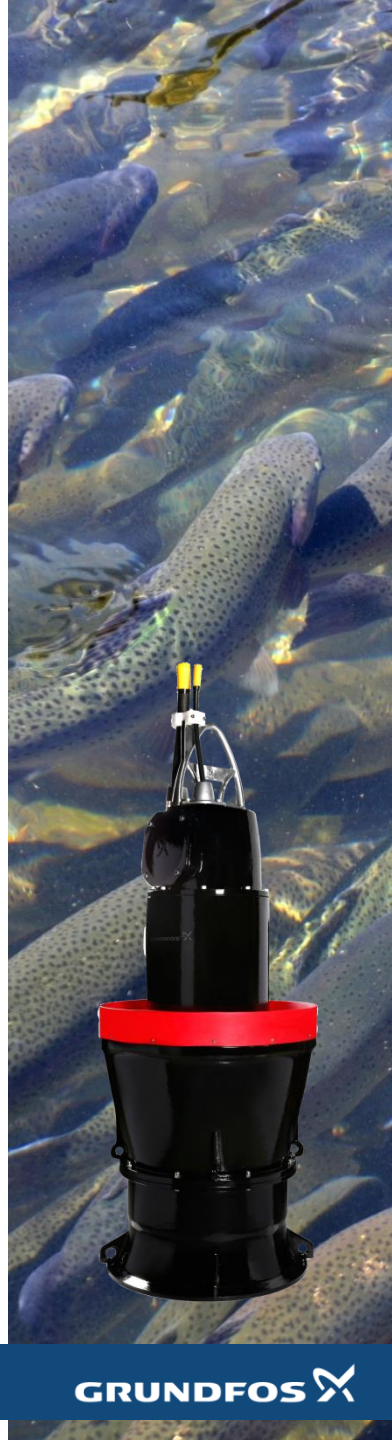
Turbulence optimizer

smartdesign

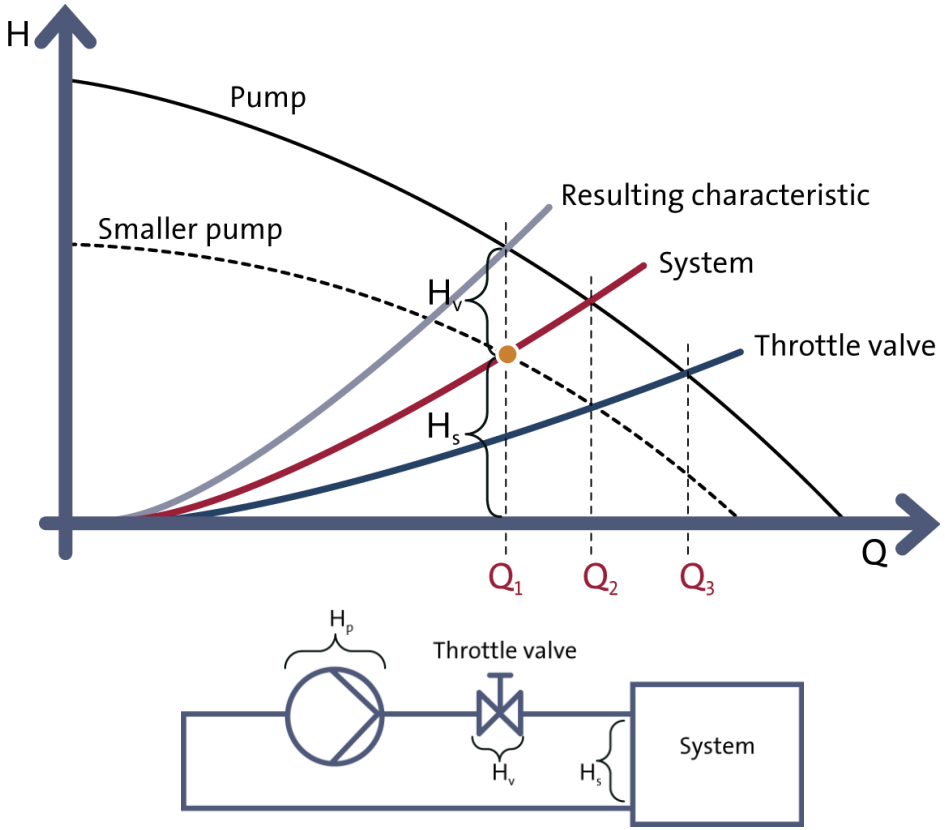
The patented Turbulence optimizer removes turbulence in the gap between the pump volute and the column pipe.
Increases the overall efficiency by up to 2%.

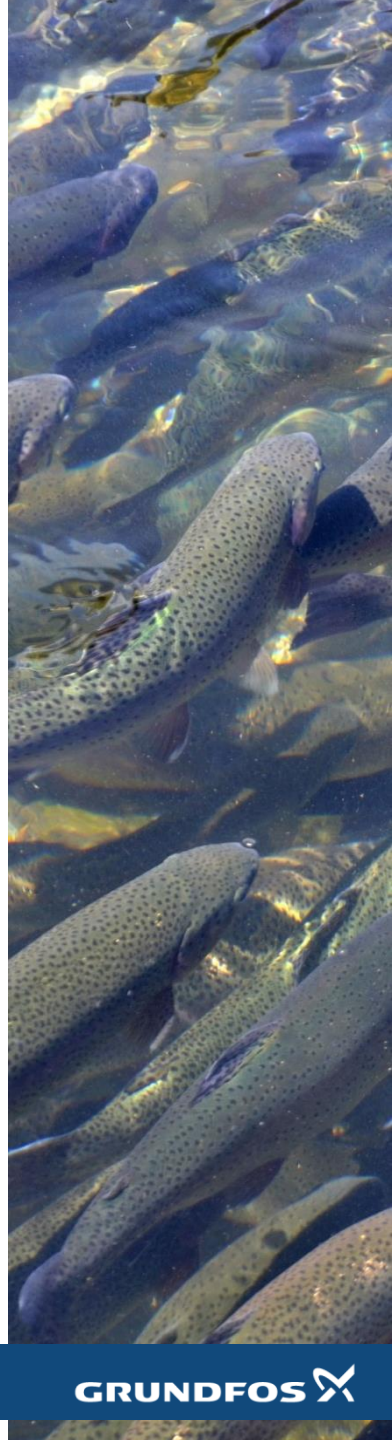




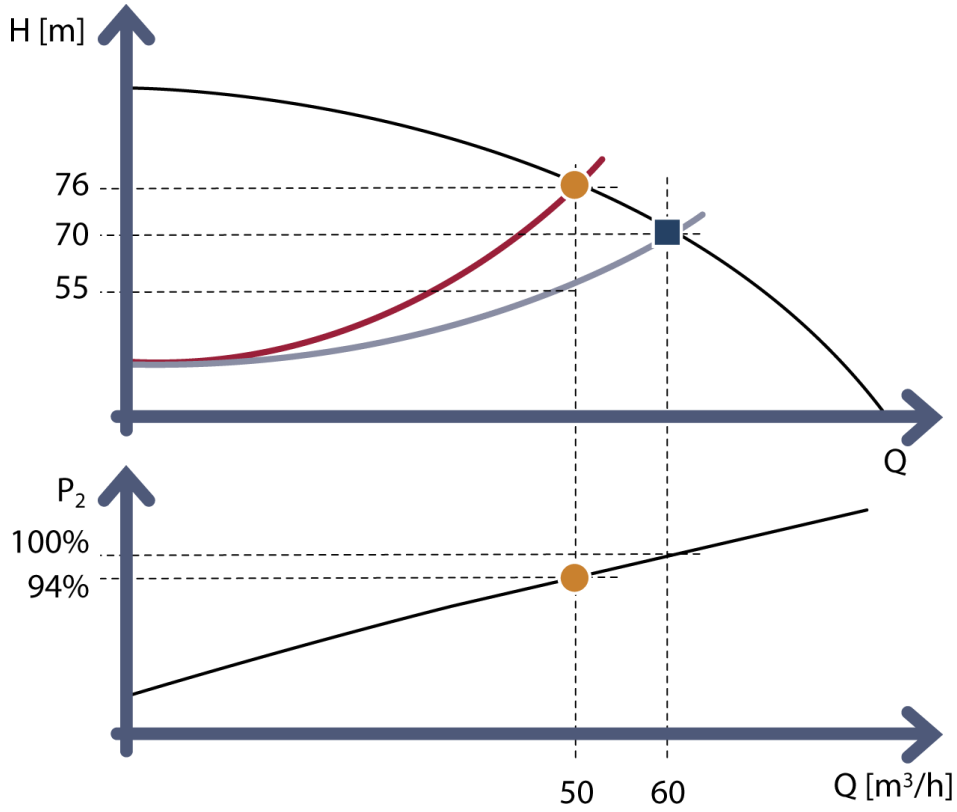


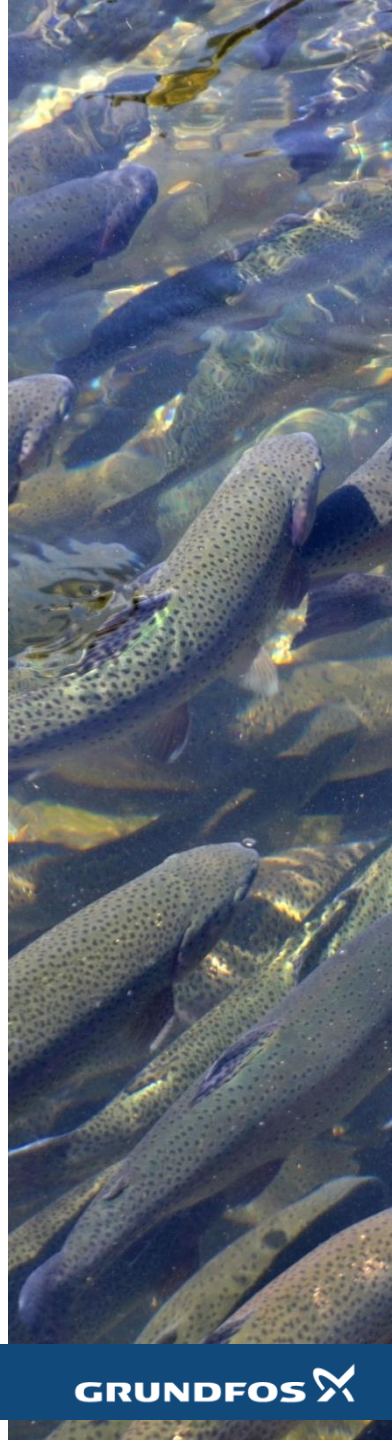
Throttle control



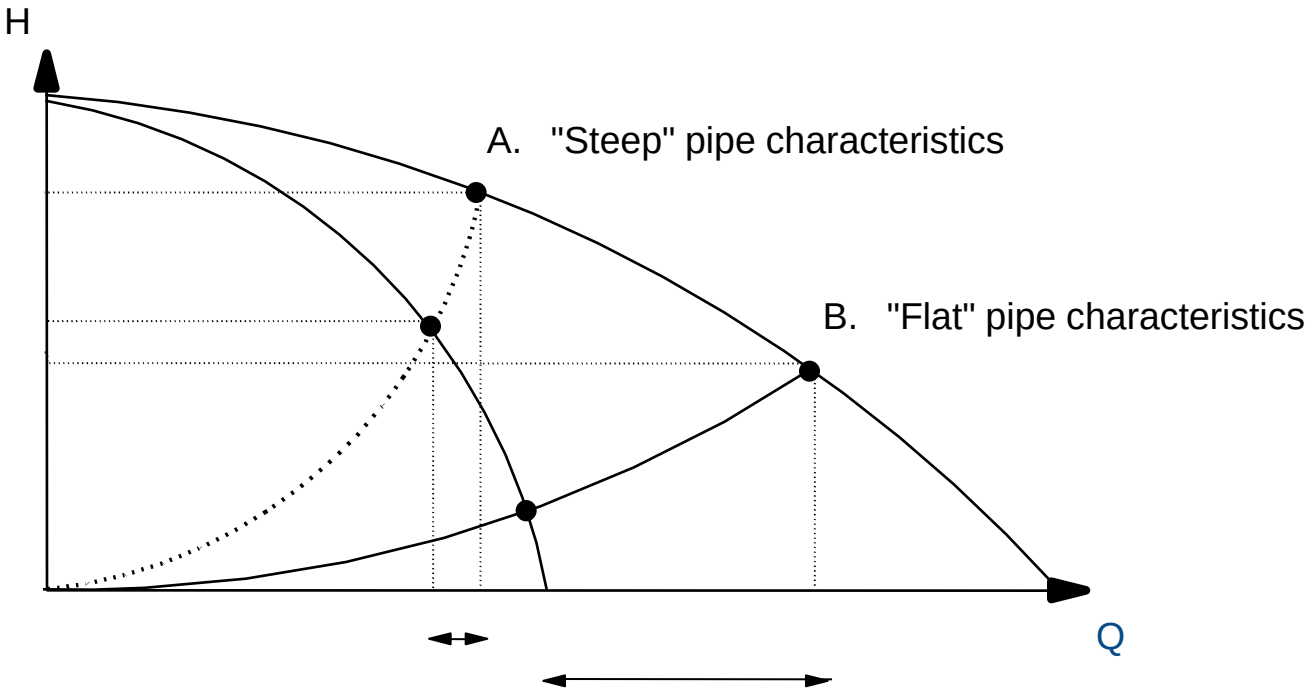


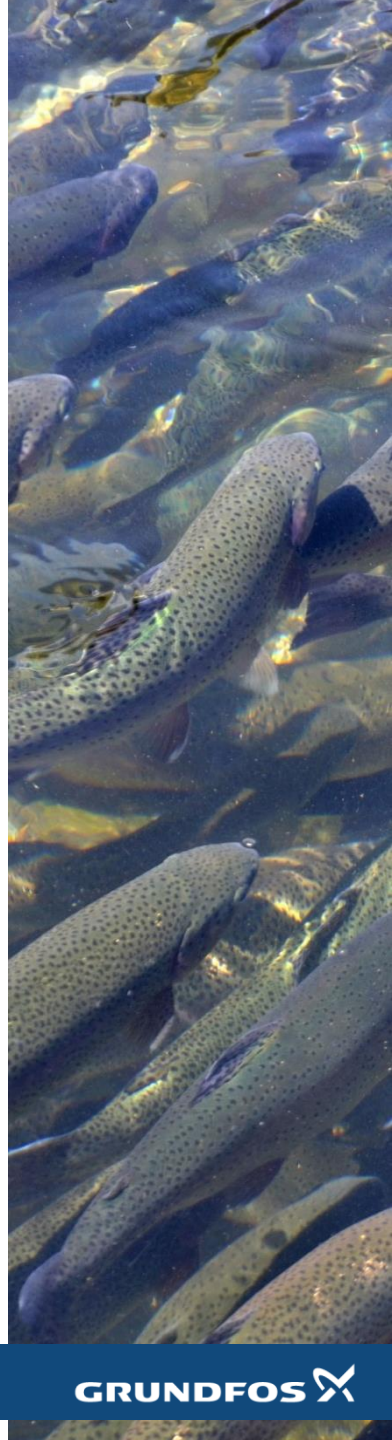
Throttle control





Choose the right pipe dimension

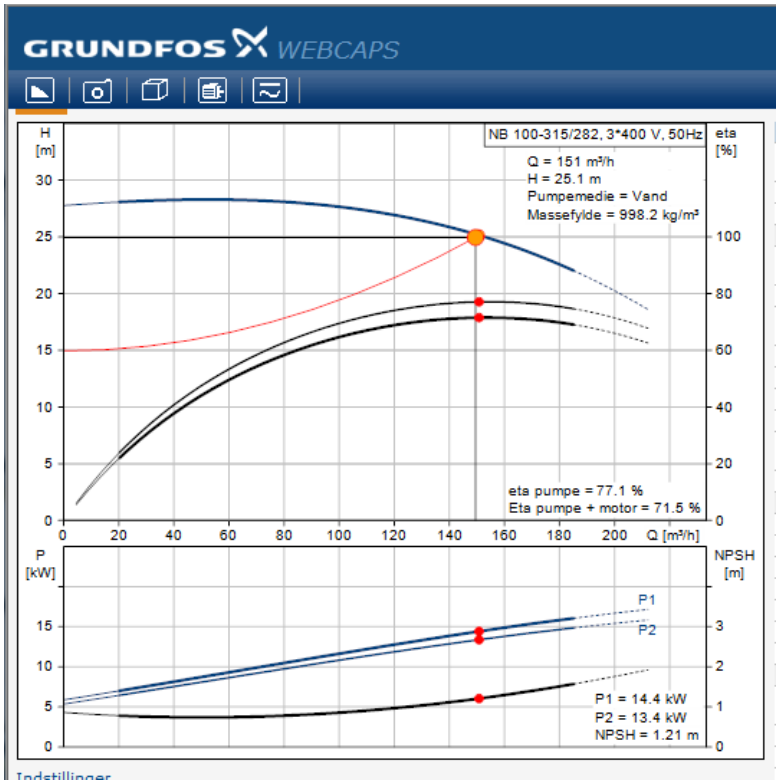


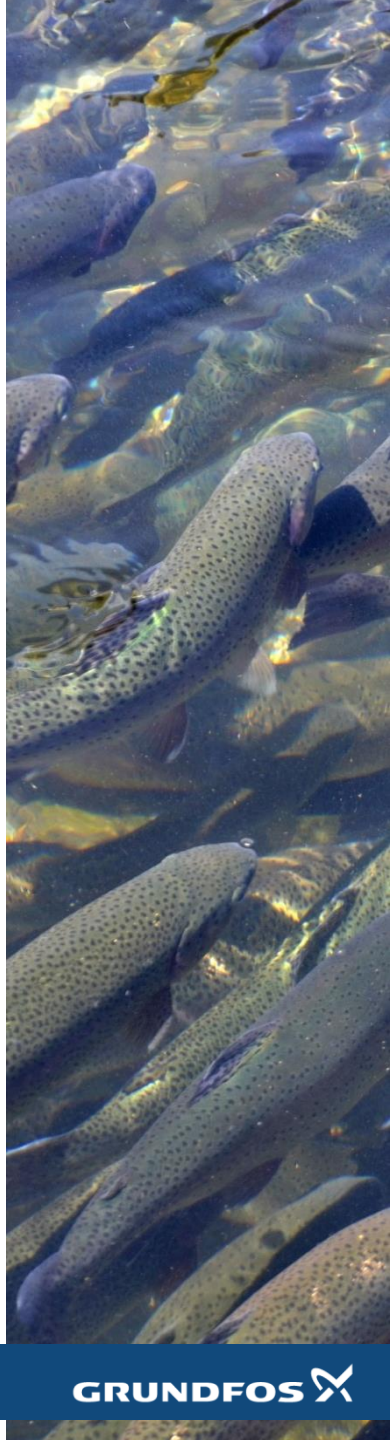


Example:

150 m3/h : Flow
15 m : Static Head: 15 meter
10 m : Friction loss, small pipes
25 m : Total Head

14,4 kW

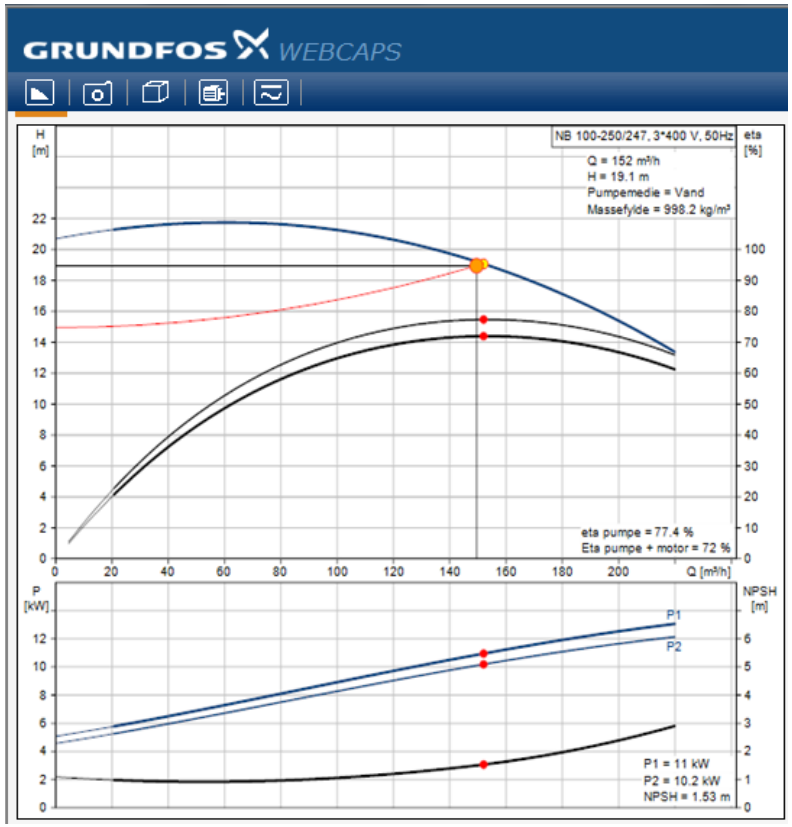


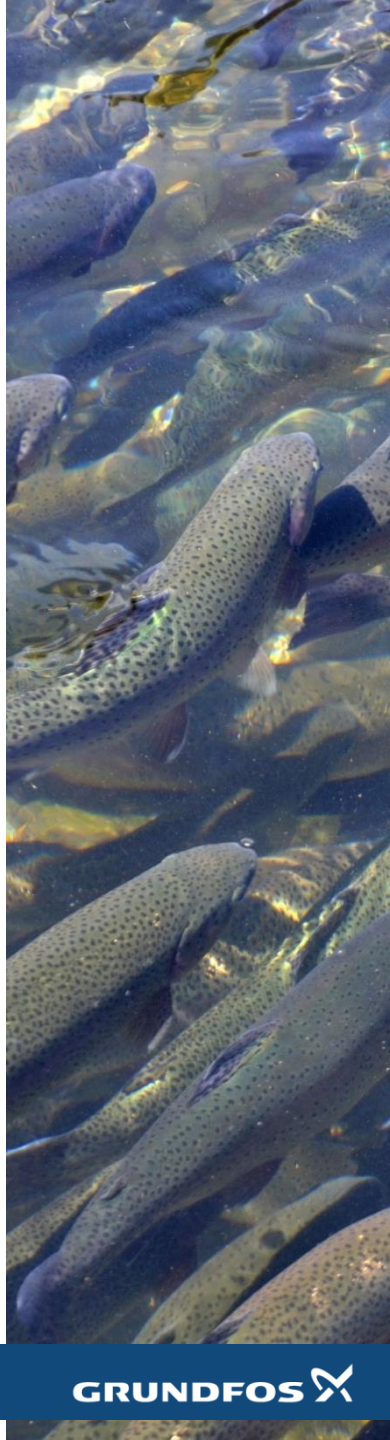


Example:

150 m3/h : Flow
15 m : Static Head: 15 meter
4 m : Friction loss, bigger pipes
1 9 m : Total Head

11,0 kW





Effects of variable speed

$Q_1 \times (n_2/n_1) = Q_2$

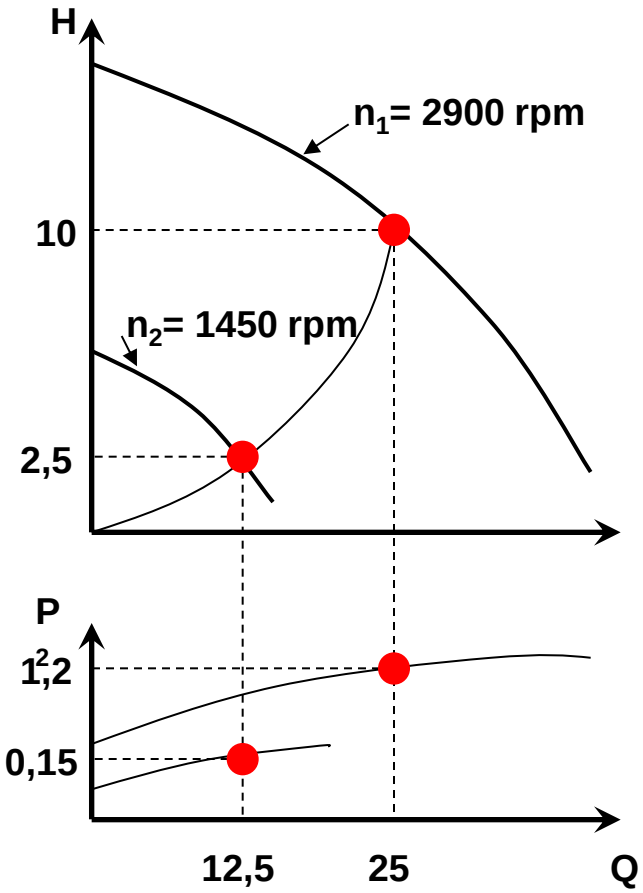
$25 \times (1450/2900) = 12,5$

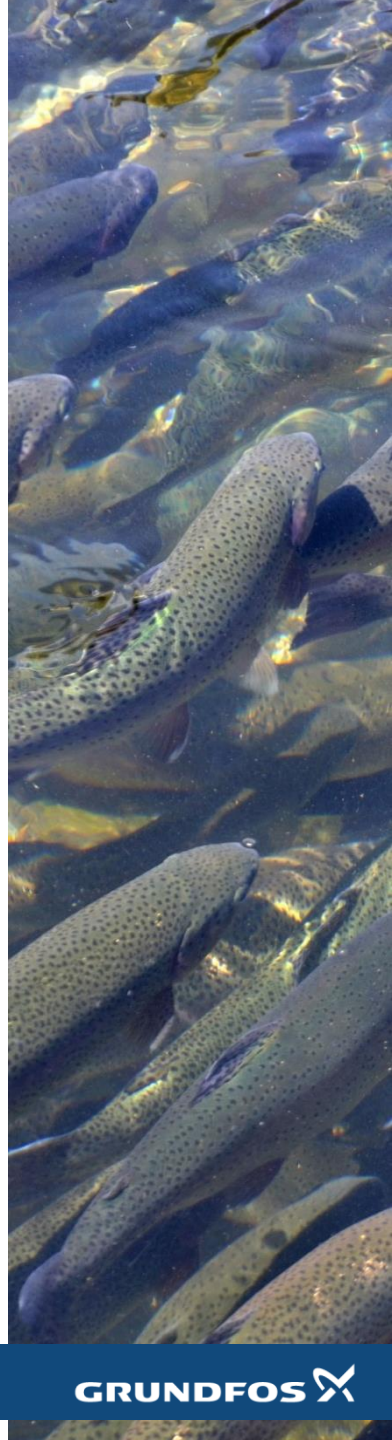
$H_1 \times (n_2/n_1)^2 = H_2$

$10 \times (1450/2900)^2 = 2,5$

$P_1 \times (n_2/n_1)^3 = P_2$

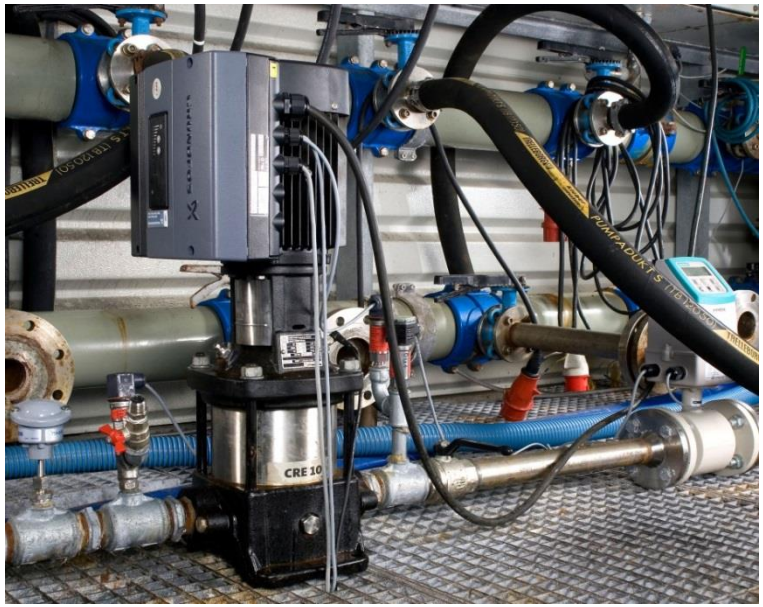
$1,2 \times (1450/2900)^3 = 0,15$

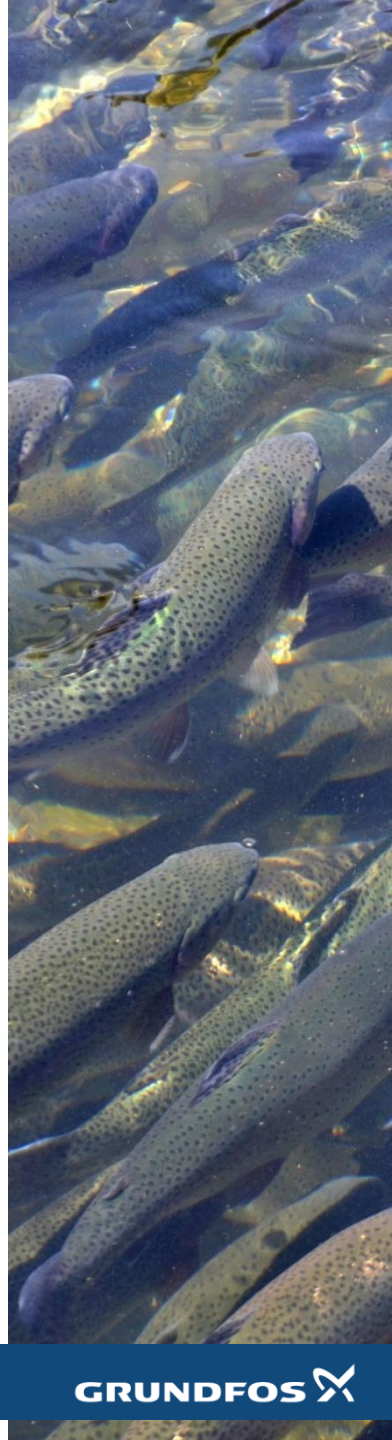




Pumping saltwater

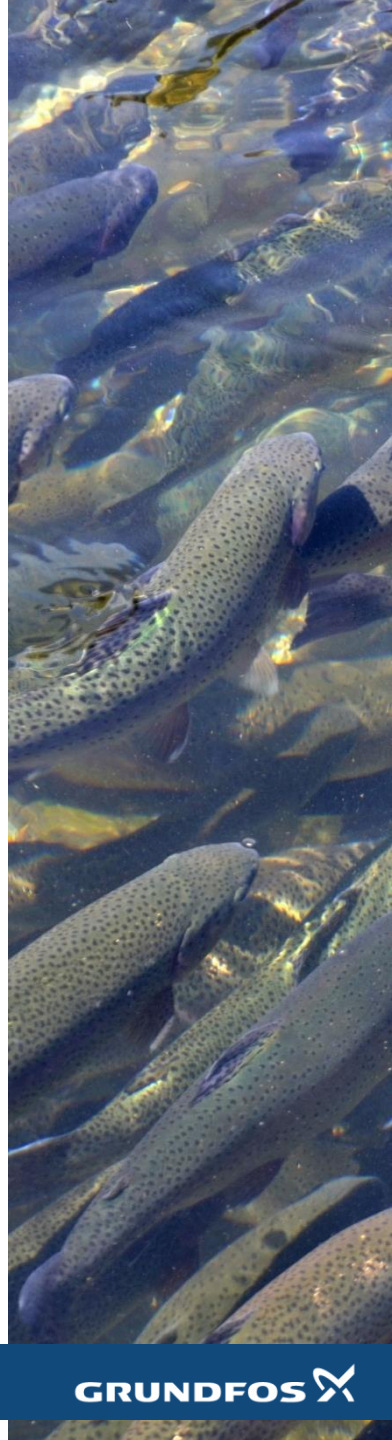
- QH loss ?
- Effiency loss?
- Cavitation, when?





Pumping saltwater

- Temperature
- Salinity
- Standby periods



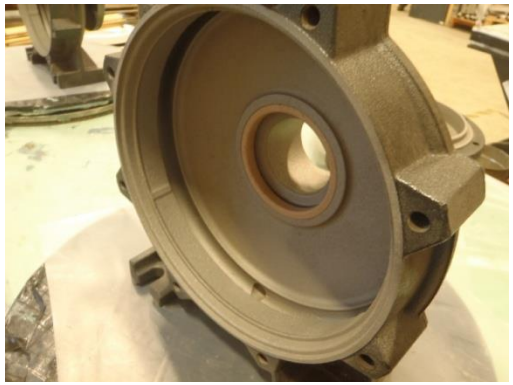
Coating: Seawater pumps

- The pump housing and top plate is coated with 600-800 µmChesterton ARC 855 black.

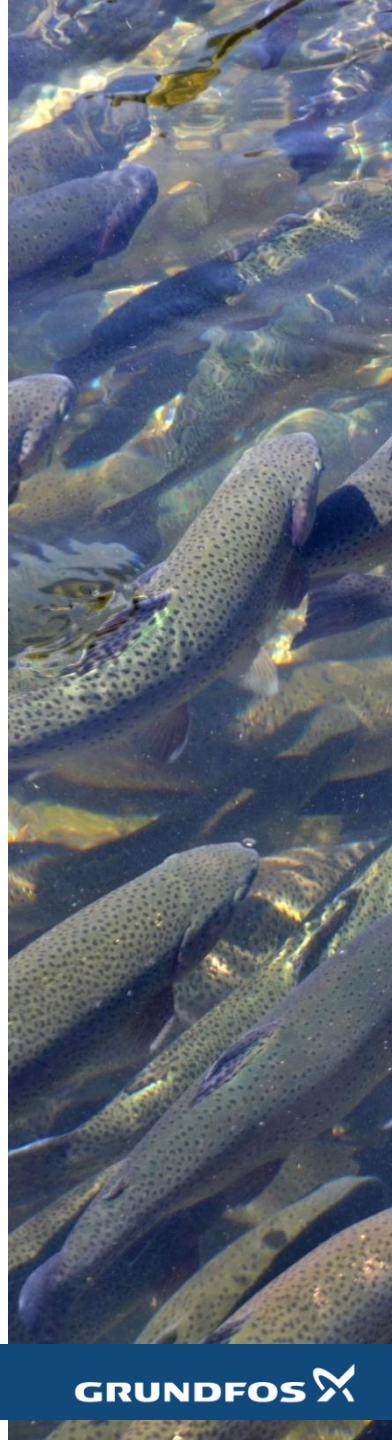
- The gab between Wear ring and housing and plugs are filled with Chesterton ARC 858 paste.

Surface preparation

- The pump part are vacuumed / blasted with compressed air for removal of dust.

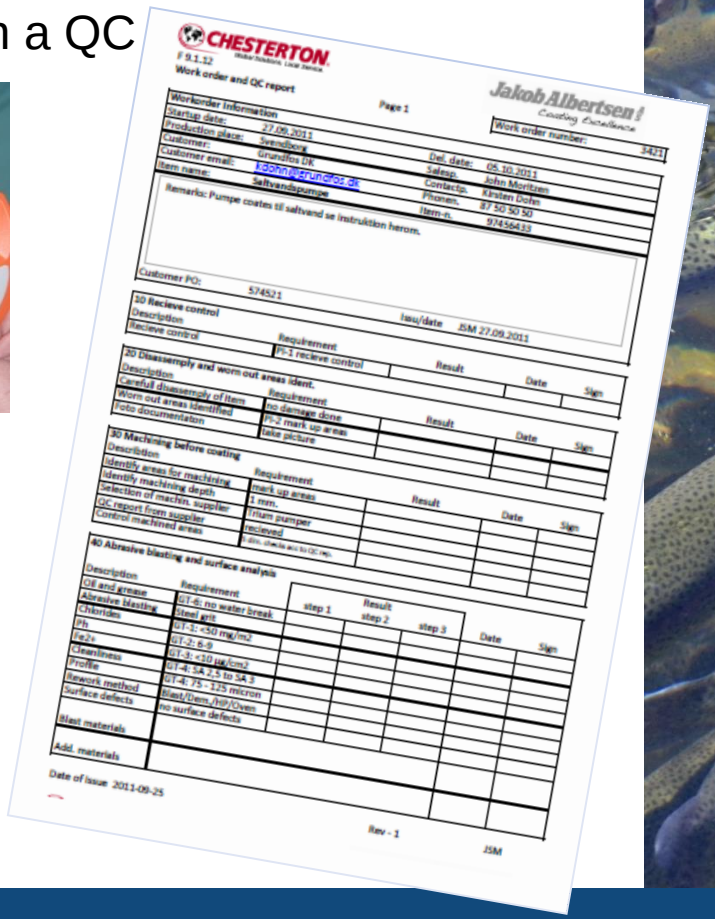


- The surface is controlled for moist/oil and roughness with tape test



Final inspection and control

- All coated pump parts are tested and undergoing an intense inspection inclusive film thickness measurements and pinhole testing, All results are monitered inn a QC report


CHESTERTON

Jakob Albertsen!
Coating Excellence

Work order and QC report

Page 1

Work order number: 3471

Workorder information
Startup date:
Production place: 27.09.2011
Customer: Svendborg
Customer email: Grundfos DK
Item name: Saltvandspumpe
Del. date: 05.10.2011
Salesm.: John Mortensen
Contactp.: Kirsten Dohn
Phonen.: 87 50 50 50
Item-n.: 97456433

Remarks: Pumpe coates til saltvand se instruktion herom.

Customer PO: 574521

10 Recieve control — Issu/date JSM 27.09.2011

Description	Requirement	Result	Date	Sign
Recieve control	PI-1 recieve control			

20 Disassembly and worn out areas ident.

Description	Requirement	Result	Date	Sign
Carefull disassembly of item	no damage done			
Worn out areas identified	PI-2 mark up areas			
Foto documentation	take picture			

30 Machining before coating

Description	Requirement	Result	Date	Sign
Identify areas for machining	mark up areas			
Identify machining depth	1 mm.			
Selection of machin. supplier	Trium pumper			
QC report from supplier	recieved			
Control machined areas				

40 Abrasive blasting and surface analysis

Description	Requirement	Result step 1	Result step 2	Result step 3	Date	Sign
Oil and grease	QT-6: no water break					
Abrasive blasting	steel grit					
Chlorides	QT-3: <50 mg/m2					
Ph	QT-3: 6-9					
Fe2+	QT-3: <10 µg/cm2					
Cleanliness	QT-4: SA 2,5 to SA 3					
Profile	QT-4: 75 - 125 micron					
Rework method	Blast/Item /Hp/Uvem					
Surface defects	no surface defects					
Blast materials						
Add. materials						

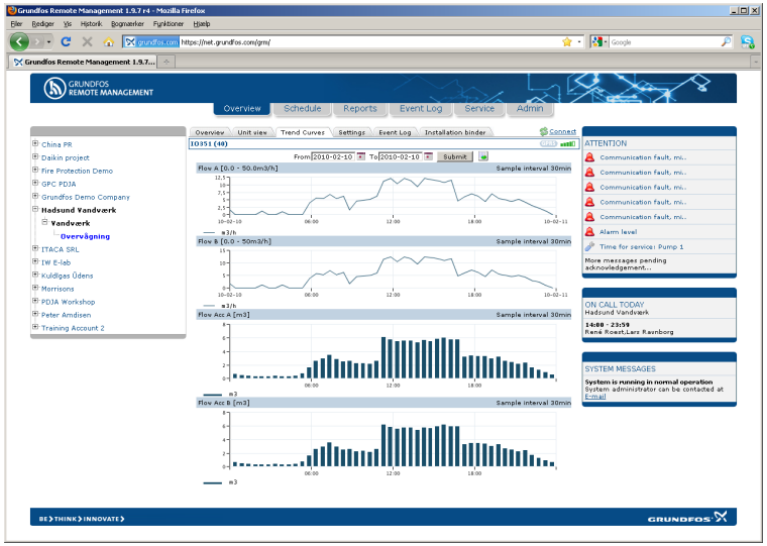
Date of issue: 2011-09-25

Rev - 1

JSM

3 years study at Danish Salmon

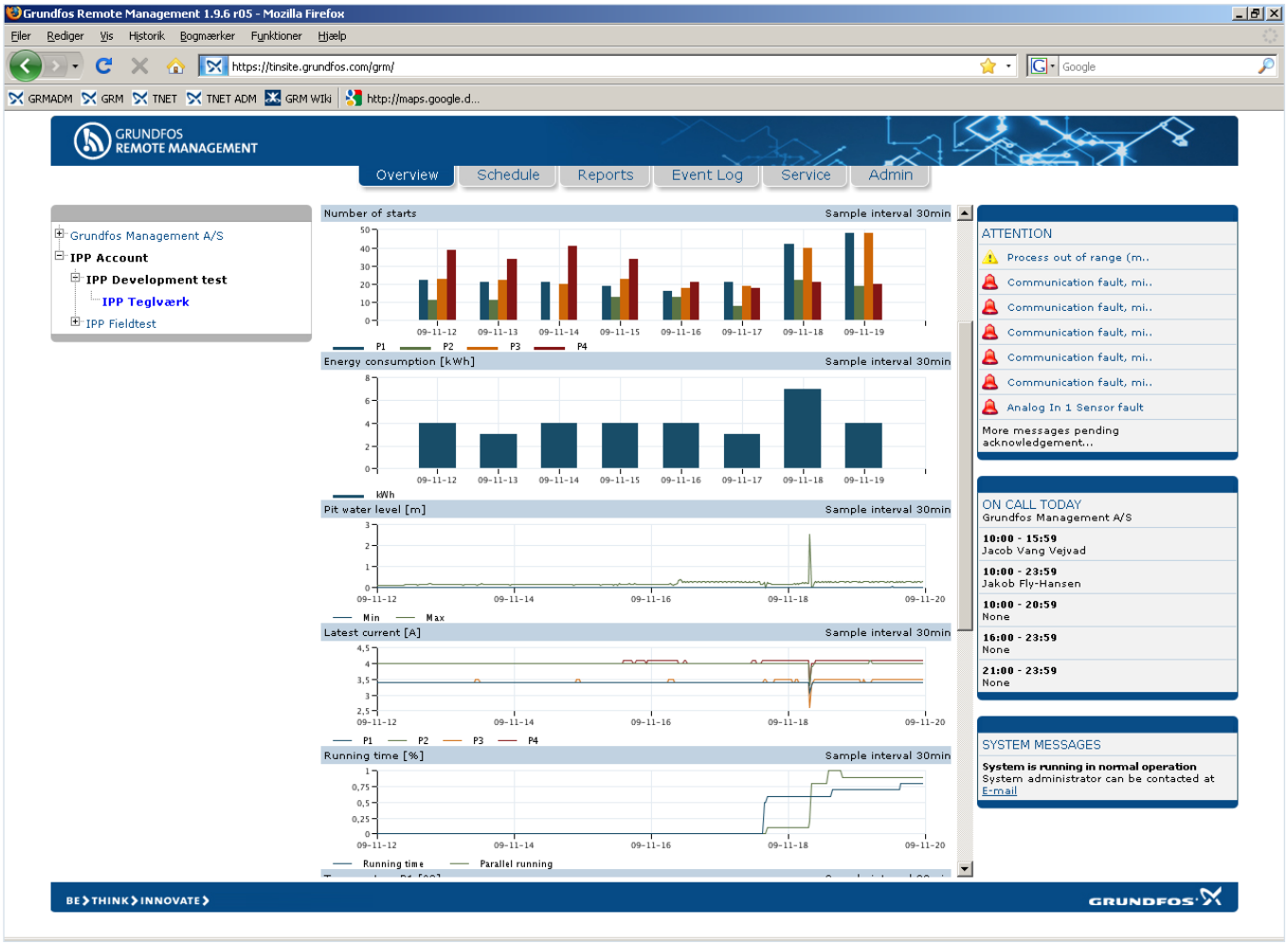
- **Oxygen cones**
  - Coated GRUNDFOS NB Pumps
- **Mechanical filters**
  - GRUNDFOS CRN (316l)
- **Propeller pumps**
  - Coated GRUNDFOS KPL



Online access to real-time data

- Flow
- Volume
- Pressure
- Power, current and voltage supply/consumption
- Energy consumption
- Operations information, alarms

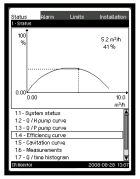
Automatic log and trend of the key performance



CR Monitor

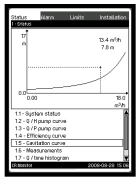

Electrical performance
Motor temperature
Liquid temperature
Inlet pressure
Outlet pressure
Flow
CR Monitor
GRUNDFOS

Features



Efficiency

- Clogging or wear
- Catching or rubbing of rotation parts



Cavitation Prevention

- Assesses the margin to cavitation

Dry-running

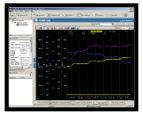
- LiqTec technology

Motor Bearing

- Supervision by turns and bearing temperature

Process Window

- Flow
- Pressure
- Temperature
- Power…

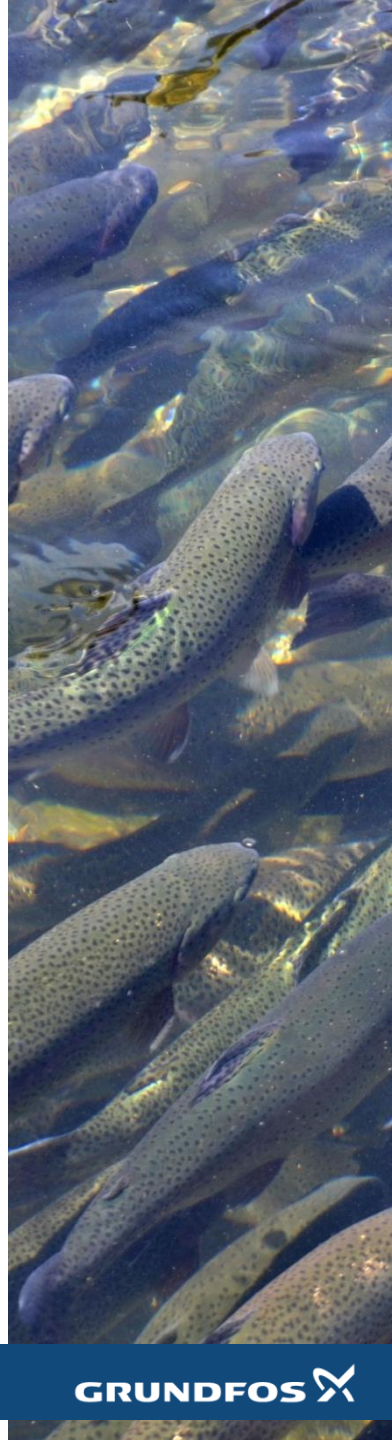


PC Tool E-products

- Advanced logging

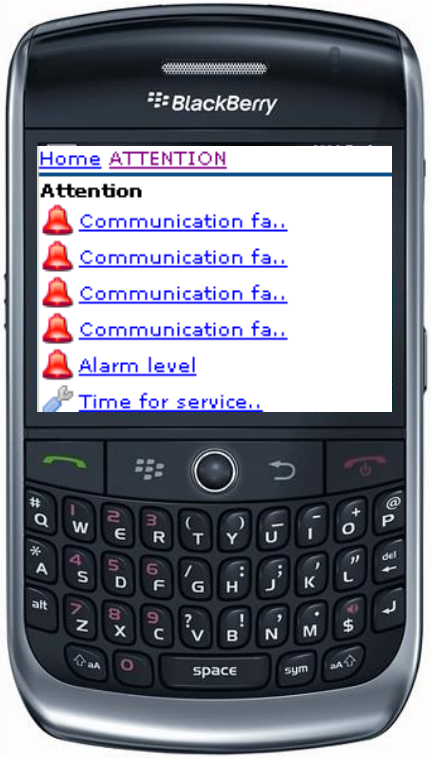
Communication options

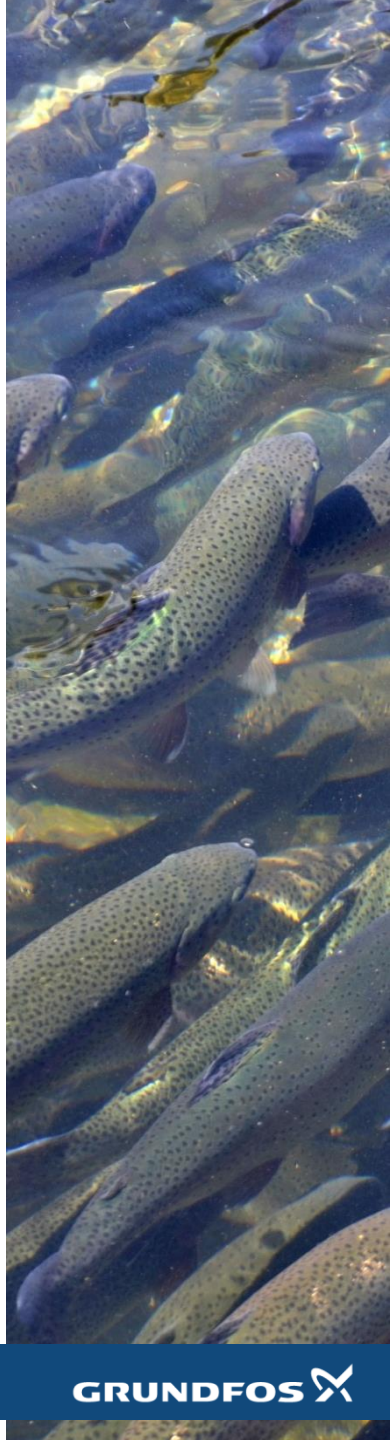
- Ethernet
- Profibus
- GSM
- Modbus



On the run…

Get access to data and perform basic functions such as acknowledge alarms, start/stop pumps, reset controllers from your mobile phone / PDA.






Thank you for your attention