

**Welcome to KSB.**  
**We Make the World Flow Round.**





# KSB Easy Select ®

## List of contents

### 1) Company presentation

### 2) Step by Step to the Right (Etanorm) Pump incl.

- Pump curve
- $NPSH_{req.}$
- Material selection
- Test standards



## KSB Group and Brand

# About us

KSB is one of the leading suppliers of pumps, valves, system solutions and services.

Our brand stands for quality, excellence, reliability and a global perspective.

- Manufacture of
  - Valves since 1872
  - Pumps since 1873
- Order intake > € 2,100 million
- Employees > 15,500
- KSB is located with production plants, sales offices and agents as well as service centres in more than 100 countries.



Markets

## Our range of products and services

Everything from a single source: pumps and valves, services and system solutions

KSB product program includes - **pumps** like “GZ5” (piston pump, lengths 20 cm) up to intake pump “SEZ” (heights 15 m, max. 79,000 m<sup>3</sup>/h)

- **Valves** like “Boa – series” (DN 15) up to “Mammoth” DN 4000

- Isobaric **Energy recovery system** Saltec N

- **Motors** for (submersible) pumps  
-etc. (...turbine, Pump meter, control systems)

|                        | <br>SEZ,<br>SEZT | <br>PNW,<br>SNW | <br>Omega,<br>RDL/RDLO | <br>HGM-RO | <br>RPH-RO | <br>Multitec-<br>RO | <br>CPKN,<br>Etanorm | <br>Movitec | <br>Amarex<br>KRT |
|------------------------|---------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|
| Seawater Intake pump   |                                                                                                   | (●)                                                                                              | ●                                                                                                       |                                                                                             |                                                                                             |                                                                                                       | ●                                                                                                       |                                                                                                | (●)                                                                                                  |
| Filtered Seawater pump |                                                                                                   |                                                                                                  | ●                                                                                                       |                                                                                             |                                                                                             |                                                                                                       | ●                                                                                                       |                                                                                                |                                                                                                      |
| High-pressure pump     |                                                                                                   |                                                                                                  |                                                                                                         | ●                                                                                           |                                                                                             | ●                                                                                                     |                                                                                                         | ●                                                                                              |                                                                                                      |
| Water transfer pump    |                                                                                                   |                                                                                                  | ●                                                                                                       |                                                                                             |                                                                                             |                                                                                                       | ●                                                                                                       |                                                                                                |                                                                                                      |
| Booster pump           |                                                                                                   |                                                                                                  |                                                                                                         |                                                                                             | ●                                                                                           |                                                                                                       |                                                                                                         |                                                                                                |                                                                                                      |
| Back wash pump         |                                                                                                   |                                                                                                  | ●                                                                                                       |                                                                                             |                                                                                             |                                                                                                       | ●                                                                                                       |                                                                                                |                                                                                                      |
| Cleaning in place pump |                                                                                                   |                                                                                                  | ●                                                                                                       |                                                                                             |                                                                                             |                                                                                                       | ●                                                                                                       |                                                                                                |                                                                                                      |
| Waste water pump       |                                                                                                   |                                                                                                  |                                                                                                         |                                                                                             |                                                                                             |                                                                                                       | ●                                                                                                       |                                                                                                | ●                                                                                                    |
| Town water pump        |                                                                                                   |                                                                                                  | ●                                                                                                       |                                                                                             |                                                                                             |                                                                                                       | ●                                                                                                       |                                                                                                |                                                                                                      |
| Performance Range      |                                                                                                   |                                                                                                  |                                                                                                         |                                                                                             |                                                                                             |                                                                                                       |                                                                                                         |                                                                                                |                                                                                                      |
| Capacity up to [m³/h]  | 79,000                                                                                            | 9,000                                                                                            | 10,000                                                                                                  | 1,150                                                                                       | 1,500                                                                                       | 850                                                                                                   | 21,600                                                                                                  | 75                                                                                             | 10,000                                                                                               |
| Head up to [m]         | 50 / 100                                                                                          | 50                                                                                               | 240                                                                                                     | 950                                                                                         | 285                                                                                         | 630                                                                                                   | 185                                                                                                     | 249                                                                                            | 100                                                                                                  |

## Pumps for Water and RO - application



IEC-compliant synchronous reluctance motor. efficiency class IE4

|                                |                                                                                   |                                                                                     |                                                                                     |
|--------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|                                |  |  |  |
| <b>Application</b>             | <b>ISORIA<br/>MAMMOUTH</b>                                                        | <b>DANAIS</b>                                                                       | <b>Check Valve<br/>Series 2000</b>                                                  |
| <b>Seawater Supply</b>         | x                                                                                 |                                                                                     | x                                                                                   |
| <b>Brine Recirculation</b>     | x                                                                                 |                                                                                     | x                                                                                   |
| <b>Brine Blowdown</b>          | x                                                                                 |                                                                                     | x                                                                                   |
| <b>Seawater Recirculation</b>  | x                                                                                 |                                                                                     | x                                                                                   |
| <b>Distillate Extraction</b>   | x                                                                                 |                                                                                     | x                                                                                   |
| <b>Brine Heater Condensate</b> |                                                                                   | x                                                                                   | x                                                                                   |
| <b>Town Water Transfer</b>     | x                                                                                 |                                                                                     | x                                                                                   |
| <b>Performance Range</b>       |                                                                                   |                                                                                     |                                                                                     |
| <b>Nom. Diameter [mm]</b>      | <b>40 - 4000</b>                                                                  | <b>50 - 600</b>                                                                     | <b>50 - 800</b>                                                                     |
| <b>Rated Pressure [bar]</b>    | <b>10.16.20.25</b>                                                                | <b>20.25.50</b>                                                                     | <b>10 to 100</b>                                                                    |

## Valves for Water and RO - application

### Actuators:

- Manual
- Electrical
- Pneumatical
- ...  
driven



# KSB Easy Select ®

## List of contents

1) Company presentation

**2) Step by Step to the Right (Etanorm) Pump**  
incl.

- Pump curve
- $NPSH_{req.}$
- Material selection
- Test standards

# KSB Easy Select ® Software – made by KSB

The screenshot shows the KSB EasySelect software interface. At the top, the KSB logo is on the left, followed by the text 'KSB EasySelect® Version 5.5b'. To the right of this is a user profile section for 'Marcel Kemper (KEMPMAR)' with a 'Go' button. Further right is a navigation bar with tabs: 'Administration', 'Selection', 'Configuration', 'Price sheet', 'Output', and 'Cancel'. A red double-headed arrow points between the 'Selection' and 'Output' tabs. On the right side of the navigation bar, there are fields for 'Units of quantity' and 'Contact', a language dropdown set to 'English', and a 'Cancel' button. A red box with the number '1' points to the 'Cancel' button. Below the navigation bar, a large blue key with a white valve symbol is highlighted. A red box with the number '2' points to this key. To the right of the key, a red box with the number '3' points to the 'Go' button in the user profile section. On the left side of the interface, a 'Welcome to KSB EasySelect' dialog box is open. It contains the text: 'KSB EasySelect is the portal to the world of KSB's configured products. With this software you can select KSB's pumps, valves and automation products and configure them to meet the exact requirements.' Below this, it asks 'How do you want to start using KSB EasySelect?' with a dropdown menu set to 'Step by step to the right pump' and a 'Go' button. At the bottom of the dialog box, there is a checkbox labeled 'Skip this page and start with Administration in the future' which is checked. At the bottom of the software window, there is a dark green footer bar with links: 'Guided tour', 'Help', 'Change user settings', 'Disclaimer', and 'Quit KSB EasySelect'.

1) Change dimension units.

2) Choose how to start here. Click „Go“ to start your product selection

3) The **navigation bar** is available during the entire KSB Easy Selection ® session.

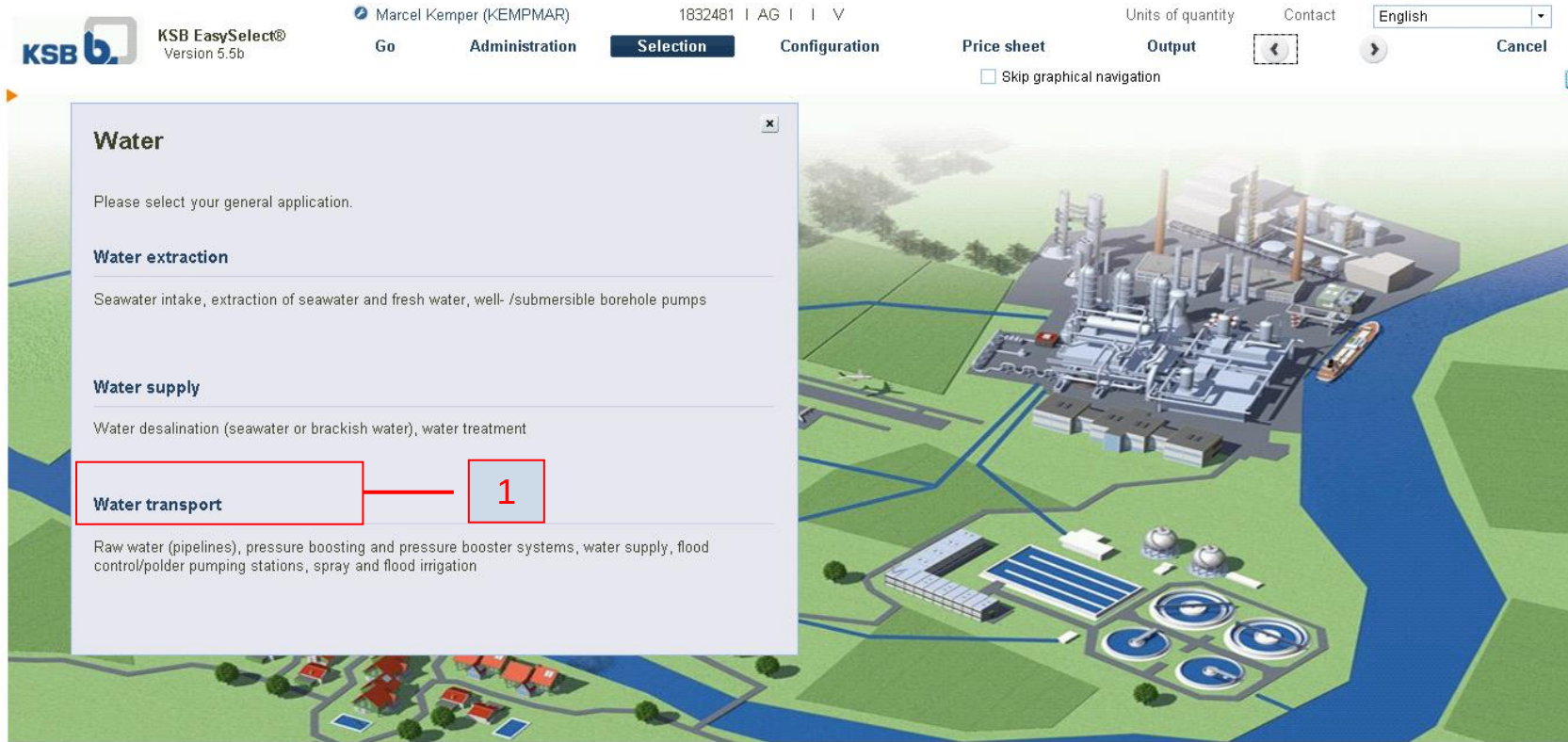
# Easy Select ® Software – made by KSB



## Graphic Selection of „Segment“

1) Select the segment by clicking on its button (e.g. Water)

# Easy Select ® Software – made by KSB



## Graphic Selection of general application

1) Select the general application

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## Graphic Selection of specific application

1) Select the specific application by clicking the button (e.g. „Water distribution“)

# Easy Select ® Software – made by KSB

File Shopping carts Administration SAP maintain Help...

Marcel Kemper (KEMPMAR) 1832481 | AG | | V Units of quantity Contact English

Go Administration Selection Configuration Price sheet Output Cancel

Product selection

Technical design Options Customer item

Application

Segment ☒ Water supply \*

General Application ☒ Water transport \*

Application ☒ Water distribution \*

Medium

Water, Clean water

Operating temperature 20.0 °C \*

Duty point

Flow Q 250.00 m³/h \*

Head H 50.00 m \*

Operating conditions

Static head Hstatic 0.00 m

NPSH available m

Maximum inlet pressure 0.00 bar.g

☐ Accept ByPass

Design

System design ☒ Single system 1 x 100 %

Preferred impeller type ☒ Any

Construction method

☐ Baseplate pump ☐ Close-coupled pump

☐ Split case pump ☐ Multistage pump

Product

☒ Omega / RDLO

☒ Etanorm/Etabloc

☒ Multitec

Hydraulic search

Omega RDLO

Max. disch. press.: 25.00 bar.g

Qmax: 10000.00 m³/h

Qmin: 50.00 m³/h

Max. head: 240.00 m

Min. temperature: 0.0 °C

Max. temperature: 70.0 °C

Omega

Avially enlit single-stage volute casing pump for horizontal or vertical installation with double-entry radial impeller

Operating parameters: Please enter the duty point. Click on "Next" to continue.

## Product selection

1) Products are preselected

2) Graphical selection

3) Input the **operating point** here. There are various tools to assist the input (e.g. **pipe calculator**)

4) System design

5) Click „i“ icon for more **product information**. Add. information available by internet link.

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KSB EasySelect® Version 5.5a Go Administration Selection Configuration Output

Pipe calculator

Pipe Calculator Suction line Discharge line Deactivate pipe calculator

Installation plan

Pipe element

Valve

Transfer to operating point

ANONYMOUS

Specific type: Cast globe valve

Nominal Size: DN 100

Quantity: 1

Description: Valves, cast

True diameter: 100.0 mm

Loss k coefficient: 3.00000

Inlet line

| St. | Type            | DN     | Dia.     | Roughn | Length | Quant. | Velocity | Head loss |
|-----|-----------------|--------|----------|--------|--------|--------|----------|-----------|
| 1   | Inlet condition | DN 150 |          |        |        | 1      | 0.0 m/s  | 3.00 m    |
| 2   | Pipe            | DN 150 | 160.3 mm | 75 µm  | 5.00 m | 1      | 3.4 m/s  | 0.33 m    |

Discharge line

| St. | Type  | DN     | Dia.     | Roughn | Length | Quant. | Velocity | Head loss |
|-----|-------|--------|----------|--------|--------|--------|----------|-----------|
| 1   | Valve | DN 100 | 100.0 mm |        |        | 1      | 8.8 m/s  | 11.96 m   |
| 2   | Elbow | DN 100 | 100.0 mm |        |        | 1      | 8.8 m/s  | 1.99 m    |

## Pipe calculator

1) Inlet side

2) Discharge side

3) Type specification:

- Open system
- Closed system
- Closed loop
- Submersible pumps

4) Inlet fields incl. fitting materials

5) Results of loss calculation

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KSB b KSB EasySelect® Version 5.5b Go Administration Selection Configuration Price sheet Output

Product selection

Technical design Options Customer item

Application

Segment ☒ Water supply \*

General Application ☒ Water transport \*

Application ☒ Water distribution \*

Medium

Water, Clean water

Operating temperature 20.0 °C \*

Duty point

Flow Q 250.00 m³/h \*

Head H 50.00 m \*

Operating conditions

Static head Hstatic 0.00 m

NPSH available m

Maximum inlet pressure 0.00 bar.g

☐ Accept ByPass

Design

System design ☒ Single system 1 x 100 %

Preferred impeller type ☒ Any

Construction method

☐ Baseplate pump ☐ Close-coupled pump

☐ Split case pump ☐ Multistage pump

Product

Hydraulic search

☒ Omega / RDLO

☒ Etanorm/Etabloc

☒ Multitec

Omega RDLO

Max. disch. press.: 25.00 bar.g

Qmax: 10000.00 m³/h

Qmin: 50.00 m³/h

Max. head: 240.00 m

Min. temperature: 0.0 °C

Max. temperature: 70.0 °C

Omega

Axially split single-stage volute casing pump for horizontal or vertical installation with double-entry radial impeller

Operating parameters: Please enter the duty point. Click on "Next" to continue.

## Product selection

1) Products are preselected

2) Graphical selection

3) Input the **operating point** here. There are various tools to assist the input (e.g. **pipe calculator**)

4) System design

5) Click „i“ icon for more **product information**. Add. information available by internet link.

# Easy Select ® Software – made by KSB

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Go Administration Selection Configuration Price sheet Output

Product selection

Technical design Options Customer item

Specialities

Shaft seal ☒ Any

Flange design ☒ Any

Connection type ☒ Any

Nominal pressure ☒ Any

Shaft axis position ☒ Any

Construction method ☒ Any

Min. free passage ☒ Any

General material group ☒ Any

Speed control General requirements

Driver speed selection ☒ Only synchronous speeds

Pump speed adjustment via ☒ None

Mains voltage ☒ Any

Mains frequency ☒ 60 Hz

Construction method

Baseplate pump ☐ Close-coupled pump ☐

Split case pump ☐ Multistage pump ☐

Hydraulic search

| Product                                             |  |
|-----------------------------------------------------|--|
| <input checked="" type="checkbox"/> Omega / RDLO    |  |
| <input checked="" type="checkbox"/> Etanorm/Etabloc |  |
| <input checked="" type="checkbox"/> Multitec        |  |
| <input checked="" type="checkbox"/> Movitec         |  |

Omega RDLO

Max. disch. press.: 25.00 bar.g

Qmax: 10000.00 m³/h

Qmin: 50.00 m³/h

Max. head: 240.00 m

Min. temperature: 0.0 °C

Max. temperature: 70.0 °C

Omega

Δiallyly enlit single-stage volute casing pump for horizontal or vertical installation with double-entry radial impeller

## Motor specification

1) Click on Options

2) **Select 60 Hz mains frequency**

3) Click „hydraulic search“ for find the appropriate **KSB solution**

NOTE: Select 60 HZ

# Easy Select ® Software – made by KSB

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Administration Selection **Configuration** Output Cancel

Solutions

KSB recommendation Alternatives **Performance curves**

Sort by: KSB recommendation then **Select**

|   | Product line      | Pump size | Select                              | Efficiency | Absorbed power | Speed    | Free passage | NPSH required | Max. power for curve | Ratio Q / Q <sub>bep</sub> | Effective hydraulic diameter | Full impeller diameter |
|---|-------------------|-----------|-------------------------------------|------------|----------------|----------|--------------|---------------|----------------------|----------------------------|------------------------------|------------------------|
| 1 | Etanorm / Etabloc | 065-200   | <input checked="" type="checkbox"/> | 78.31 %    | 21.71 kW       | 2922 rpm | 16 mm        | 4.61 m        | 23.48 kW             | 111.01 %                   | 207 mm                       | 219.0 mm               |
| 2 | Etanorm / Etabloc | 080-200   | <input type="checkbox"/>            | 75.90 %    | 22.38 kW       | 2924 rpm | 20 mm        | 4.77 m        | 30.37 kW             | 70.39 %                    | 196 mm                       | 219.0 mm               |
| 3 | Etanorm / Etabloc | 080-400   | <input type="checkbox"/>            | 71.48 %    | 23.77 kW       | 1460 rpm | 13 mm        | 2.15 m        | 29.50 kW             | 90.31 %                    | 397 mm                       | 404.0 mm               |
| 4 | Etanorm / Etabloc | 100-400   | <input type="checkbox"/>            | 72.07 %    | 23.54 kW       | 1460 rpm | 17 mm        | 1.74 m        | 34.87 kW             | 70.91 %                    | 388 mm                       | 404.0 mm               |

Product information **Performance curves** Hydraulic data

 Etabloc family  Etanorm family **2**

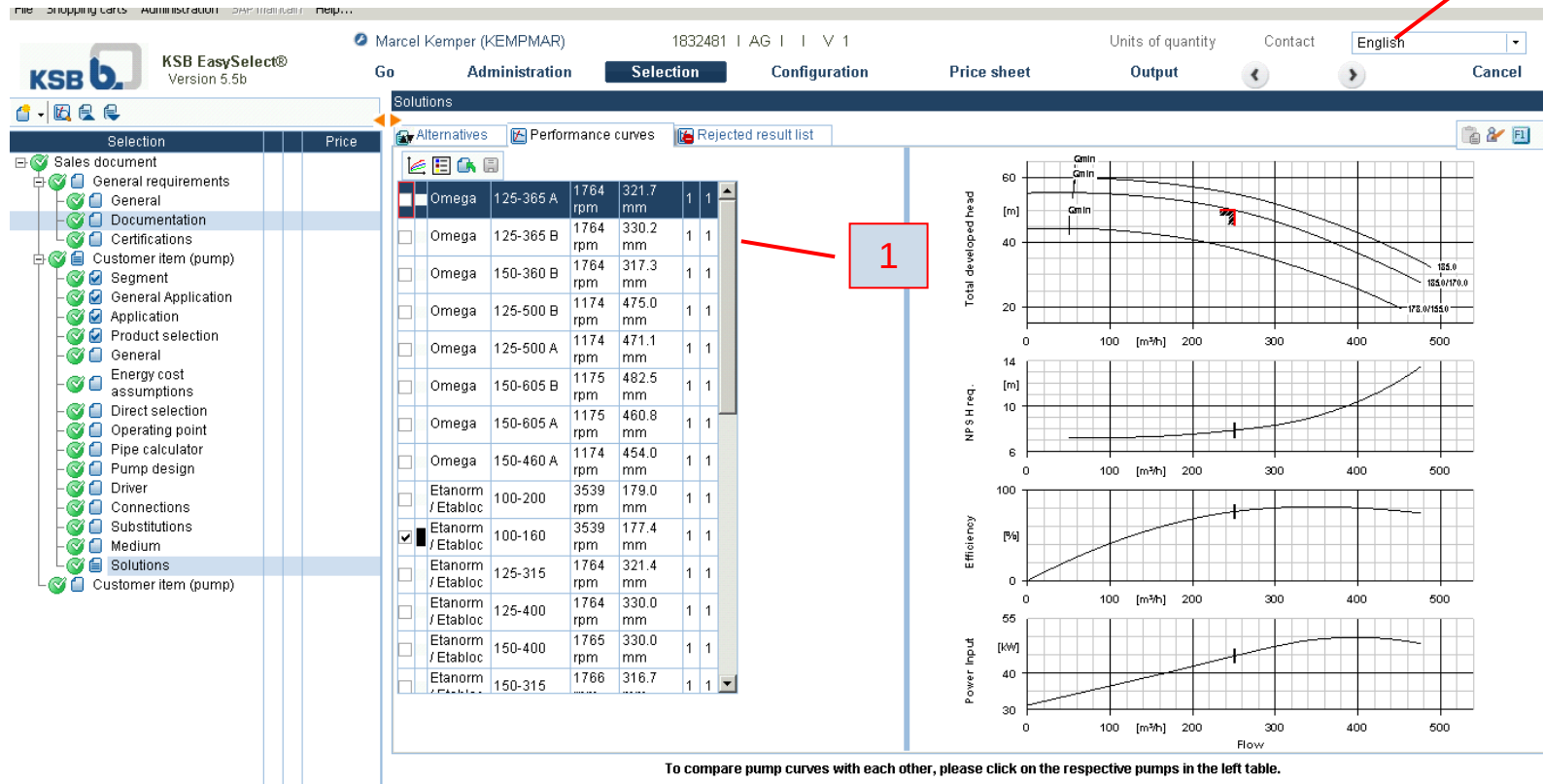
Max. disch. press.: 16.00 bar.g

## Selection result

- 1) Sort pumps by your requirement.
- 2) Take a view to the pump curves

Here you see other pumps which are also suitable for the operating conditions you have selected. Double-clicking allows the selection of a pump from the list.

# Easy Select ® Software – made by KSB



## Selection result

1) Compare pump curves together on one diagram on the „Performance curves“ tab.

2) Continue configuration of selected solution

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KSB EasySelect® Version 5.5b

Go Administration Selection **Configuration** Price sheet Output

Hydraulic performance

Summary Details Diagram Speed performance charts

Variant KSB basic design Selected size 100-160

Result  
Hydraulic calculation OK.

Recommended

Requested operating point

|                        |                        |            |
|------------------------|------------------------|------------|
| Load point description | Static head Hstatic    | 0.00 m     |
| Operating temperature  | Maximum inlet pressure | 0.00 bar.g |
| NPSH available         | Minimum inlet pressure |            |
| Start up pressure pE   | Stop pressure pA       |            |
| Flow rate              | Mass flow rate         |            |
| Discharge head         | Differential pressure  |            |
|                        | Discharge pressure     |            |

Resulting operating point

|                               |                      |                            |                                     |
|-------------------------------|----------------------|----------------------------|-------------------------------------|
| Speed                         | 3565 rpm             | Point no. 1                |                                     |
| Flow rate                     | 249.96 m³/h          | Mass flow rate             | 69.29 kg/s                          |
| Discharge head                | 49.98 m              | Discharge pressure         | 4.89 bar.g                          |
| Shutoff head                  | 55.27 m              | Shutoff pressure           | 5.41 bar.g                          |
| Min. allow. flow rate         | 54.96 m³/h           | Min. allow. mass flow      | 15.24 kg/s                          |
| Max. allowable flow rate      | 478.27 m³/h          | Max. allow. mass flow      | 132.59 kg/s                         |
| Efficiency                    | 75.6 %               | Sound pressure level       |                                     |
| Absorbed power                | 44.90 kW             | Temperature                | 20.0 °C                             |
| Max. power for curve          | 49.54 kW             | Density                    | 998 kg/m³                           |
| NPSH required                 | 7.98 m               | Viscosity                  | 1.00 mm²/s                          |
|                               |                      | Vapour pressure            | 0.02 bar.a                          |
| Inlet pressure                | 0.00 bar.g           | Ratio Q / Qbep             | 70.7 %                              |
| Viscosity factor CQ / CH / CE | 1.0000 1.0000 1.0000 | Definitive operating point | <input checked="" type="checkbox"/> |

Selection Price

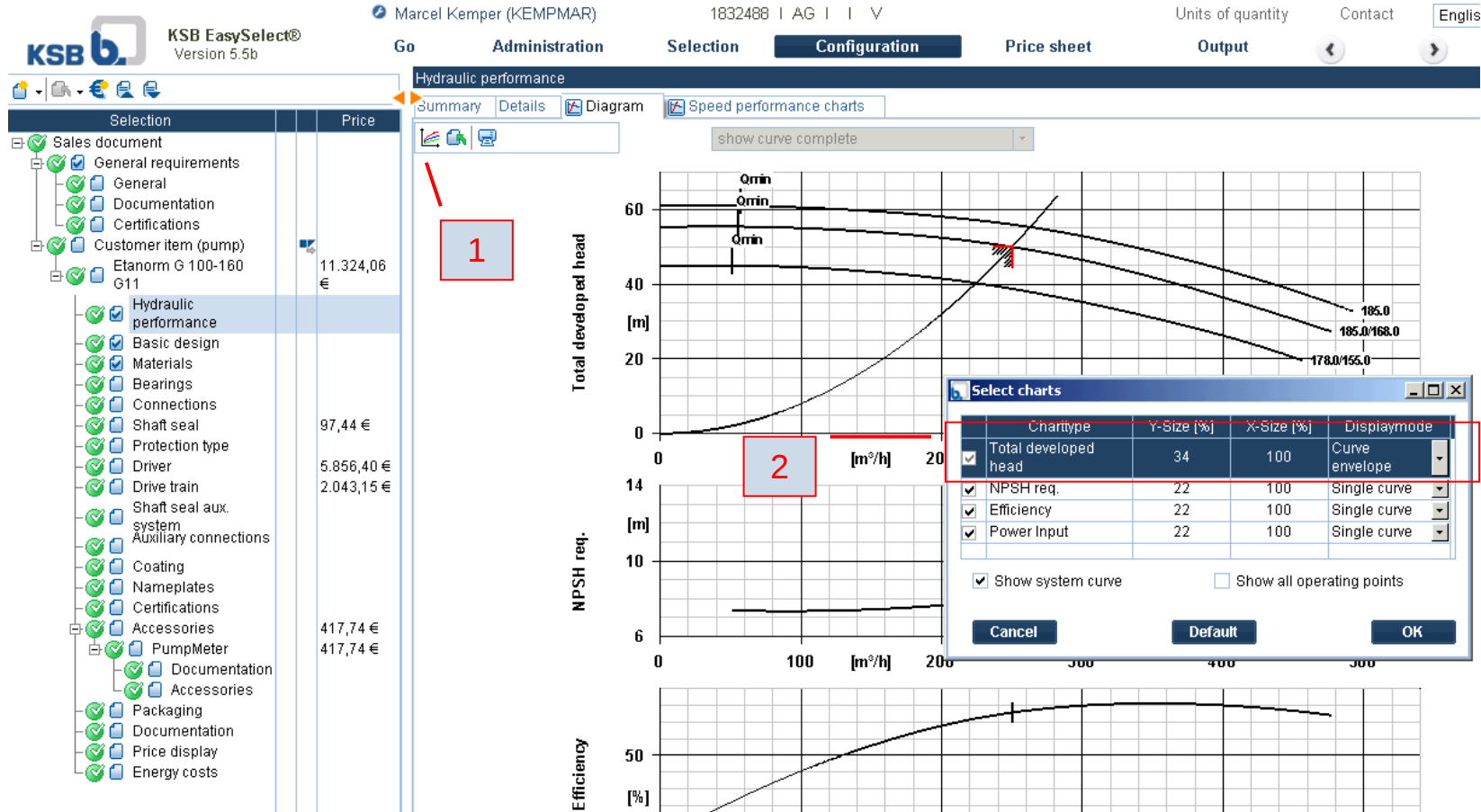
|                        |             |
|------------------------|-------------|
| Sales document         |             |
| General requirements   |             |
| General                |             |
| Documentation          |             |
| Certifications         |             |
| Customer item (pump)   |             |
| Etanorm G 100-160 G11  | 11.324,08 € |
| Hydraulic performance  |             |
| Basic design           |             |
| Materials              |             |
| Bearings               |             |
| Connections            |             |
| Shaft seal             | 97,44 €     |
| Protection type        |             |
| Driver                 | 5.856,40 €  |
| Drive train            | 2.043,15 €  |
| Shaft seal aux. system |             |
| Auxiliary connections  |             |
| Coating                |             |
| Nameplates             |             |
| Certifications         |             |
| Accessories            | 417,74 €    |
| PumpMeter              | 417,74 €    |
| Documentation          |             |
| Accessories            |             |
| Packaging              |             |
| Documentation          |             |
| Price display          |             |
| Energy costs           |             |

## Overview selected pump

1) Overview of selected pump

2) Tool bar to select pump curve design

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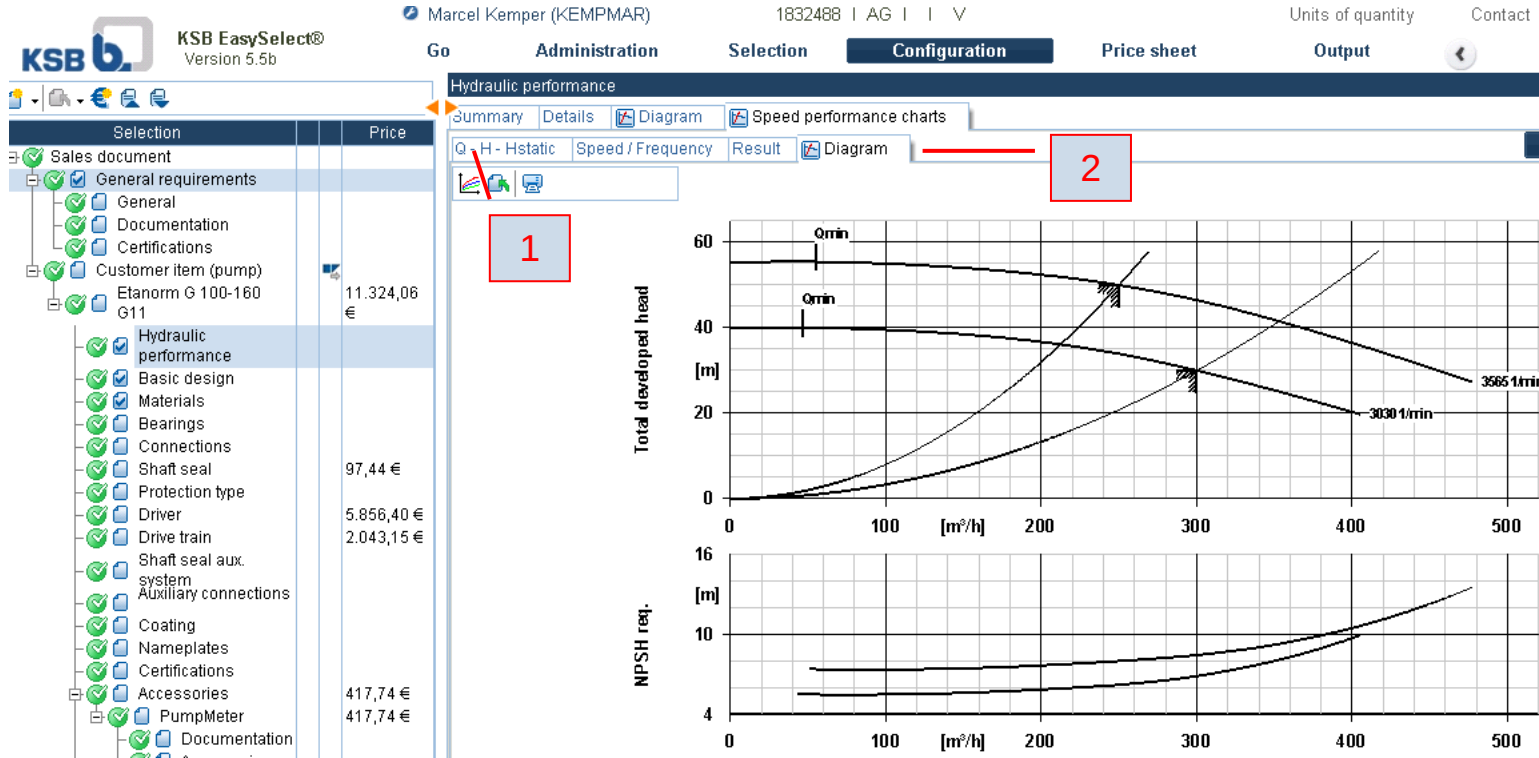


## Selection of curve design

1) Click „curve symbol“

2) „Select „Single curve“ and / or system curve as requested“

# Easy Select ® Software – made by KSB



**Selection of add.  
Operating points  
(vfd - driven)**

1) Add editorial  
operating points

2) Take a look vfd  
driven curves

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KSB EasySelect® Version 5.5b

Go Administration Selection **Configuration** Price sheet Output

Hydraulic performance

Summary Details Diagram Speed performance charts

Variant ☒ KSB basic design Selected size 100-160

Result ☒ Hydraulic calculation OK. Recommendation

Requested operating point

|                               |                                   |
|-------------------------------|-----------------------------------|
| Load point description        | Static head Hstatic 0.00 m        |
| Operating temperature 20.0 °C | Maximum inlet pressure 0.00 bar.g |
| NPSH available                | Minimum inlet pressure            |
| Start up pressure pE          | Stop pressure pA                  |
| Flow rate 250.00 m³/h         | Mass flow rate                    |
| Discharge head 50.00 m        | Differential pressure             |
|                               | Discharge pressure                |

Resulting operating point

|                                                    |                                   |
|----------------------------------------------------|-----------------------------------|
| Speed 3565 rpm                                     | Point no. 1                       |
| Flow rate 249.96 m³/h                              | Mass flow rate 69.29 kg/s         |
| Discharge head 49.98 m                             | Discharge pressure 4.89 bar.g     |
| Shutoff head 55.27 m                               | Shutoff pressure 5.41 bar.g       |
| Min. allow. flow rate 54.96 m³/h                   | Min. allow. mass flow 15.24 kg/s  |
| Max. allowable flow rate 478.27 m³/h               | Max. allow. mass flow 132.59 kg/s |
| Efficiency 75.6 %                                  | Sound pressure level              |
| Absorbed power 44.90 kW                            | Temperature 20.0 °C               |
| Max. power for curve 49.54 kW                      | Density 998 kg/m³                 |
| NPSH required 7.98 m                               | Viscosity 1.00 mm²/s              |
| Inlet pressure 0.00 bar.g                          | Vapour pressure 0.02 bar.a        |
| Viscosity factor CQ / CH / CE 1.0000 1.0000 1.0000 | Ratio Q / Qbep 70.7 %             |

☒ Definitive operating point

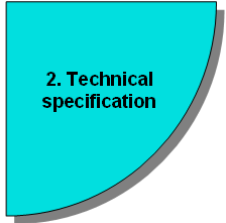
Selection Price

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <ul style="list-style-type: none"> <li>✓ Sales document</li> <li> <ul style="list-style-type: none"> <li>✓ General requirements</li> <li>✓ General</li> <li>✓ Documentation</li> <li>✓ Certifications</li> </ul> </li> <li>✓ Customer item (pump) Etanorm G 100-160 G11 11.324,08 €</li> <li> <ul style="list-style-type: none"> <li>✓ Hydraulic performance</li> <li>✓ Basic design</li> <li>✓ Materials</li> <li>✓ Bearings</li> <li>✓ Connections</li> <li>✓ Shaft seal 97,44 €</li> <li>✓ Protection type</li> <li>✓ Driver 5.856,40 €</li> <li>✓ Drive train 2.043,15 €</li> <li>✓ Shaft seal aux. system</li> <li>✓ Auxiliary connections</li> <li>✓ Coating</li> <li>✓ Nameplates</li> <li>✓ Certifications</li> <li>✓ Accessories 417,74 €</li> <li> <ul style="list-style-type: none"> <li>✓ PumpMeter 417,74 €</li> <li> <ul style="list-style-type: none"> <li>✓ Documentation</li> <li>✓ Accessories</li> </ul> </li> <li>✓ Packaging</li> <li>✓ Documentation</li> <li>✓ Price display</li> <li>✓ Energy costs</li> </ul> </li> </ul> </li></ul> |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|

## Overview selected pump

1) NPSH required has to be considered

# Easy Select ® Software – made by KSB



## ⇒ Cavitation

- disruption of flow and head
- noise emission increase
- vibration increase
- damage of impeller
- interruption to lubricate (medium lubricated) bearings
- malfunction of axial thrust balancing

### NPSH – Net positive suction head

- NPSH is (beside operation flow, - head and required power) one of the most important operating data.

NPSH is related to cavitation

### NPSH definition

- NPSH<sub>available</sub> = given NPSH by the design of the system

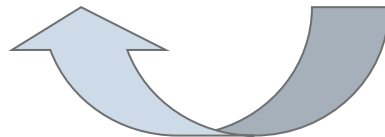
- NPSH<sub>required</sub> = NPSH, given by the design of the pump

1) **NPSH<sub>available</sub> > NPSH<sub>required</sub>**

to guarantee the pump operation reliability (= to guarantee that the pumps don't run into cavitation)

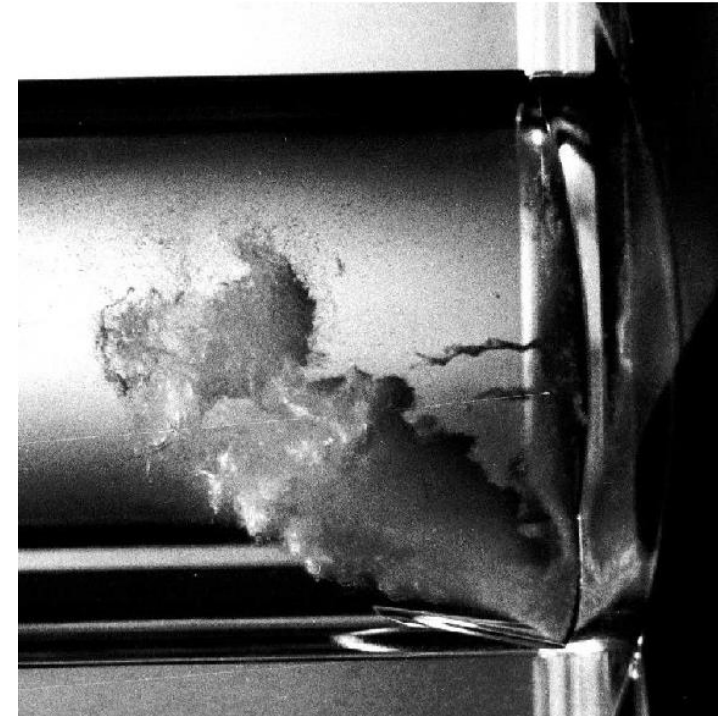
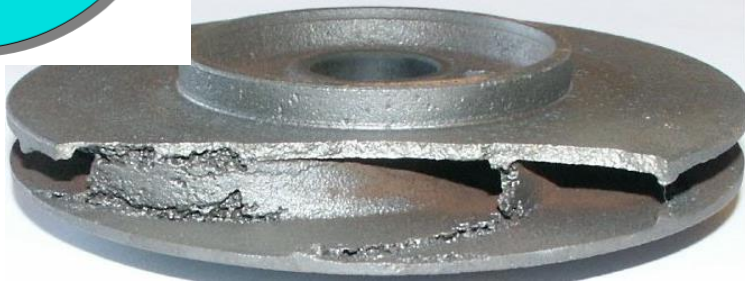
**e.g:**

What happen in case of a situation where NPSH<sub>available</sub> = 3m and NPSH<sub>required</sub> = 4 m



# Cavitation

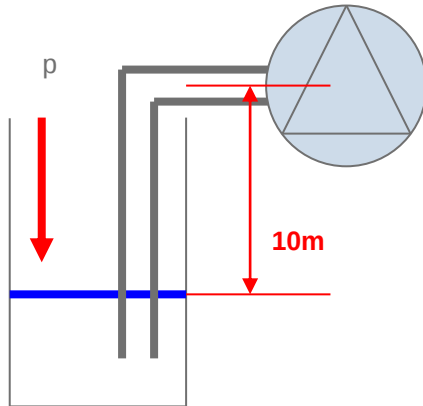
-gas/vapour bubble (depending to pressure and temperature) and implode on surfaces (micro – jet up to  $10^5$  bar).



# Easy Select ® Software – made by KSB

## 2. Technical specification

Theorie



NPSH<sub>available</sub> depends on

### General definition

#### NPSH – Net positive suction head

In theorie would it be possible that a pump suck fluids up to 10 m ( $H_{geo} = 10\text{m}$ ).

- In reality it is not possible. Reasons:

**Vapour pressure ( $p_D$ ):** Required pressure to vaporize a fluid. The vapour pressure depends to the fluid temperature.

- **Flow loss ( $H_{vs}$ ):** losses of all installed parts like pipe and valves, losses to speed up the fluid, fluid friction related to pipe surface, losses depends on direction changes

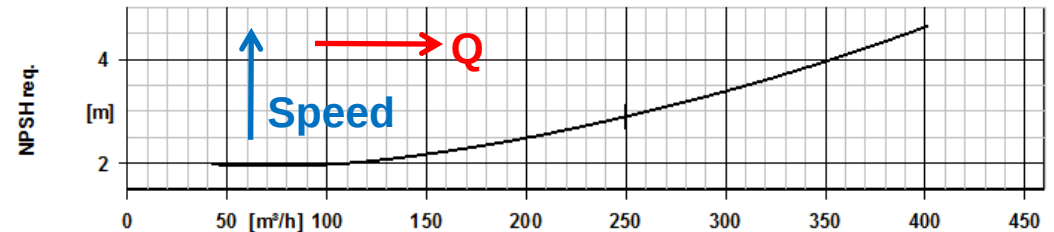
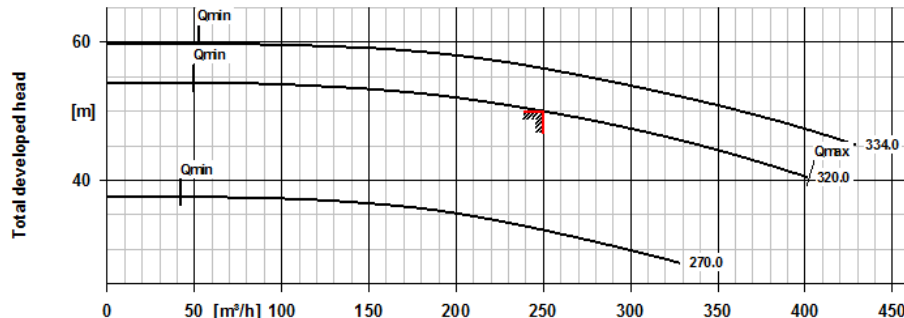
- **Static pressure ( $p'$ ) = path +  $p_L$**

1) – open tank ->  $p'$ : available pressure is the atmospheric pressure only

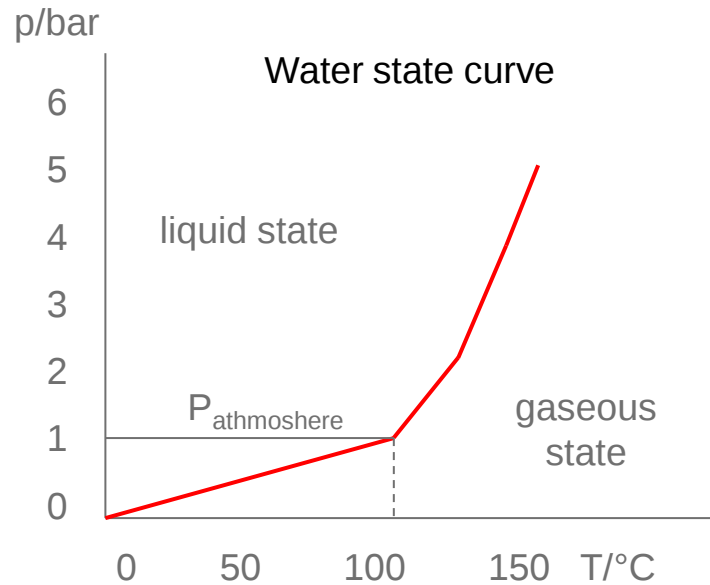
2) – closed tank: ->  $p' = \text{path. (inside the tank)} + p_L$  // „+“ (high pressure) or „-“ (low pressure / vakuum).

**Atmospheric pressure path:** Depends on altitude on site ( if altitude on site increase -> lower atmospheric pressure).

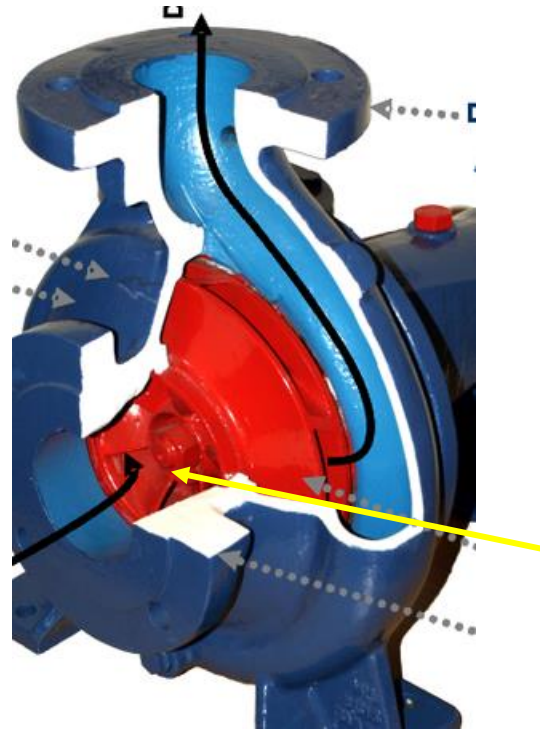
**NPSH<sub>req</sub>:** Depends on pump design, increase with flow and rotation. **NPSH<sub>req</sub>** has to be 0,5 m (min.) lower as NPSH<sub>available</sub>.



## 2. Technical specification



**NPSH<sub>req</sub>**



To guarantee the reliability of pump operation it is necessary to avoid gas/vapour bubbles (cavitation).

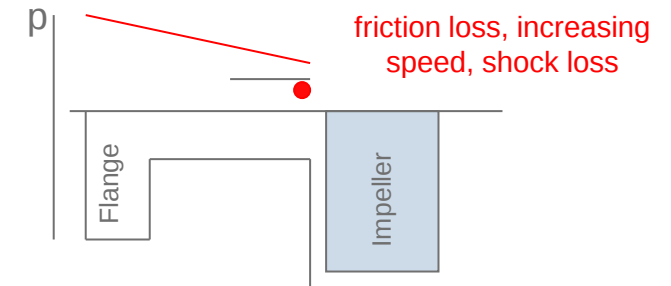
**NPSH<sub>available</sub> > NPSH<sub>required</sub>**

**What happens inside the pump?**

**P<sub>available</sub> "inside pump" > P<sub>vapour</sub> required**

⇒ the pressure has to be higher as the vapour pressure (related to the temperature) as in the pump area with the lowest pressure

- „in rule“ it's the impeller entry edge





# KSB Easy Select ®

## List of contents

1) Company presentation

2) Step by Step to the Right (Etanorm) Pump  
incl.

- Pump curve
- $NPSH_{req.}$
- **Material selection**
- Test standards

# Easy Select ® Software – made by KSB

**KSB EasySelect®**  
Version 5.5b

Go Administration Selection **Configuration** Price sheet Output

**Materials**

Selection ☒ Materials table 2

Selection Price

☒ Sales document

☒ General requirements

☒ General

☒ Documentation

☒ Certifications

☒ Customer item (pump)

☒ Etanorm G 100-160 G11 11.324,06 €

☒ Hydraulic performance

☒ Basic design

☒ Materials 97,44 €

☒ Bearings

☒ Connections

☒ Shaft seal

☒ Protection type

☒ Driver 5.856,40 €

☒ Drive train 2.043,15 €

☒ Shaft seal aux. system

☒ Auxiliary connections

☒ Coating

☒ Nameplates

☒ Certifications

☒ Accessories 417,74 €

☒ PumpMeter 417,74 €

☒ Documentation

☒ Accessories

☒ Packaging

☒ Documentation

☒ Price display

☒ Energy costs

**Materials table**

Variant ☒ KSB basic design

**Material execution**

Material code ☒ G 1

Execution acc. to regulation Standard

Selected material code suitable for temp. from ☒ 0.0 °C to ☒ 60.0 °C

**Wear ring, impeller wear ring**

Wear ring placement ☒ Casing wear ring

Wear ring type ☒ Standard design

Wear ring material ☒ Cast iron/Cast iron

**Shaft**

Shaft ☒ Steel/Tempered steel E335/C45

Shaft sleeve material ☒ Stainless steel 1.4571

**Impeller**

Impeller material ☒ Grey cast iron JL 1040

Impeller attachment material ☒ Steel 8

**Bearings**

Brg. bracket/lantern material ☒ Grey cast iron JL 1040

Plain bearing materials (bush) ☒ Without

**Other**

Gasket ☒ DPAF Sealing plate asbestos-free

**Operator notes**

general criteria for a water analysis: pH-value >= 7; chloride content (Cl) <=250 mg/kg.  
chlorine (Cl2) <=0.6 mg/kg.

## Material selection

1) Click „Material code“ to select material requirement

2) Material overview see register „Material table“

# Easy Select ® Software – made by KSB

Selection Materials table

|                                     | Se                                  | No. |   | Part                    | Mat.ID | Material                         | T min    | T max    |
|-------------------------------------|-------------------------------------|-----|---|-------------------------|--------|----------------------------------|----------|----------|
| <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | 102 |   | Volute casing           | 1821   | Grey cast iron JL 1040           | 0.0 °C   | 60.0 °C  |
| <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | 163 |   | Discharge cover         | 1821   | Grey cast iron JL 1040           | 0.0 °C   | 60.0 °C  |
| <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | 210 |   | Shaft                   | 7550   | Steel/Tempered steel E335/C45    | -30.0 °C | 140.0 °C |
| <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | 230 |   | Impeller                | 1821   | Grey cast iron JL 1040           | 0.0 °C   | 60.0 °C  |
| <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | 330 |   | Bearing bracket         | 1821   | Grey cast iron JL 1040           | 0.0 °C   | 60.0 °C  |
| <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | 411 |   | Joint ring              | 7798   | DPAF Sealing plate asbestos-free | -30.0 °C | 140.0 °C |
| <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | 502 | 1 | Casing wear ring        | 1800   | Grey cast iron GG/CAST IRON      | 0.0 °C   | 60.0 °C  |
| <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | 502 | 2 | Casing wear ring        | 1800   | Grey cast iron GG/CAST IRON      | 0.0 °C   | 60.0 °C  |
| <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | 523 |   | Shaft sleeve            | 1300   | Stainless steel 1.4571           | 0.0 °C   | 140.0 °C |
| <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | 902 |   | Stud                    | 0210   | Steel 8.8                        | -30.0 °C | 140.0 °C |
| <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | 903 |   | Screwed plug            | 0250   | Steel ST                         | -30.0 °C | 140.0 °C |
| <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | 922 |   | Impeller nut            | 0243   | Steel 8                          | -30.0 °C | 140.0 °C |
| <input type="checkbox"/>            | <input type="checkbox"/>            | 210 |   | Shaft                   | 1360   | Chrome steel 1.4057+QT800        | -30.0 °C | 140.0 °C |
| <input type="checkbox"/>            | <input type="checkbox"/>            | 210 |   | Shaft                   | 1647   | Duplex stainless steel 1.4462    | -30.0 °C | 140.0 °C |
| <input type="checkbox"/>            | <input type="checkbox"/>            | 230 |   | Impeller                | 2750   | Stainless steel 1.4408           | 0.0 °C   | 140.0 °C |
| <input type="checkbox"/>            | <input type="checkbox"/>            | 502 | 1 | Casing wear ring        | 2750   | Stainless steel 1.4408           | 0.0 °C   | 140.0 °C |
| <input type="checkbox"/>            | <input type="checkbox"/>            | 502 | 2 | Casing wear ring        | 2750   | Stainless steel 1.4408           | 0.0 °C   | 140.0 °C |
| <input type="checkbox"/>            | <input type="checkbox"/>            | 524 |   | Shaft protecting sleeve | 1270   | Chrome steel 1.4122+QT750        | 0.0 °C   | 60.0 °C  |
| <input type="checkbox"/>            | <input type="checkbox"/>            | 902 |   | Stud                    | 1337   | Stainless steel A2-70            | -30.0 °C | 140.0 °C |
| <input type="checkbox"/>            | <input type="checkbox"/>            | 903 |   | Screwed plug            | 1414   | CrNiMo steel A4                  | -30.0 °C | 140.0 °C |
| <input type="checkbox"/>            | <input type="checkbox"/>            | 922 |   | Impeller nut            | 1414   | CrNiMo steel A4                  | -30.0 °C | 140.0 °C |
|                                     |                                     |     |   |                         |        |                                  |          |          |

# Easy Select ® Software – made by KSB

File Shopping carts Administration SAP maintain Help... Marcel Kemper (KEMPMAR) 1832488 | AG | | V 1 Units of quantity

KSB EasySelect® Version 5.5b Go Administration Selection Configuration Price sheet Output

PumpMeter Customer item

| Selection                | Price       |
|--------------------------|-------------|
| ✓ Sales document         |             |
| ✓ General requirements   |             |
| ✓ General                |             |
| ✓ Documentation          |             |
| ✓ Certifications         |             |
| ✓ Customer item (pump)   |             |
| ✓ Etanorm G 100-160 G11  | 11.937,79 € |
| ✓ Hydraulic performance  |             |
| ✓ Basic design           |             |
| ✓ Materials              |             |
| ✓ Bearings               |             |
| ✓ Connections            |             |
| ✓ Shaft seal             | 97,44 €     |
| ✓ Protection type        |             |
| ✓ Driver                 | 5.856,40 €  |
| ✓ Drive train            | 2.043,15 €  |
| ✓ Shaft seal aux. system |             |
| ✓ Auxiliary connections  |             |
| ✓ Coating                |             |
| ✓ Nameplates             |             |
| ✓ Certifications         | 613,73 €    |
| ✓ Accessories            | 417,74 €    |
| ✓ PumpMeter              | 417,74 €    |
| ✓ Documentation          |             |
| ✓ Accessories            |             |
| ✓ Packaging              |             |
| ✓ Documentation          |             |
| ✓ Price display          |             |
| ✓ Energy costs           |             |
| ✓ Customer item (pump)   |             |



**2**

**1**

**PumpMeter may only be used for solids-free fluids not liable to gum, encrust, solidify, crystallise or polymerise.**

**General description:**  
PumpMeter in an intelligent pressure transmitter with on-site display of measurement values and operating data of the pump. It comes factory-provided completely assembled and parameterised for your individual pump, to be connected via M12 connector and immediately ready to operate. PumpMeter records the pumps load profile during operation in order to – if applicable – provide information on the potential for energy savings or increased availability.

## Pump Meter

1) Selected by EasySelect ® automatically

# Easy Select ® Software – made by KSB

File Shopping carts Administration SAP maintain Help...

KSB EasySelect® Version 5.5b

Go Administration Selection **Configuration** Price sheet Output

Marcel Kemper (KEMPMAR) 1832488 | AG | | V 1 Units of quantity Contact

Certifications

Variant ☒ KSB basic design

☒ **Hydraulic performance test**

Acceptance standard ☒ ISO 9906 class 2 / 2B

Quantity meas. points ☒ 5

Test participation ☒ Non-witnessed Quantity, non-witnessed ☒ 1

Certificate ☒ Report Quantity, witnessed ☒ 0

☐ **NPSH test**

☐ **Strip test**

☐ **Hydrostatic test (room temp.)**

☐ **Final visual inspection**

☐ **Material certificates: Volute casing, pressure cover, impeller (102, 163, 230)**

| Selection                                                  | Price       |
|------------------------------------------------------------|-------------|
| <input checked="" type="checkbox"/> Sales document         |             |
| <input checked="" type="checkbox"/> General requirements   |             |
| <input checked="" type="checkbox"/> General                |             |
| <input checked="" type="checkbox"/> Documentation          |             |
| <input checked="" type="checkbox"/> Certifications         |             |
| <input checked="" type="checkbox"/> Customer item (pump)   |             |
| <input checked="" type="checkbox"/> Etanorm G 100-160 G11  | 11.937,79 € |
| <input checked="" type="checkbox"/> Hydraulic performance  |             |
| <input checked="" type="checkbox"/> Basic design           |             |
| <input checked="" type="checkbox"/> Materials              |             |
| <input checked="" type="checkbox"/> Bearings               |             |
| <input checked="" type="checkbox"/> Connections            |             |
| <input checked="" type="checkbox"/> Shaft seal             | 97,44 €     |
| <input checked="" type="checkbox"/> Protection type        |             |
| <input checked="" type="checkbox"/> Driver                 | 5.856,40 €  |
| <input checked="" type="checkbox"/> Drive train            | 2.043,15 €  |
| <input checked="" type="checkbox"/> Shaft seal aux. system |             |
| <input checked="" type="checkbox"/> Auxiliary connections  |             |
| <input checked="" type="checkbox"/> Coating                |             |
| <input checked="" type="checkbox"/> Nameplates             |             |
| <input checked="" type="checkbox"/> Certifications         | 613,73 €    |
| <input checked="" type="checkbox"/> Accessories            | 417,74 €    |
| <input checked="" type="checkbox"/> PumpMeter              | 417,74 €    |
| <input checked="" type="checkbox"/> Documentation          |             |
| <input checked="" type="checkbox"/> Accessories            |             |
| <input checked="" type="checkbox"/> Packaging              |             |
| <input checked="" type="checkbox"/> Documentation          |             |
| <input checked="" type="checkbox"/> Price display          |             |
| <input checked="" type="checkbox"/> Energy costs           |             |
| <input checked="" type="checkbox"/> Customer item (pump)   |             |

## Test runs

1) Click „Acceptance standard“ to select ISO - standard

# Easy Select ® Software – made by KSB

## Summary of Test Standards Changes

- 1) Selectable in KSB EasySelect ® : ISO 9906 / 2011 or HI, depends on pump type
- 2) Goal of new Hydraulic performance tests Grades ISO 9906 1 / 2 / 3: Harmonisation with ANSI / HI 1.6 and 2.6
- 3) ISO 9906 / 2011\*:
  - measuring of 5 points minimum
  - one point being -5% up to 0%, another within 0% to + 5% of the guarantee point of flow
  - other 3 points shall be spaced over the allowable operating range
- 4) Tolerances for pumps with an input below of 10 KW are similar to ISO 9906 / 1999
  - rate of flow  $t_Q = \pm 10\%$
  - pump total head  $t_H = \pm 8\%$

\*Note other Test procedures apply to (NPSH) tests

# Easy Select ® Software – made by KSB

## Summary of Test Standards Changes

### ISO 9906: 2011

Table 8 — Pump Test Acceptance Grades and Corresponding Tolerance

| Grade            | 1           |        |        | 2     |        | 3   | Guarantee Requirement |
|------------------|-------------|--------|--------|-------|--------|-----|-----------------------|
| $\Delta t_Q$     | 10%         |        |        | 16%   |        | 18% |                       |
| $\Delta t_H$     | 6%          |        |        | 10%   |        | 14% |                       |
| Acceptance Grade | 1U          | 1E     | 1B     | 2B    | 2U     | 3B  | mandatory             |
| $t_Q$            | + 10%       | +/- 5% | +/- 8% | + 16% | +/- 9% |     |                       |
| $t_H$            | + 6%        | +/- 3% | +/- 5% | + 10% | +/- 7% |     |                       |
| $t_P$            | + 10%       | + 4%   | + 8%   | + 16% | + 9%   |     | optional              |
| $t_\eta$         | <u>≥ 0%</u> | - 3%   | - 5%   | - 7%  |        |     |                       |

NOTE  
 $t_x$  (x= Q,H, P,  $\eta$ ) stands for the tolerance of the indicated quantity

### ISO 9906: 1999

Tabelle 10 – Werte der Toleranzfaktoren

| Größe                | Formelzeichen | Klasse 1<br>% | Klasse 2<br>% |
|----------------------|---------------|---------------|---------------|
| Volumenstrom         | $t_Q$         | ± 4,5         | ± 8           |
| Förderhöhe der Pumpe | $t_H$         | ± 3           | ± 5           |
| Pumpenwirkungsgrad   | $t_\eta$      | - 3           | - 5           |

Volumenstrom = flow rate  
 Förderhöhe = pumping head  
 Pumpenwirkungsgrad = pump efficiency

# Easy Select® Software – made by KSB

File Shopping carts Administration SAP maintain Help...

Marcel Kemper (KEMPMAR) 1832488 | AG | | V 1 Units of quantity Contact English

KSB EasySelect® Version 5.5b Go Administration Selection Configuration Price sheet **Output** Cancel

Document language English

1

Save configuration Export configuration

Document selection

|                                                     | Selected                            | Format |
|-----------------------------------------------------|-------------------------------------|--------|
| Sales document                                      | <input type="checkbox"/>            |        |
| Price sheet                                         | <input checked="" type="checkbox"/> | html   |
| Customer item (pump)                                | <input type="checkbox"/>            |        |
| Etanorm G 100-160 G11                               | <input type="checkbox"/>            |        |
| Internal data sheet                                 | <input type="checkbox"/>            | pdf    |
| Technical data sheet                                | <input checked="" type="checkbox"/> | pdf    |
| Compact data sheet                                  | <input type="checkbox"/>            | pdf    |
| Performance curve                                   | <input checked="" type="checkbox"/> | pdf    |
| Speed curve                                         | <input checked="" type="checkbox"/> | pdf    |
| General arrangement drawing                         | <input checked="" type="checkbox"/> | pdf    |
| Auxiliary connection plan                           | <input checked="" type="checkbox"/> | pdf    |
| Schematic drawing with allowable forces and moments | <input type="checkbox"/>            | pdf    |
| Head loss calculation in piping system              | <input type="checkbox"/>            | pdf    |
| Text for invitation of tenders                      | <input type="checkbox"/>            | pdf    |
| CAD File Request Form                               | <input type="checkbox"/>            | html   |

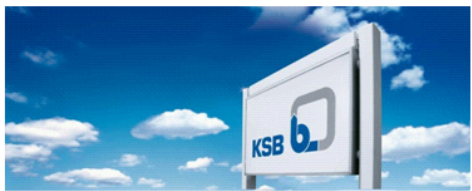
2

3

This is the last page of your configuration.

When you have finished printing or saving your documentation click "Next" to add new items or complete the project.

ES-file format



Document processing (only for pdf-format)

All selected documents For all items All in one file

Preview / Print Save Document...

## Output

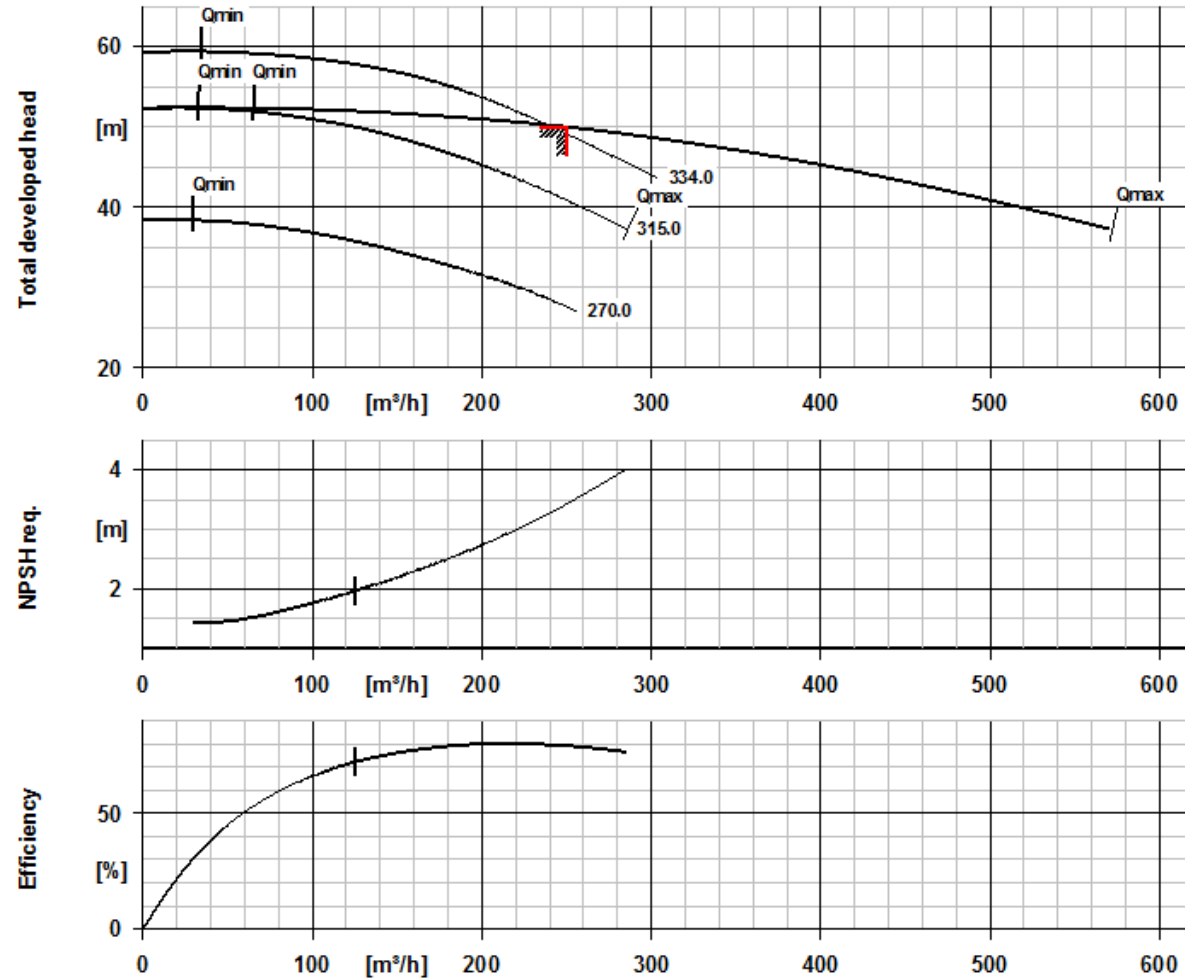
1) Switch the document language here

2) Click on the desired technical information to get a preview in Acrobat Reader, where you also can print or save the document

3) Output of CAD files in over 40 different formats sent via e-mails.

# Appendix

# Easy Select ® Software – made by KSB

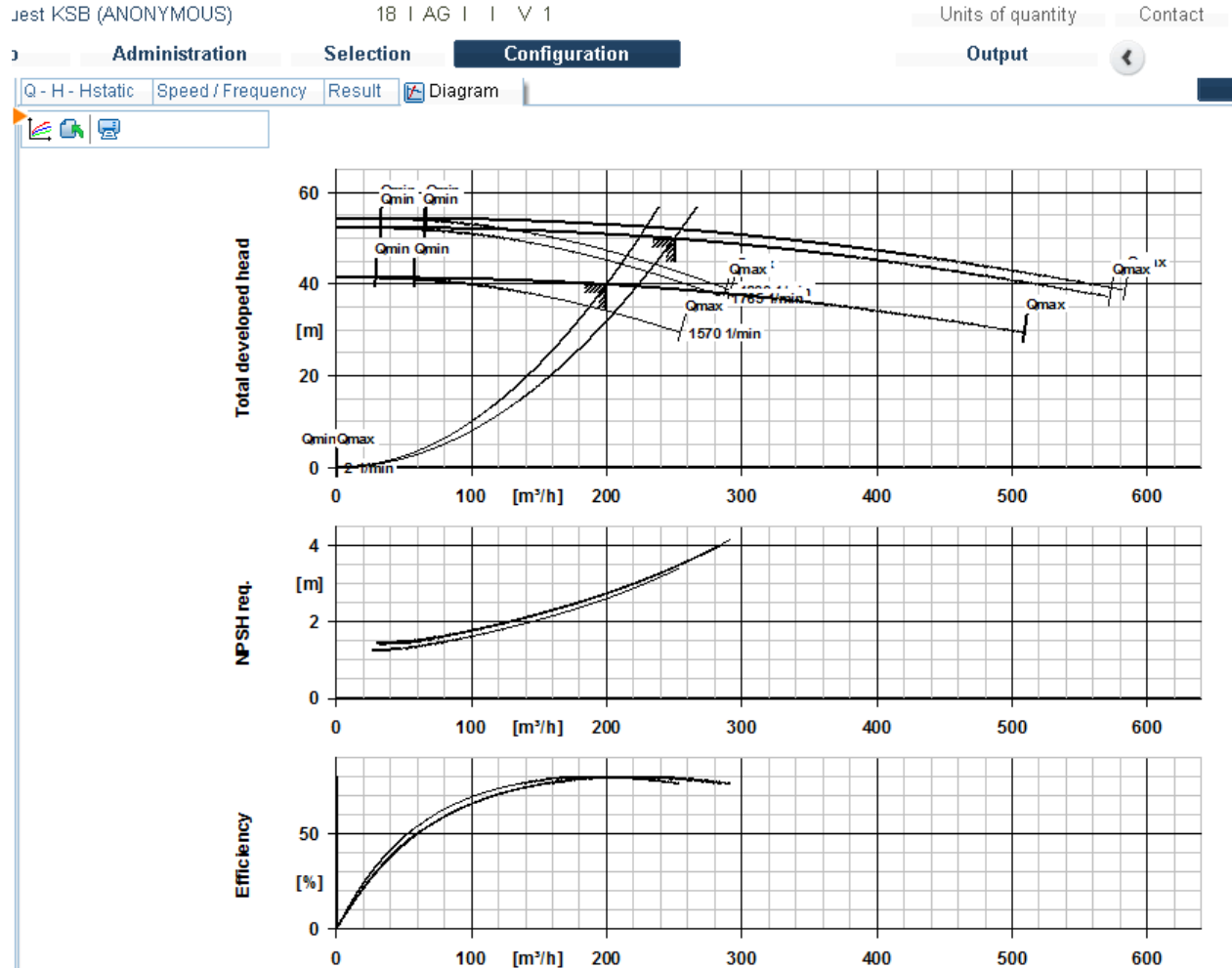


## Parallel curve

Twin system, each pump 50% of total

Twin system, one full duty, one standby pump

# Easy Select® Software – made by KSB



Parallel curve

V<sub>f</sub> - driven pumps

# Etanorm material overview

## Materials

|                            | Etanorm G /<br>Etanorm-RG                  | Etanorm-R GC1 | Etanorm M                                                 | Etanorm-RM | Etanorm B                                |
|----------------------------|--------------------------------------------|---------------|-----------------------------------------------------------|------------|------------------------------------------|
| Volute casing              | Grey cast iron JL 1040 <sup>1)</sup>       |               | Grey cast iron JL 1040 <sup>1)</sup>                      |            | Tin bronze CC 480 K-GS <sup>3)</sup>     |
| Discharge cover            | Grey cast iron JL 1040 <sup>1)</sup>       |               | Grey cast iron JL 1040 <sup>1)</sup>                      |            | Tin bronze CC 480 K-GS <sup>3)</sup>     |
| Impeller                   | Grey cast iron JL 1040 <sup>1)</sup>       | 1.4408        | Tin bronze CC 480 K-GS <sup>3)</sup>                      |            | Tin bronze CC 480 K-GS <sup>3)</sup>     |
| Wear rings                 | Grey cast iron GG                          |               | Grey cast iron/Leaded bronze GG/CC 495 K-GS <sup>3)</sup> |            | Leaded bronze CC 495 K-GS <sup>3)</sup>  |
| Shaft                      | Tempering steel C45                        |               | Tempering steel C45                                       |            | Chrome nickel molybdenum steel<br>1.4462 |
| Shaft sleeve               | Chrome nickel molyb-<br>denum steel 1.4571 | 1.4122        | Chrome nickel molybdenum<br>steel 1.4571                  | 1.4122     | Chrome nickel molybdenum steel<br>1.4571 |
| Shaft protection<br>sleeve | Chrome nickel molybdenum steel 1.4122      |               | Chrome nickel molybdenum steel 1.4122                     |            | Chrome nickel molybdenum steel<br>1.4571 |
| Bearing bracket            | Grey cast iron JL 1040 <sup>1)</sup>       |               | Grey cast iron JL 1040 <sup>1)</sup>                      |            | Grey cast iron JL 1040 <sup>1)</sup>     |

|                         | Etanorm S                               | Etanorm-RS | Etanorm C                                  |
|-------------------------|-----------------------------------------|------------|--------------------------------------------|
| Volute casing           | Nodular cast iron JS 1025 <sup>2)</sup> |            | Cast chrome nickel molybdenum steel 1.4408 |
| Discharge cover         | Nodular cast iron JS 1025 <sup>2)</sup> |            | Cast chrome nickel molybdenum steel 1.4408 |
| Impeller                | Grey cast iron JL 1040 <sup>1)</sup>    |            | Cast chrome nickel molybdenum steel 1.4408 |
| Wear rings              | Grey cast iron GG                       |            | Cast chrome nickel molybdenum steel 1.4408 |
| Shaft                   | Tepering steel C45                      |            | Chrome nickel molybdenum steel 1.4462      |
| Shaft sleeve            | Chrome nickel molybdenum steel 1.4571   | 1.4122     | Chrome nickel molybdenum steel 1.4571      |
| Shaft protection sleeve | Chrome nickel molybdenum steel 1.4122   |            | Chrome nickel molybdenum steel 1.4571      |
| Bearing bracket         | Grey cast iron JL 1040 <sup>1)</sup>    |            | Grey cast iron JL 1040 <sup>1)</sup>       |

1) to EN 1561 = GJL-250

2) to EN 1563 = GJS-400-18-LT

3) to EN 1982

# NPSH formula

$$\text{NPSH}_a = (p_e + p_b - p_v) / (\rho \cdot g) + v_e^2 / 2g - H_{L,s} - H_{s \text{ geo}} \pm s' \quad (29)$$

where

- $p_e$  Gauge pressure in suction tank in  $\text{N/m}^2$
- $p_b$  Absolute atmospheric pressure in  $\text{N/m}^2$  (Table 13: consider effect of altitude!)
- $p_v$  Vapour pressure in  $\text{N/m}^2$  (in Table 12 as absolute pressure!)
- $\rho$  Density in  $\text{kg/m}^3$
- $g$  Gravitational constant,  $9.81 \text{ m/s}^2$
- $v_e$  Flow velocity in the suction tank or sump in  $\text{m/s}$
- $H_{L,s}$  Head loss in the suction piping in  $\text{m}$
- $H_{s \text{ geo}}$  Height difference between the fluid level in the suction tank or sump and the centre of the pump inlet in  $\text{m}$
- $s'$  Height difference between the centre of the pump inlet and the centre of the impeller inlet in  $\text{m}$

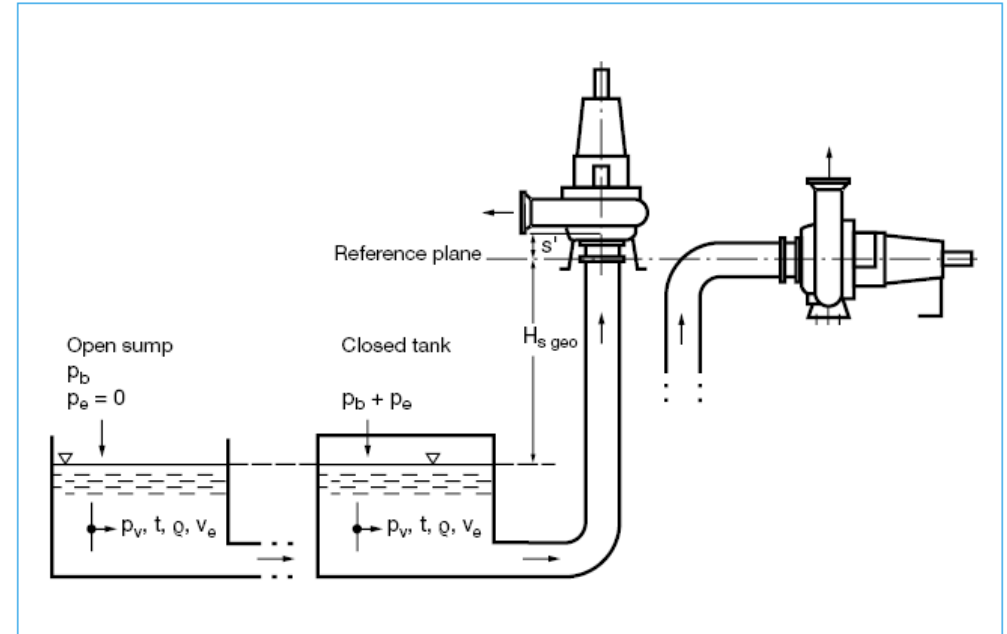


Fig. 36: Calculation of the  $\text{NPSH}_a$  for suction lift operation for horizontally or vertically installed pumps

# NPSH formula

Table 12: Vapour pressure  $p_v$ , density  $\rho$  and kinematic viscosity  $\nu$  of water at saturation conditions as a function of the temperature  $t$

| t<br>°C | $p_v$<br>bar | $\rho$<br>kg/m <sup>3</sup> | $\nu$<br>mm <sup>2</sup> /s | t<br>°C | $p_v$<br>bar | $\rho$<br>kg/m <sup>3</sup> | $\nu$<br>mm <sup>2</sup> /s | t<br>°C | $p_v$<br>bar | $\rho$<br>kg/m <sup>3</sup> | $\nu$<br>mm <sup>2</sup> /s |
|---------|--------------|-----------------------------|-----------------------------|---------|--------------|-----------------------------|-----------------------------|---------|--------------|-----------------------------|-----------------------------|
| 0       | 0.00611      | 999.8                       | 1.792                       | 61      | 0.2086       | 982.6                       | 0.413                       | 145     | 4.155        | 921.7                       | 0.1890                      |
| 1       | 0.00656      | 999.9                       |                             | 62      | 0.2184       | 982.1                       |                             | 150     | 4.760        | 916.9                       |                             |
| 2       | 0.00705      | 999.9                       |                             | 63      | 0.2285       | 981.6                       |                             | 155     | 5.433        | 912.2                       |                             |
| 3       | 0.00757      | 1000.0                      |                             | 64      | 0.2391       | 981.1                       |                             | 160     | 6.180        | 907.4                       |                             |
| 4       | 0.00812      | 1000.0                      |                             | 65      | 0.2501       | 980.5                       |                             | 165     | 7.008        | 902.4                       |                             |
| 5       | 0.00872      | 1000.0                      |                             | 66      | 0.2614       | 980.0                       |                             | 170     | 7.920        | 897.3                       |                             |
| 6       | 0.00935      | 999.9                       |                             | 67      | 0.2733       | 979.4                       |                             | 175     | 8.925        | 892.1                       |                             |
| 7       | 0.01001      | 999.9                       |                             | 68      | 0.2856       | 978.8                       |                             | 180     | 10.027       | 886.9                       |                             |
| 8       | 0.01072      | 999.8                       |                             | 69      | 0.2983       | 978.3                       |                             | 185     | 11.234       | 881.4                       |                             |
| 9       | 0.01146      | 999.7                       |                             | 70      | 0.3116       | 977.7                       |                             | 190     | 12.553       | 876.0                       |                             |
| 10      | 0.01227      | 999.6                       | 1.307                       | 71      | 0.3253       | 977.1                       | 0.365                       | 195     | 13.989       | 870.3                       | 0.1579                      |
| 11      | 0.01311      | 999.5                       |                             | 72      | 0.3396       | 976.6                       |                             | 200     | 15.550       | 864.7                       |                             |
| 12      | 0.01401      | 999.4                       |                             | 73      | 0.3543       | 976.0                       |                             | 205     | 17.245       | 858.7                       |                             |
| 13      | 0.01496      | 999.3                       |                             | 74      | 0.3696       | 975.4                       |                             | 210     | 19.080       | 852.8                       |                             |
| 14      | 0.01597      | 999.2                       |                             | 75      | 0.3855       | 974.8                       |                             | 215     | 21.062       | 846.6                       |                             |
| 15      | 0.01703      | 999.0                       |                             | 76      | 0.4019       | 974.3                       |                             | 220     | 23.202       | 840.3                       |                             |
| 16      | 0.01816      | 998.8                       |                             | 77      | 0.4189       | 973.7                       |                             |         |              |                             |                             |
| 17      | 0.01936      | 998.7                       |                             | 78      | 0.4365       | 973.0                       |                             |         |              |                             |                             |
| 18      | 0.02062      | 998.5                       |                             | 79      | 0.4547       | 972.5                       |                             |         |              |                             |                             |
| 19      | 0.02196      | 998.4                       |                             | 80      | 0.4736       | 971.8                       |                             |         |              |                             |                             |
| 20      | 0.02337      | 998.2                       | 1.004                       | 81      | 0.4931       | 971.3                       |                             |         |              |                             |                             |

## Monitoring

- Heat generation/distribution
- Water supply systems

### Intelligent Pressure Sensor

## PumpMeter



PumpMeter

### Product description

The PumpMeter device is an intelligent pressure sensor for pumps, with local output of measured values and operating data.

The device consists of two pressure sensors and a display unit. It records the load profile of the pump in order to indicate any potential for optimising energy efficiency and availability.

PumpMeter is supplied completely assembled and parametered for the corresponding pump. It is ready for operation as soon as the M12 plug connector is plugged in.

### Main applications

#### Industry:

- Refrigeration/distribution
- Heat generation/distribution
- Water conditioning
- Cooling lubricant distribution
- Water extraction
- Service water supply

#### Water:

- Water extraction/withdrawal
- Water treatment/conditioning
- Water distribution/transport

#### Building Services:

- Air-conditioning systems

- 1) Provided that the plugs are connected correctly
- 2) Depending on the basic material design of the pump

### Technical data

Technical data of the display unit

| Characteristics       | Value                     |
|-----------------------|---------------------------|
| Power supply          | 24V DC $\pm$ 15%          |
| Power input           | 150 mA                    |
| Analog signal output  | 4-20 mA, 3-core           |
| Digital connection    | RS485, Modbus RTU (Slave) |
| Enclosure             | IP 65 <sup>1)</sup>       |
| Service interface     | RS232                     |
| Bearing temperature   | -30 °C to 80 °C           |
| Operating temperature | -10 °C to 60 °C           |

Technical data of the sensors

| Characteristics     | Value               |
|---------------------|---------------------|
| Signal              | 4-20 mA             |
| Gauge pressure      | 40 bar max.         |
| Enclosure           | IP 67 <sup>1)</sup> |
| Burst pressure      | 80 bar max.         |
| Fluid temperature   | -30 °C to 140 °C    |
| Installation torque | 10 Nm               |
| Ambient temperature | -10 °C to 60 °C     |

### Materials

Overview of materials

| Wetted components                          | Material         |
|--------------------------------------------|------------------|
| Pressure sensor measuring unit             | 1.4542           |
| Pressure sensor process connection         | 1.4301           |
| Adapter for fitting a sensor <sup>2)</sup> | 1.0037 or 1.4571 |
| Joint ring                                 | Certialen®       |

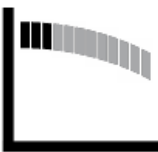
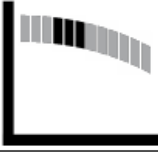
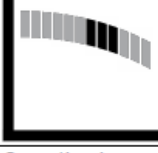
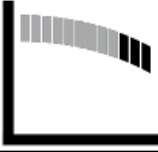
### Product benefits

- Transparent pump operation  
Local output of the relevant operating data, especially the operating point of the pump.
- Identifies energy saving potentials  
by recording and analysing the load profile and displaying the energy efficiency icon (EFF), if applicable.
- Saves time and money  
The sensors are fitted to the pump at the factory, unlike conventional instruments used in systems.
- Helps increase pump availability  
by recognising and avoiding operation outside of the intended operating range.

### Functions

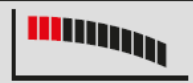
#### Pressure transmitter function

The discharge pressure or differential pressure of the pump are transmitted as a 4-20 mA signal. Connection via the RS485 serial interface with Modbus protocol is also possible.

| Operating range                                                                                                                    | Segment display             | Description                                                                                                                                                |
|------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operation at extremely low flow <sup>3)</sup><br>  | First quarter flashing (1)  | <ul style="list-style-type: none"> <li>Pump possibly not operated in accordance with its intended use</li> <li>Increased load on the components</li> </ul> |
| Operation at moderately low flow <sup>3)</sup><br> | Second quarter flashing (2) | <ul style="list-style-type: none"> <li>Operation with potential for optimising energy efficiency</li> </ul>                                                |
| Operation near the optimum<br>                     | Third quarter flashing (3)  | <ul style="list-style-type: none"> <li>Operation within intended operating range. Optimum energy efficiency</li> </ul>                                     |
| Operation in overload conditions<br>              | Fourth quarter flashing (4) | <ul style="list-style-type: none"> <li>Limit of the intended operating range</li> <li>Possibly overload of pump and/or motor</li> </ul>                    |

#### Anzeige im Display

#### Interpretation des aktuellen Betriebspunktes

|                                                                                   |                                                             |                                                                                     |                                                            |
|-----------------------------------------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------------------------------------|------------------------------------------------------------|
|  | Sehr niedriger, möglicherweise kein Förderstrom.*           |  | Handlungsbedarf bei dauerhaftem Betrieb in diesem Bereich. |
|  | Niedriger Förderstrom.*                                     |  | Langfristiger Optimierungsbedarf.                          |
|  | Optimaler Betriebspunkt.                                    |  | Die Pumpe arbeitet optimal.                                |
|  | Zu hoher Förderstrom, möglicherweise oberhalb des Maximums. |  | Handlungsbedarf bei dauerhaftem Betrieb in diesem Bereich. |

\* Je nach Charakteristik der Pumpenkennlinie werden bei Betrieb in Teillast die ersten beiden Viertel der Kennlinie nicht differenziert und gleichzeitig angezeigt.

#### Anzeige im Display

#### Beispielhafte Lastprofile

#### Empfehlung

|                                                                                   |                                                                                                                                                                     |                                                                                                 |
|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
|  | <br>Betrieb im oder rund um den optimalen Betriebspunkt.                          | Keine Anpassungen notwendig. Die Pumpe arbeitet normal.                                         |
|  | <br>Betriebspunkt bewegt sich in einem breiten Bereich der Kennlinie.             | Optimierungsmaßnahmen zur Nutzung des signifikanten Einsparpotenzials, z. B. Drehzahlregelung.  |
|                                                                                   | <br>Grenzwertiger Betriebsbereich mit ggf. Überlastung von Pumpe und/oder Motor. | Optimierungsmaßnahme abgedrehtes Laufrad zur Steigerung von Verfügbarkeit und Energieeffizienz. |