

## Side channel pumps

*SK and ASK series*

*with mechanical seal or magnetic coupling*

*PN 40*

# Research and development with recent test stands



Computer-controlled and fully automated test stands on the premises of Speck in Roth.

Measuring of hydraulics, power requirements, axial thrust, vibrations and NPSH values. Heads of up to 400 m and flow rates of up to 750 m<sup>3</sup>/h are possible.



Thermal oil test stand with pump surveillance system on the premises of Speck in Roth.

Research of impacts of high temperatures up to 350 °C on the lifetime of the pumps.

## Your contacts

### Speck Pumpen Walter Speck GmbH & Co. KG Speck Pumpen Systemtechnik GmbH

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## International representatives

→ page 15

# Side channel pumps made by Speck

## Design

- » Horizontal multistage modular pumps
- » Designed for feeding, filling and emptying operations under difficult physical conditions
- » Suitable for the delivery of gas / self-priming
- » Suitable for liquids without abrasive contaminants and without solid particles
- » Available in a wide range of materials with components from stainless steel, bronze and spheroidal graphite cast iron
- » ATEX certified

With mechanical seal from 0 to + 180 °C

With magnetic coupling from -100 to + 350 °C

Nominal pressure PN 40

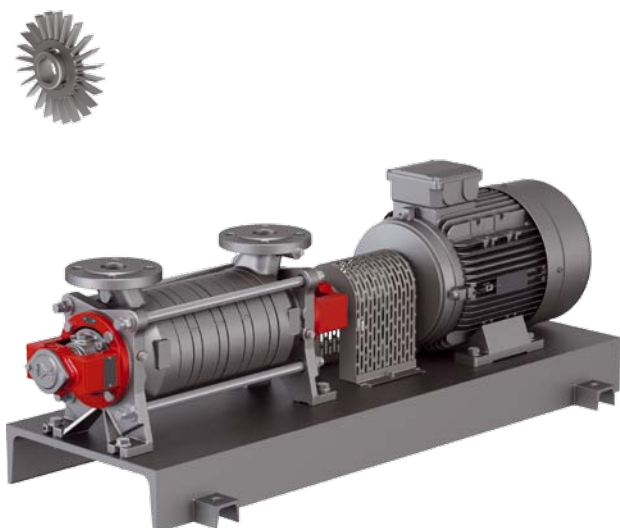
H<sub>max</sub> 400 m

Q<sub>max</sub> 42 m<sup>3</sup>/h

Temperature ranges depend on materials, seals and pumped media

## SK series

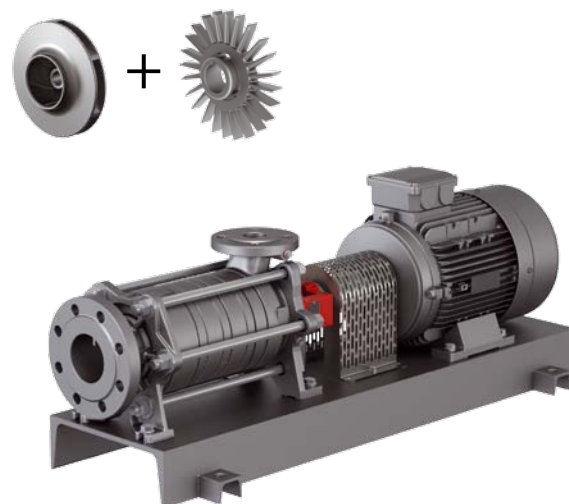
Side channel pumps in acc. with EN 734



Proven side channel pumps for universal applications

## ASK series

Side channel pumps with NPSH stage



Combi-pumps for delivering liquids in physically difficult conditions on the suction side

Their very good NPSH values make them particularly suitable for pumped media near the boiling-point

### Main applications

- » Filling and emptying tanks and tankers
- » Delivery of hot water or feedwater in boiler systems
- » Delivery of salt water and fresh water in marine applications
- » Recovering condensates (water) in the food and chemical industries
- » Delivery of liquefied gas and hydrocarbons
- » Delivery of coolants
- » Extracting palm oil
- » Filling and emptying thermal oil systems

# Find the right pump for your system

## Choose the best solution from six ranges

Each system is unique in its own way - on some, the sealing principle is key, on others the installation frame or perhaps the special properties of the medium. You can choose from six ranges and find the best solution for your system.

### Pumps with mechanical seal

Pumped media temperatures from 0 to + 180 °C depending on the materials used

Wide range of seals

Available in clockwise and anticlockwise rotation



#### SKG-LL

- » 1 – 8 stages
- » 2 external rolling bearings



#### SKG-LO

- » 1 – 8 stages
- » 1 internal casing sleeve bearing
- » 1 external rolling bearing



#### SKG-LA

- » 1 – 3 stages
- » 1 internal casing sleeve bearing
- » 1 external rolling bearing



#### ASKG

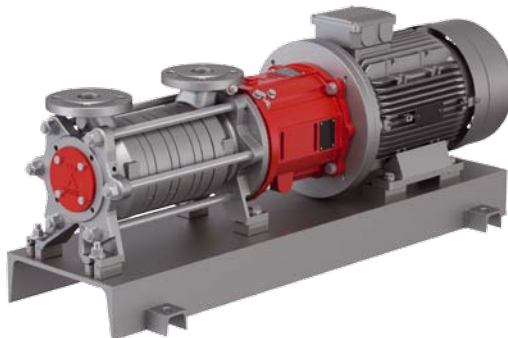
- » With NPSH-stage
- » 1 – 8 stages
- » 1 internal casing sleeve bearing
- » 1 external rolling bearing

### Pumps with magnetic coupling

Pumped media temperatures from - 100 to + 350 °C depending on the materials used

Wide range of magnetic coupling sizes

Hastelloy® or ceramic separating cans



#### SKM

- » 1 – 8 stage
- » 2 internal casing sleeve bearings

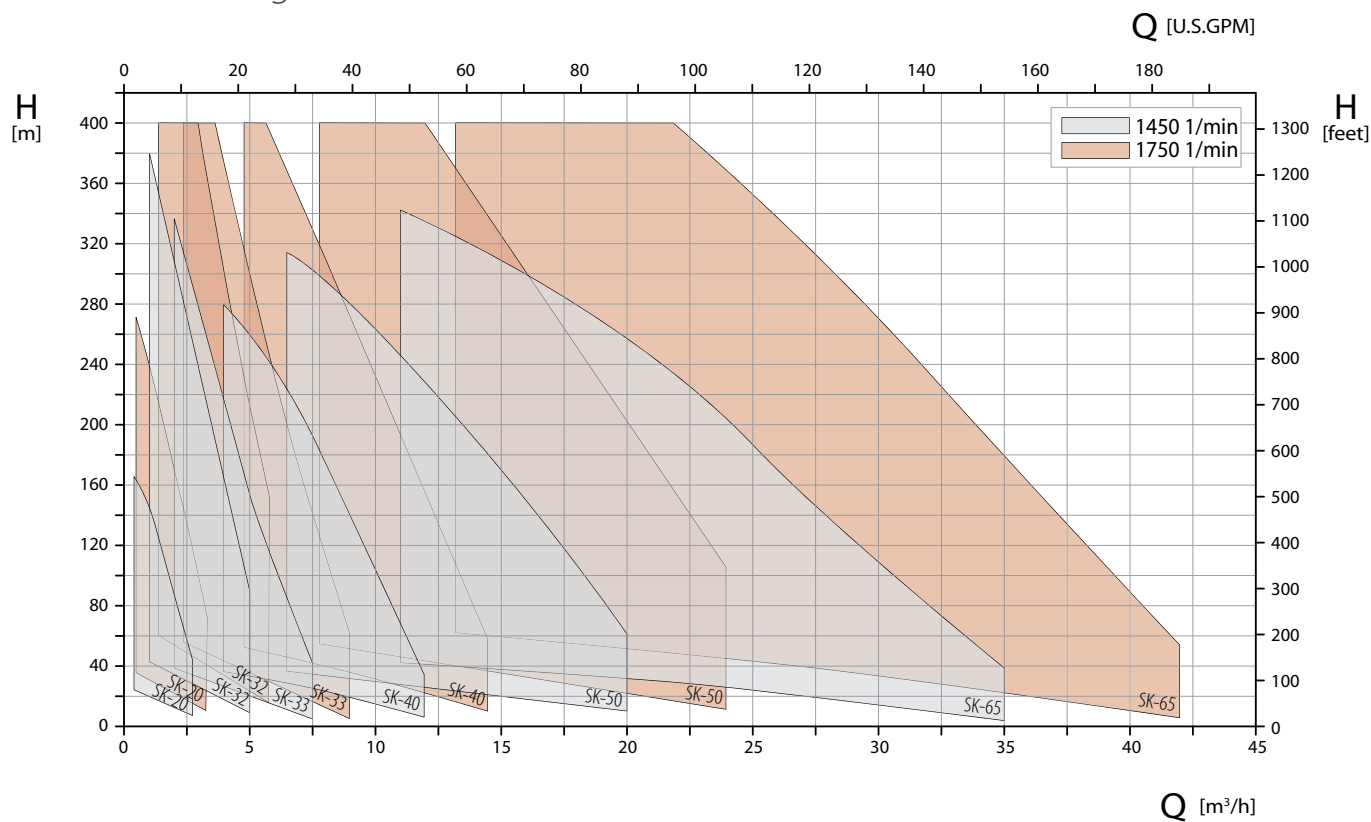


#### ASKM

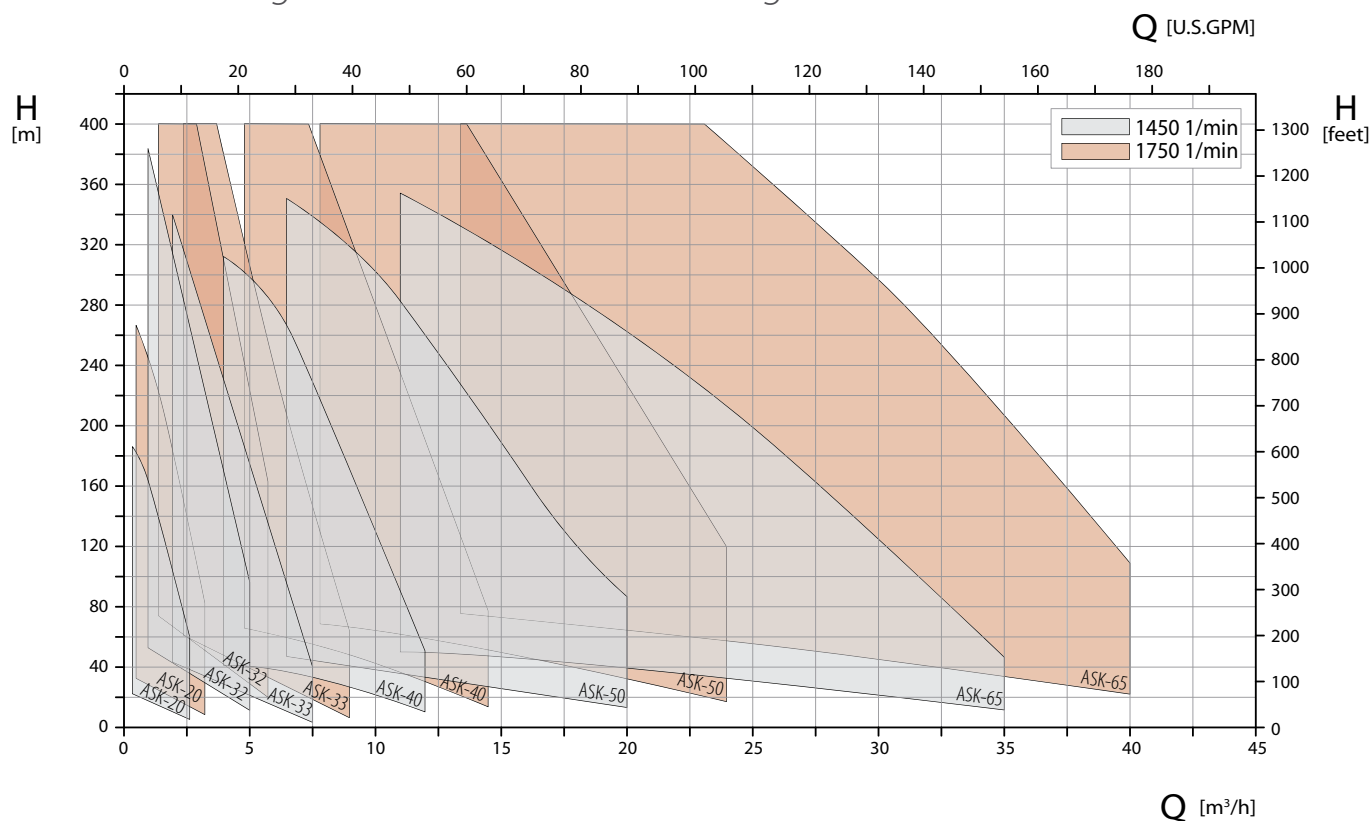
- » With NPSH-stage
- » 1 – 8 stages
- » 2 internal casing sleeve bearings

# Performance range

Characteristic diagram SK series

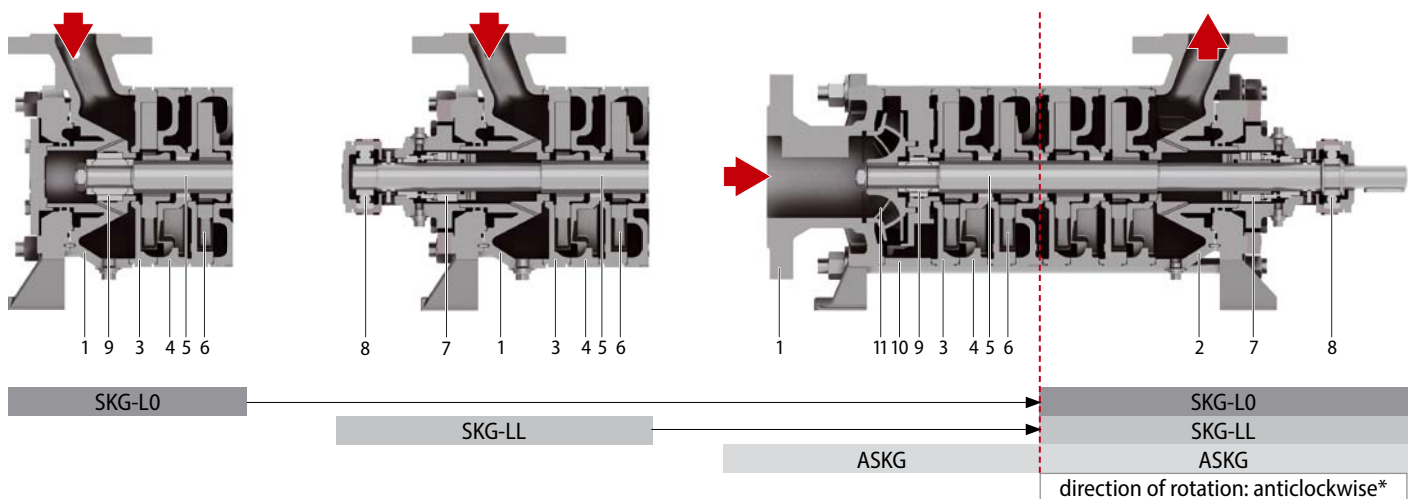
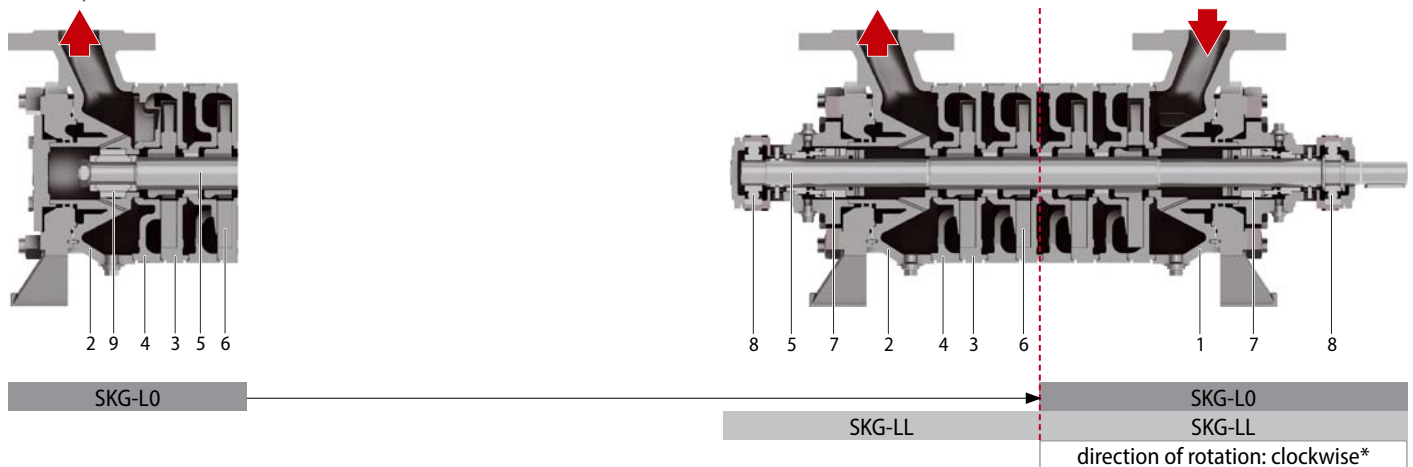


Characteristic diagram ASK series with NPSH-stage

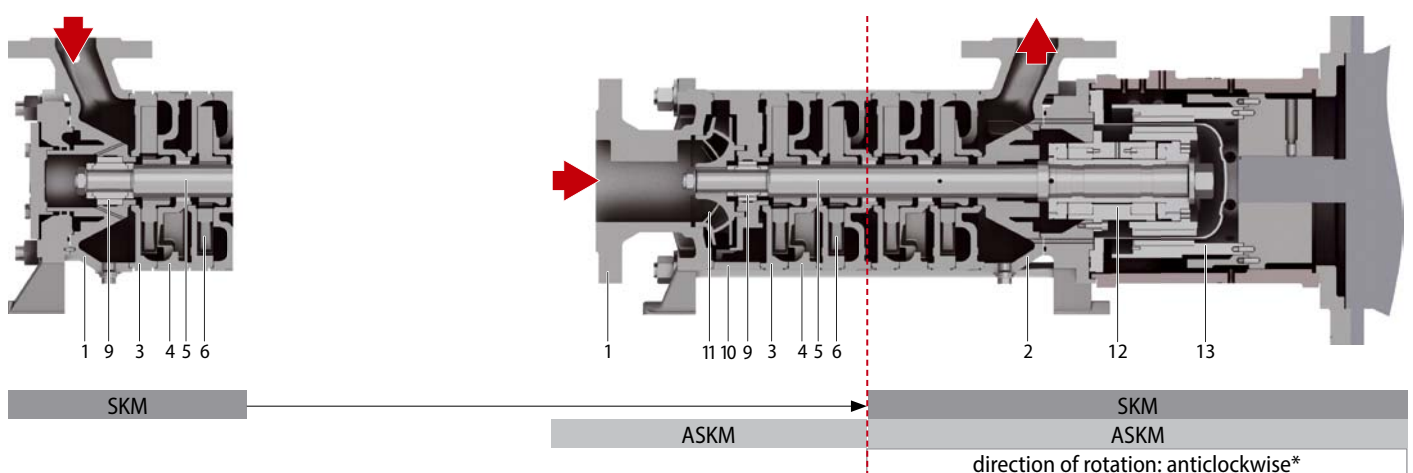


# Smart modular system

## Pumps with mechanical seal



## Pumps with magnetic coupling



No.	Designation
1	Suction casing
2	Discharge casing
3	Suction stage
4	Discharge stage
5	Shaft
6	Star impeller
7	Mechanical seal

No.	Designation
8	Rolling bearing
9	Sleeve bearing made of SiC (or carbon bearing, not illustrated)
10	N-stage
11	Radial impeller
12	Bearing cartridge made of SiC
13	Magnetic coupling

With Speck you get a smart modular system with many identical parts. In addition, the SK series allows two directions of rotation, providing full flexibility when replacing or converting a system.

\*View on pump shaft end

# High operational safety, optimal design and service-friendly

## *Robust and durable*

### **Rolling bearing**

Robust lifetime lubricated rolling bearings suitable for a long service life

### **Wear resistant sleeve bearings**

Solid, hydrodynamically lubricated sleeve bearings made from carbon, a proven slide material – extremely hard wearing and highly resistant to corrosive media.

Alternatively, SiC sleeve bearings are also available.

## *A perfect seal*

### **Mechanical seals**

We offer a wide range of mechanical seals for a variety of applications.

- » Nominal pressure up to PN 40
- » Balanced and unbalanced mechanical seals
- » Double-acting mechanical seals
- » Non-cooled mechanical seals
- » Cooled mechanical seals available for media temperature exceeding 140 °C
- » Diverse combinations of materials available depending on the pumped medium:  
Sealing rings in A-carbon, B-carbon or SiC  
O-rings in FKM, EPDM or FFKM

### **Magnetic couplings**

You will find a great variety of magnetic couplings at Speck. The magnetic couplings are optimally designed for your operating point. See page 8 for further details.

### **Stuffing box packing**

- » Available on request

## *Wide temperature range*

Depending on the material, the seals and the pumped medium, these side channel pumps can be used across a wide range of temperature.

Material	with mechanical seal	with magnetic coupling
Spheroidal graphite cast iron	0 – 180 °C	- 20 – 350 °C
Bronze	0 – 180 °C	0 – 180 °C
Stainless steel	0 – 180 °C	- 100 – 250 °C

## *Flexible and simple to service*

### **Minimum stock of spares required**

Thanks to the consistently developed modular system, many components are completely identical and interchangeable across six ranges.

This means you require a minimum stock of spare parts.

It guarantees complete flexibility as replacing pumps and components or changing the pump execution is easy.

## *Efficient motors*

4-pole motors meeting current energy efficiency standards

## *Even for critical media*

We offer a range of medium-specific designs suitable for the delivery of acids, lyes, fuel, glycol, glycerine, hot water, oil, etc.

Casing seals with graphite, FKM, FFKM or EPDM O-rings are available.

You can choose for stage sealing among graphite, Teflon® or various liquid seals by Epple®.

## *ATEX*

All series are ATEX certified

- » Mechanical seal version: II 2G / 2D c TX
- » Magnetic coupling version: II 2G / 2D cb TX

# Magnetic couplings

## Optimal design

The wide range of magnetic couplings offers an optimum configuration for your operating conditions and cuts energy consumption.

### Wide range

Magnetic couplings consist of an inner rotor, a separating can and an outer rotor. The separating can hermetically seals the pumped media from the atmosphere.

A great variety of sizes and configuration using the latest software guarantee the best design for your operating point.

The transmissible torques of the magnetic couplings range between 10 and 500 Nm.

### Type code for magnetic couplings

Type code (example)	135-	70
Nominal diameter DN		
Magnet length [mm]		

### Magnetic coupling sizes and versions

		Magnet diameter				
		DN 60	DN 75	DN 110	DN 135	DN 165
Magnet length in mm	40	x	x	x		
	50		x	x		
	60	x	x	x	x	
	70			x	x	
	80			x	x	x
	90				x	x
	100				x	x
	110					x
	120					x
Separating can made of Hastelloy®		PN 40		PN 25 / PN 40		
Separating can made of ceramic ZrO <sub>2</sub> Mg		not available		PN 40 on request		

### Cooling through flushing bores

Eddy current, viscosity and bearing friction losses generate heat inside the pump, adding to the temperature of the medium. Flushing bores in the inner rotor and the casing ensure that critical points are cooled with the medium.

At the same time, gases or air are conducted out of the inner rotor.

## Robust Hastelloy® separating cans



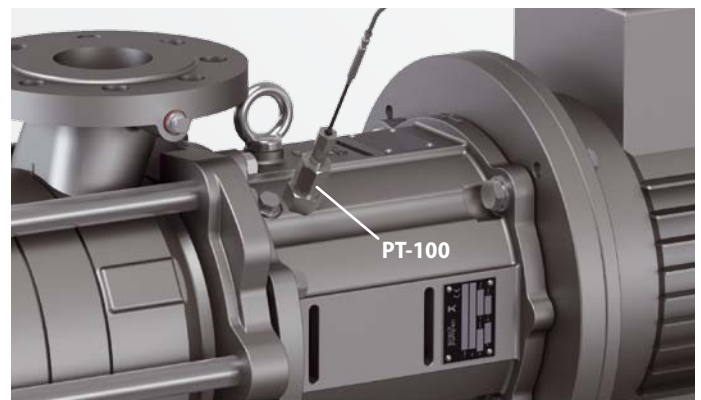
### Proven and with low eddy current losses

High-grade Hastelloy® separating cans come as standard with Speck. This robust material has proven its properties in daily use in many industries.

The finely graduated coupling and separating can diameters allow optimum design with minimum eddy current losses.

### Safety with temperature monitoring

If required (e. g. in areas with potentially explosive atmospheres), with Hastelloy® separating cans, temperature sensors can be mounted into the bracket to monitor the surface temperature of the separating can.



PT-100 temperature sensor (standard design)

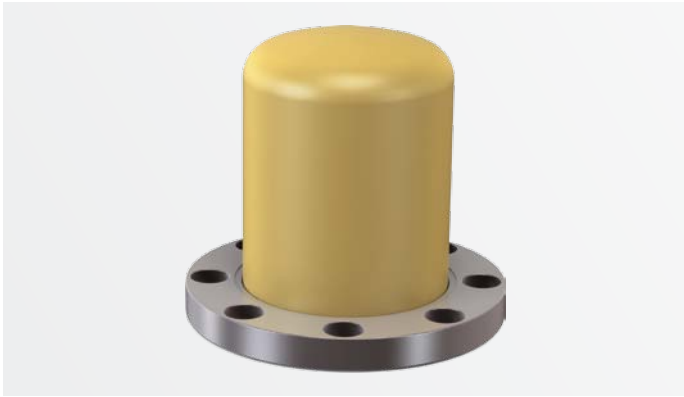
The universal linear PT-100 temperature sensor with a detection range from - 100 to + 400 °C is available in three versions.

- » Standard design
- » ATEX design without SIL/IPL2
- » ATEX design with SIL/IPL2

All three versions can be optimally adjusted for length using a compression fitting. In addition, the sensor tip is held against the separating can using a spring to guarantee secure contact.



## Ceramic $ZrO_2Mg$ separating cans



### No current eddy losses in the separating can

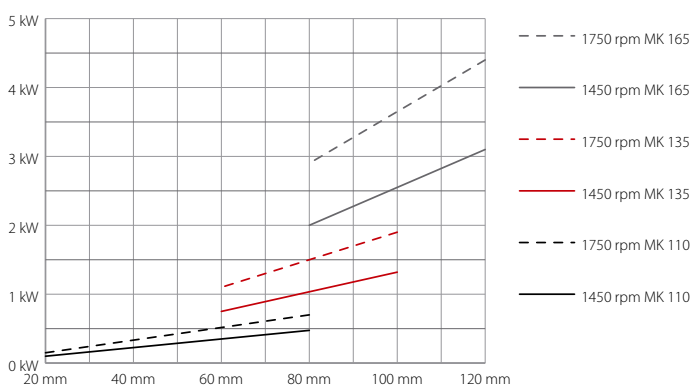
When non-conductive ceramics are used, no eddy currents occur within the coupling. This has two advantages.

### Energy savings

Magnetic fields cause eddy currents within metal separating cans, increasing the overall energy consumption of the pumps. Ceramic separating cans mean there are no eddy currents, leading to significant energy savings.

The graph below shows the additional energy consumption of a metal separating can in kW due to eddy currents. It shows the energy consumption in relation to the length of the magnet (in 10 mm increments) and to the diameters.

In the case of the largest separating can diameter, energy consumption rises to the power of three.



The additional energy consumption found in magnetic couplings with metal separating cans in kW due to electrical eddy currents is completely eliminated by using ceramic separating cans.

### No entry of heat into the medium

In metal separating cans, the electrical eddy currents described above are converted into thermal energy, thereby increasing the heat of the medium. With ATEX applications and media near vapour pressure, this can become a considerable problem.

Ceramic separating cans do not create losses of energy through eddy currents and the medium retains its temperature.

## Safety through leak detection

Separating cans often break as a result of vibrations caused, for example, by damaged bearings after they have been running dry, or by vibrations in the system.

In the event of a rupture, there is a danger of the medium getting into the motor through the motor casing, which must be avoided when explosive substances are being pumped.

For your safety we can offer a leak monitoring sensor which detects any medium emerging after a rupture of the separating can and immediately switches off the pump or the system.

In addition, the sealed slots on the bracket temporarily prevent the medium from entering the environment.

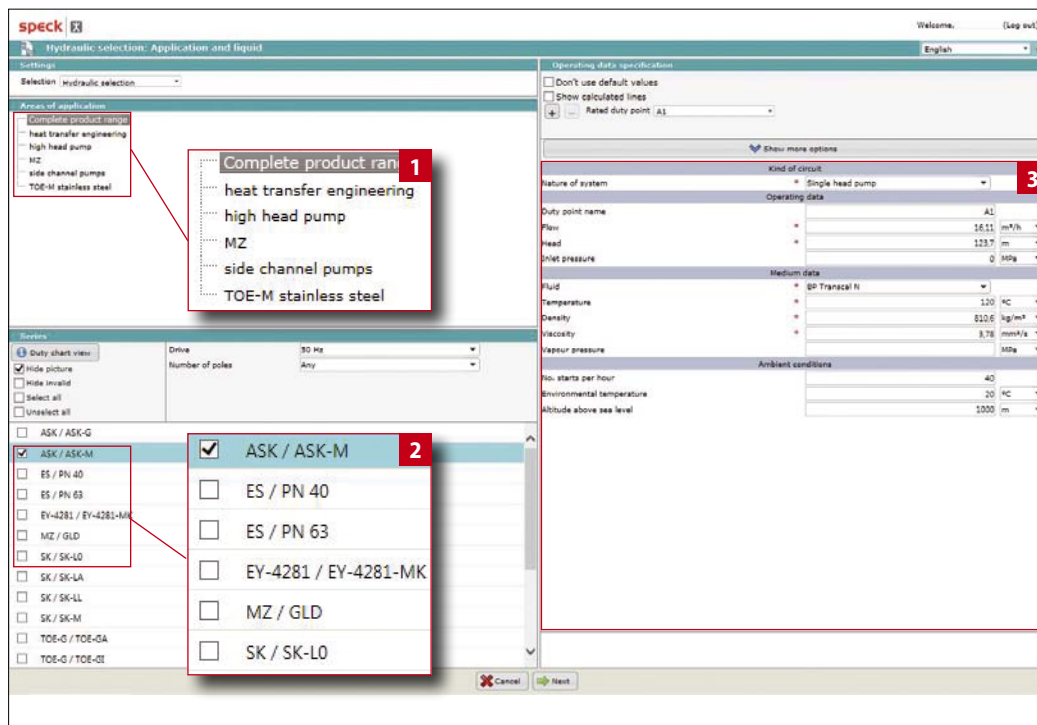
On request, we can also fit a pipe to the bracket to safely remove the pumped medium. The connector for the pipe is directly opposite the sensor.



- 1 Leak sensor
- 2 Externally sealed slots covered: the connector for the media removal pipe on the back of the bracket opposite the sensor

# Simple and optimal configuration software

## SPAIX selection program



The software allows you to configure heat transfer pumps, side channel pumps and boiler feed pumps via your Internet browser. As well as design details, the system will also request operating details and details about the medium to be pumped.

### Ideal for system planners

Speck now also offers the latest version 4 of the renowned SPAIX design software.

We make the program available to authorised customers who can pre-select the pumps within their system.

The web-based software always accesses an up-to-date database.

### Easy pre-selection

The configuration system avoids a wide range of selection parameters with regard to design, sealing systems, hydraulics, operating conditions and media.

The software has language options for German and English.

### Checking the pre-selection

When the order is submitted, the customer's choices are double-checked to ensure that your project requirements are met.

### Key

- 1 List of all pump designs that can be configured in the software
- 2 List of all series within the pump designs
- 3 Selection parameters operating parameters and medium data in the first instance
- 4 Characteristic curve depending on hydraulic selection generated

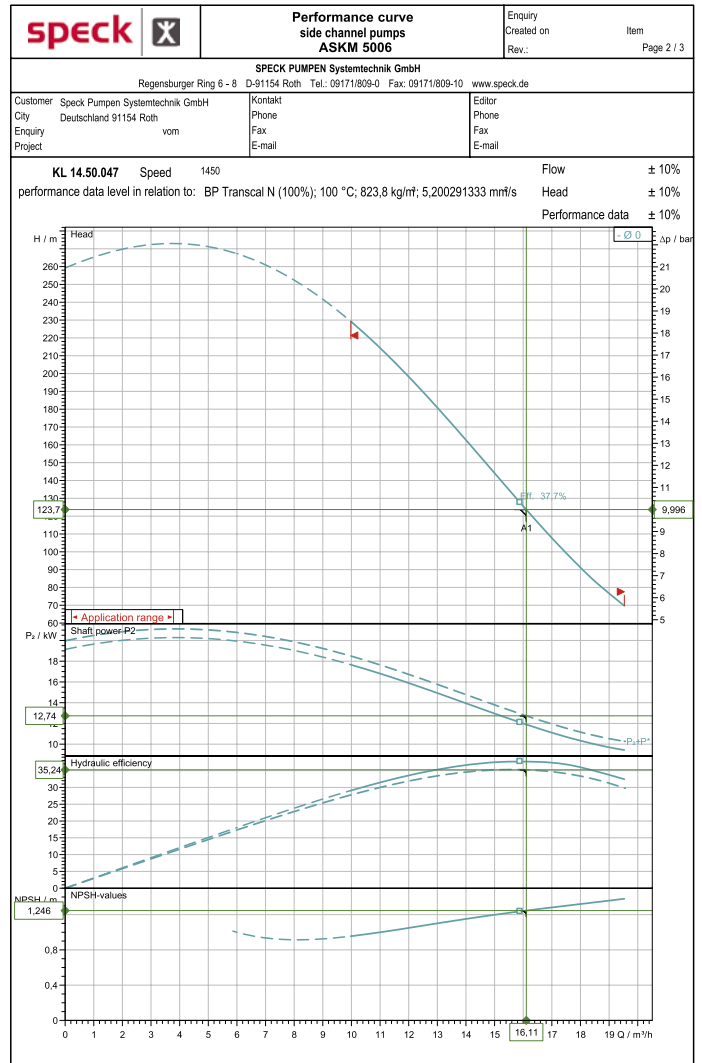


Characteristic curve depending on hydraulic selection

# Documentation based on the selection program

<b>speck</b>		<b>Data Sheet</b> side channel pumps <b>ASKM 5006</b>		Enquiry Created on Rev.: _____	Item Page 1 / 3
SPECK PUMPEN Systemtechnik GmbH Regensburger Ring 6-8 D-91154 Roth Tel.: 09171/809-0 Fax: 09171/809-10 www.speck.de					
Customer City Enquiry Project	Speck Pumpen Systemtechnik GmbH Deutschland 91154 Roth vom	Kontakt Phone Fax E-mail	Editor Phone Fax E-mail		
<b>Operating Data</b>					
1 Fluid	BP Transcal N	Flow rate	rated 16,11 m <sup>3</sup> /h	Speed	1450 1/min
2 Corrosive matters	keine/none	Wght.-%		Efficiency	35,24 %
3 Abrasive matters	keine/none	Wght.-%		Total abs. power	12,74 kW
4 Solids	Ø	Pressure	Inlet 9,996 bar (ü)	Dissipation	0,835 kW
5 Oper. Temp. tW / tS	100 / °C	Head	Disch. 123,7 m		
6 Density at tW / tS	823,8 / kg/m <sup>3</sup>	Pressure differential	10,00 bar (ü)		
7 Kin. viscosity at tW / tS	5,2 / mm <sup>2</sup> /s			Flow rate at cold start	m <sup>3</sup> /h
8 Vapor press. at tW / tS	7 / bar	NPSH	System required 1,75 m	Total abs. power at cold start	kW
9 PH value				Dissipation cold	kW
<b>Installation / Environment</b>					
10 Building / Outside	Gebäude	Altitude	< 1000 m	Amb. Temp. min	20 / 40 °C
11 under roof yes/no	Ja / Yes	ATEX aggregate category	not Alex	rel. Humidity	< 95 %
<b>Pumpe</b>					
12 Impeller type	side channel impeller	Pressure rating	PN 40	Pressure rating	PN 40
13 direction of rotation	left	Suction port	nom. diam. DN 100	Delivery port	nom. diam. DN 50
14		Standard	EN 1092-1	Standard	EN 1092-1
15 Single head pump	X 1	Specifying calming suction side s = min.	1000 mm	Material combination	11
<b>Accessories</b>					
<b>Motor</b>		<b>Magnetic drive</b>		<b>Base plate</b>	
17 Make	HOYER	Type	HMC2 180M-4	Description	135-060 bis 40 bar
18 Specific design	IE 2 / 50 Hz / Pole pairs 2	Number of poles	4	Description	U 400, 1500 L
19 Rated power	18,5 kW	Degree of p	IP 55	rated load torque	155 Nm
20 Rated current	34 A	Frequency	50 ± 2% Hz	Magnetic drive pow	22,1 kW
21 1-phase / 3-phase	3-	Voltage	400 ± 5% V	Length	1500 mm
22 Rated speed	1470 1/min	Mounting	IM B35	Width	400 mm
23 Motor flange ø	350 mm	Sound pressure level	dB(A)		
24					
25		terminal box, motor	oben		
<b>Materials</b>					
26 Suction casing	EN-GJS-400-15	Discharge casing	EN-GJS-400-15		
27 Stage	EN-GJL-250	side channel impeller	GBz		
28 Impeller	EN-GJL-250	Shaft	1.4122		
29 pump frame MK	EN-GJS-400-15				
30					
31					
32 seal stage	Teflon	O-ring pump frame	FKM	seal separating can	Graphit
<b>Tests and Inspections</b>					
33					
34 Suction casing	keine	keine	Hydrost. Pressure Test	keine	alle
35 Discharge casing	keine	keine	Gas Pressure Test	keine	alle
36 Stage	keine	keine	Performance curve	keine	alle
37 side channel impeller	keine	keine	NPSH-Measurement	keine	alle
38 Impeller	keine	keine	Final check	keine	alle
39			vibration	keine	alle
40			temperature	keine	alle
41			Max. operating pressure	40 bar / 20 °C   X   Factor 1,5   test time 30 min	
<b>Shipping data</b>					
42 Net weight appr.	kg	Gross weight appr.	kg	motor color	
<b>Documentation</b>					
43 Dimensional drwg	Cross sect. drwg	performance curve No.	Oper. & Instruct. Man.	Other (see attached)	Qty
44	RD 14. xxx	E 1420. xxx	KL 14.50.047	DE 1096.0851	1
<b>Remarks</b>					
45	motor article				
46	1) motor supplement corresponds to ISO 9908 2) according to EN 10284 3) volute casing & casing cover 4) without NPSH test 5) scope of deliv. to price sheet				

Technical data sheet (example)



Characteristic curve (example)

<b>speck</b>		<b>Dimension drawing</b> side channel pumps <b>ASKM 5006</b>		Customer Speck Pumpen Systemtechnik GmbH City Deutschland 91154 Roth	Kontakt Phone Fax E-Mail	Editor Phone Fax E-Mail	Created on Rev.: _____	Item Page 3 / 3																																																																																																				
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Aggregat	Motor	HOYER - HMC2 180M-4 - IM B35	<table border="1"> <tr> <th colspan="2">Anschlüsse</th> <th colspan="2">Dimensions in mm</th> </tr> <tr> <td>Suction port</td> <td>Delivery port</td> <td>a</td> <td>680</td> </tr> <tr> <td>EN 1092-1</td> <td>EN 1092-1</td> <td>m1</td> <td>728</td> </tr> <tr> <td>DN 100 PN 40</td> <td>DN 50 PN 40</td> <td>m2</td> <td>690</td> </tr> <tr> <td>ø D1 190 mm</td> <td>ø D1 125 mm</td> <td>m3</td> <td>353</td> </tr> <tr> <td>ø D2 22 mm</td> <td>ø D2 18 mm</td> <td>B1</td> <td>400</td> </tr> <tr> <td>D2 x 8</td> <td>D2 x 4</td> <td>B2</td> <td>500400</td> </tr> <tr> <td></td> <td></td> <td>B3</td> <td>500</td> </tr> <tr> <td></td> <td></td> <td>G1</td> <td>290</td> </tr> <tr> <td></td> <td></td> <td>G2</td> <td>110</td> </tr> <tr> <td></td> <td></td> <td>G3</td> <td>38</td> </tr> <tr> <td></td> <td></td> <td>G5</td> <td>477</td> </tr> <tr> <td></td> <td></td> <td>R1</td> <td>18,5</td> </tr> <tr> <td></td> <td></td> <td>L1</td> <td>1500</td> </tr> <tr> <td></td> <td></td> <td>L2</td> <td>100</td> </tr> <tr> <td></td> <td></td> <td>L3</td> <td>1300</td> </tr> <tr> <td></td> <td></td> <td>L5</td> <td>50</td> </tr> <tr> <td></td> <td></td> <td>P</td> <td>350</td> </tr> <tr> <td></td> <td></td> <td>B</td> <td>241</td> </tr> <tr> <td></td> <td></td> <td>BB</td> <td>315</td> </tr> <tr> <td></td> <td></td> <td>A'</td> <td>279</td> </tr> <tr> <td></td> <td></td> <td>AA</td> <td>70</td> </tr> <tr> <td></td> <td></td> <td>K</td> <td>14,5</td> </tr> <tr> <td></td> <td></td> <td>ø</td> <td>30</td> </tr> <tr> <td></td> <td></td> <td>Z</td> <td>1580</td> </tr> </table>						Anschlüsse		Dimensions in mm		Suction port	Delivery port	a	680	EN 1092-1	EN 1092-1	m1	728	DN 100 PN 40	DN 50 PN 40	m2	690	ø D1 190 mm	ø D1 125 mm	m3	353	ø D2 22 mm	ø D2 18 mm	B1	400	D2 x 8	D2 x 4	B2	500400			B3	500			G1	290			G2	110			G3	38			G5	477			R1	18,5			L1	1500			L2	100			L3	1300			L5	50			P	350			B	241			BB	315			A'	279			AA	70			K	14,5			ø	30			Z	1580
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			<p>* Die angegebenen Motormaße sind ca. Maße. Genauere Angaben richten sich nach dem an Anforderfall zusätzlich angegebene Fabrikat.</p> <p>* The indicated motor dimensions are approx. dimensions. Exact details correspond to the actual model used in every single order.</p> <p>* nur bei Grundplatten mit Laschen *only for base plates with flaps</p>																																																																																																									

Dimensional drawing (example)

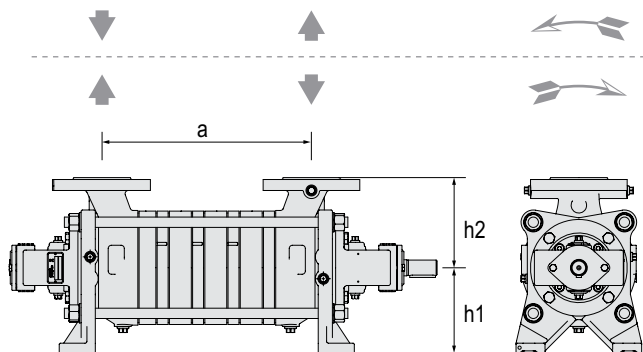
## Save projects

Interim configuration results such as characteristic curves, scale drawings or technical data sheets can be saved as a project and generated as a pdf file.

# Main dimensions

## SK series

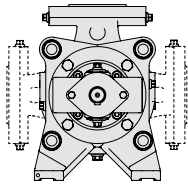
### Connecting dimensions for SKG-LL, SKG-L0, SKG-LA and SKM



Dimensions →	a									h1	h2	Flanges
Stage no. →	1	2	3	4	5	6	7	8	–	–	Suction / Discharge	
SK...20	120	120	154	188	222	256	290	324	100	100	DN 20	
SK...32 / 33	146	146	186	226	266	306	346	386	112	132	DN 32	
SK...40	160	215	270	325	380	435	490	545	132	140	DN 40	
SK...50	175	250	325	400	475	550	625	700	160	165	DN 50	
SK...65	195	285	375	465	555	645	735	825	180	180	DN 65	

### Position of inlet and outlet nozzle

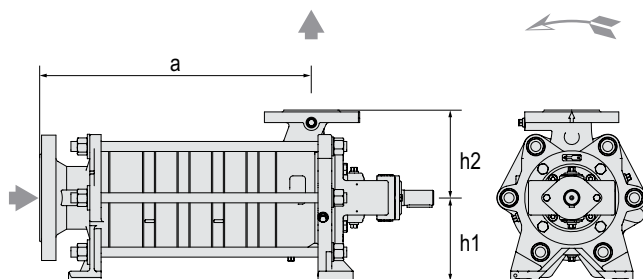
With almost all sizes, the nozzles can be rotated 90°



Size	Stage no.	
	1, 2, 3, 4, 5	6, 7, 8
SK...20	Nozzles at the side / on top	Nozzles at the side / on top
SK...32 / 33 / 40 / 50 / 65	Nozzles at the side / on top	Nozzles on top

## ASK series

### Connecting dimensions for ASKG and ASKM



Dimensions →	a									h1	h2	Flanges	
Stage no. →	1	2	3	4	5	6	7	8	–	–	Suction	Discharge	
ASK...20	195	229	263	297	331	365	399	433	100	100	DN 40	DN 20	
ASK...32 / 33	213	253	293	333	373	413	453	493	112	132	DN 65	DN 32	
ASK...40	268	323	378	433	488	543	598	653	132	140	DN 80	DN 40	
ASK...50	305	380	455	530	605	680	755	830	160	165	DN 100	DN 50	
ASK...65	337,5	427,5	517,5	607,5	697,5	787,5	877,5	967,5	180	180	DN 100	DN 65	

## Flanges

Flanges in acc. with EN 1092 PN 40.

Flanges in acc. with DIN EN 1092-2, drilled in acc. with ANSI 150 lbs or 300 lbs on request.

# Order-related tests and dimensioning

## Pressure tests

Speck carries out the tests below as standard:

### Gas pressure test

The gas pressure test is used to prove that the components are leak-proof. All components that bear pressure are tested, such as the discharge casing and the suction casing, stages and mechanical seal casing. The test is carried out with forming gas at 2 bar. The holding time is 15 minutes.

### Hydrostatic pressure test

The hydrostatic pressure test is used to prove strength of the components and that the pump is leak-proof. The fully assembled pump is tested. The test is carried out with a hydrostatic test pressure based on prEN 12162; the hydrostatic test pressure corresponds to 1.5 x the nominal pressure (PN16) at 20 °C. The holding time is 10 minutes.

If you want to use pressure tests according to different criteria, please enter them in the request.

## Testing the performance

At the customer's request, Speck offers the following tests:

### Hydraulic tests

The measurement of the characteristic curves apply to the delivery of water with a temperature of 20 °C at nominal speed. Tolerances: flow rate  $\pm 10\%$ , total head  $\pm 10\%$ , power requirement  $+ 10\%$ . Deviating properties of the media to be pumped affect the characteristic curves.

### NPSH test

In this test, the suction-side pressure is gradually reduced until the decrease in the delivered head reaches 3 % at a constant flow rate. At least four flows are evaluated that are spread appropriately over the admissible operating range. The NPSH value is not a guarantee point.

### Vibration test

Vibration test according to EN ISO 5199, Edition 2002. The vibration values are measured radially and vertically at every operating point on the bearing casing at the nominal speed and with the corresponding flow rate.

### Temperature measurement

The measurement is taken on the motor-side bearing at operating temperature. The operating temperature and the ambient temperature at every operating point measured are documented.

## Standard conditions at site

- » Ambient temperature from - 20 °C to + 40 °C
- » Permissible altitude up to 1000 m above sea level

Deviations from the site conditions specified herein must already be disclosed in the inquiry.

## Dimensioning

### Assessment of the maximum pump outlet pressure

- The pump outlet pressure at the pump nozzle depends on
  - » the pump inlet pressure
  - » the density of the medium to be pumped

The maximum pump outlet pressure  $p_{2\max\text{ op}}$  is calculated using the formula:

$$p_{2\max\text{ op}} = p_{1\max\text{ op}} + \rho \cdot g \cdot H \cdot 10^{-5}$$

With:

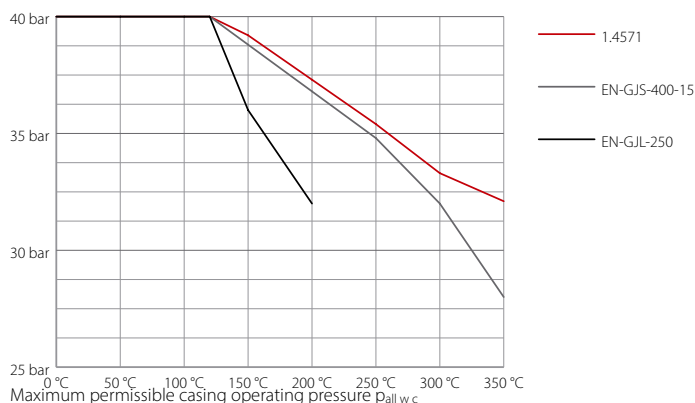
- $p_{2\max\text{ op}}$  = maximum pump outlet pressure [bar]
- $p_{1\max\text{ op}}$  = maximum pump inlet pressure [bar]
- $\rho$  = density of the medium to be pumped [kg/m<sup>3</sup>]
- $g$  = gravitation constant [m/s<sup>2</sup>]
- $H$  = maximum total head at zero flow or at the peak of the pump's characteristic curve [m]

Pumps must be selected and operated in a way which ensures that the maximum pump outlet pressure does by no means exceed the maximum permissible operating pressure of the casing  $p_{\text{all w c}}$  at operating pressure.

This also applies to commissioning while the discharge valve is closed (refer to diagram).

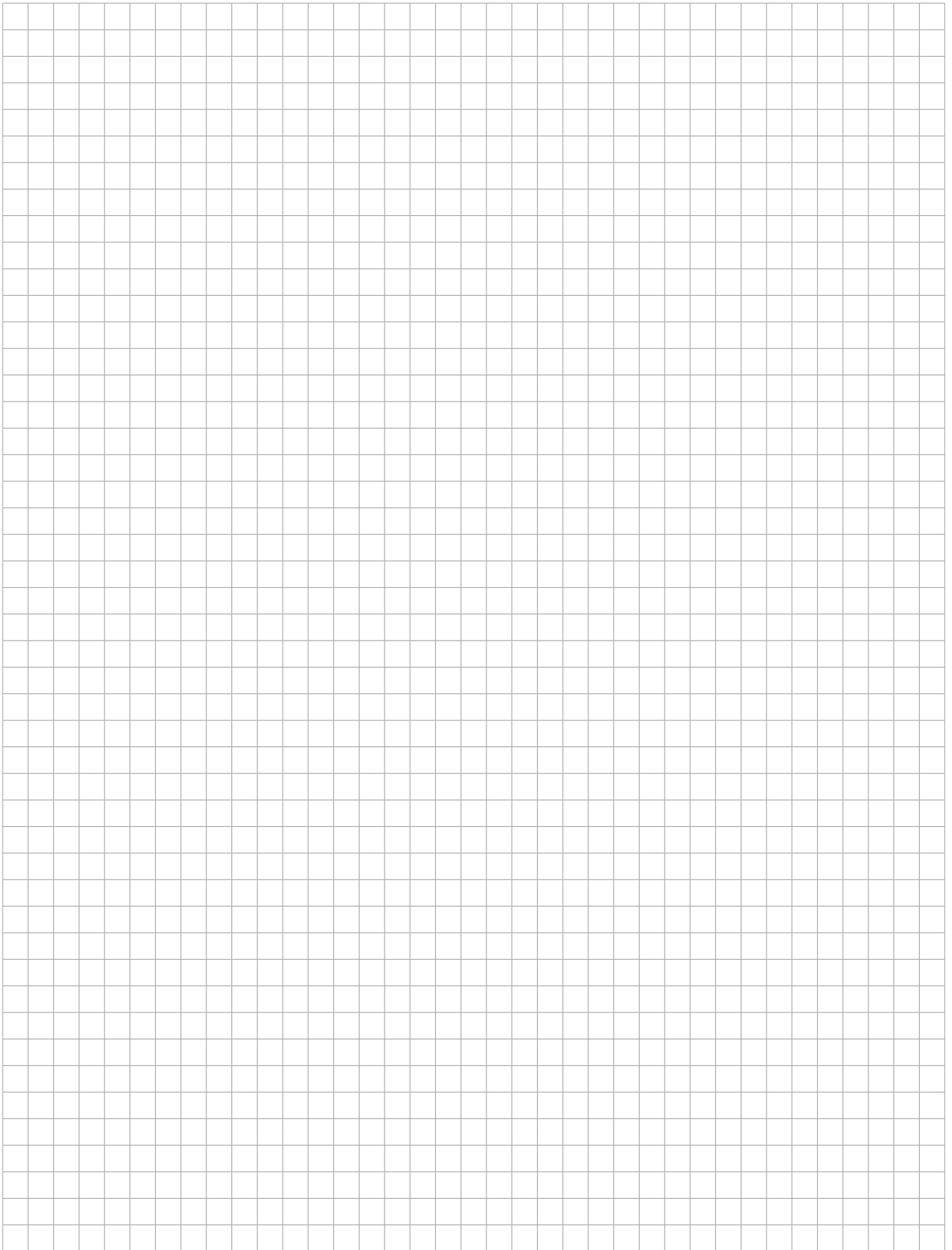
### Pressure and temperature limitations

The maximum casing operating pressure  $p_{\text{all w c}}$  of the pressure retaining parts depends on the operating temperature:



- 1.4571: stainless steel
- EN-GJS-400-15: spheroidal graphite cast iron
- EN-GJL-250: cast iron

*Your notes*



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