Energy efficiency in RAS
Pump solutions for saltwater RAS
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

Supply from mains

η_M
P_1
M
3~

η_p
P_2
P_H

P (kW)
0 10 20 30 40 50 60 70

P_H
η_p
Efficiency

H [m]
0 10 20 30 40 50 60

h [%]
0 10 20 30 40 50 60 70

Q [m³/h]
0 10 20 30 40 50 60 70

NPSH [m]
0 2 4 6 8 10 12

P (kW)
0 2 4 6 8 10 12
Range overview – by column size

- Small: 500, 600, 700
- Middle: 800, 900, 1000, 1200
- Large: 1400, 1500, 1600, 1800, (2000, 2200)
High hydraulic efficiency

Typical design

Grundfos KPL
Turbulence optimizer

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

Diagram showing the relationship between head height (H in meters) and flow rate (Q in cubic meters per hour). The graph indicates different head heights at varying flow rates, with specific points labeled at 76, 70, and 55 meters for different flow rates. The diagram also shows the percentage of performance, with 100% at one point and 94% at another, likely representing efficiency or power output at these flow rates.
Choose the right pipe dimension

A. "Steep" pipe characteristics
B. "Flat" pipe characteristics
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
19 m : Total Head

11,0 kW
Effects of variable speed

\[ Q_1 \times \left( \frac{n_2}{n_1} \right) = Q_2 \]
\[ 25 \times \left( \frac{1450}{2900} \right) = 12.5 \]

\[ H_1 \times \left( \frac{n_2}{n_1} \right)^2 = H_2 \]
\[ 10 \times \left( \frac{1450}{2900} \right)^2 = 2.5 \]

\[ P_1 \times \left( \frac{n_2}{n_1} \right)^3 = P_2 \]
\[ 1.2 \times \left( \frac{1450}{2900} \right)^3 = 0.15 \]
Pumping saltwater

• QH loss?
• Efficiency loss?
• Cavitation, when?
Pumping saltwater

- Temperature
- Salinity
- Standby periods
Coating: Seawater pumps

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

- The gap 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 monitored in a QC report.
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
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