TOE-MI Series
Heat transfer pumps
for heat transfer oils up to 330 °C

With magnetic coupling in close coupled version
Volute casing in inline design
Hydraulic power ratings in acc. with EN 733

Volute casing PN 16
Bearing bracket 360

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Usage

Pumps of the TOE-MI series are designed for the transportation and recirculation of organic liquids on mineral oil or synthetic basis in heat transfer plants in acc. with DIN 4754.

They are suitable for clean media to be pumped which do not chemically attack the pump materials used.

Main applications

The pumps are mainly used in the following industrial sectors:

- Tempering in the plastics and die cast industry
- Baking ovens, large frying units as well as in the production of edible oil and dry mass for the food and feedstuff industries
- Heating of calenders and melting pots in the leather and rubber industry
- Heating of agitator and mixing tanks for the processing of colours, paints and lacquers
- Heating of tanks on stationary and FPSE platforms as well as in tank vessels
- Heating of press lines in the wood and pulp industry
- Flat glass production
- Solar power stations & ORC processes

Operating data

- Flow rate up to approx. 100 m^3/h
- Total heads up to approx. 50 m
- Max. operating temperatures up to + 330 °C

Standard conditions at site

- Relative humidity during continuous operation max. 55%
- Ambient temperature up 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.

Flow rate

The permissible operating range of centrifugal pumps depends on diverse factors such as

- impeller shape
- speed
- type of liquid
- viscosity
- bearing load
- heat dissipation - particularly with regard to insulated volute casings
- clearance between the net positive suction head of the plant and the pump
- size of magnet coupling

The hydraulic operating range applicable to the TOE-MI series is indicated in the individual performance curves and the pump data sheet.

Pump outlet pressure

The pump outlet pressure at the outlet nozzle depends on

- the pump inlet pressure
- the maximum total head of the selected impeller diameter
- the density of the medium to be pumped

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

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

With:

$p_{2max\ op}$ = maximum pump outlet pressure [bar]

$p_{1max\ op}$ = maximum pump inlet pressure [bar]

ρ = density of the medium to be pumped [kg/m^3]

g = gravitation constant [m/s^2]

H = maximum total head at zero flow or at the peak of the pump´s characteristic curve at the selected impeller diameter [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 $p_{all\ w\ c}$ at operating temperature.

This also applies to commissioning while the discharge valve is closed (refer to Fig. 1).

Pressure and temperature limitations

The maximum casing operating pressure $p_{all\ w\ c}$ of the volute casing and the casing cover depends on the operating temperature:

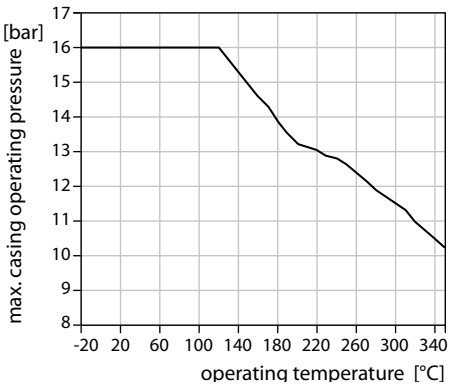


Fig. 1: Maximum permissible casing operating pressure $p_{all\ w\ c}$

Speeds

The operating speed of the pump shaft must not exceed the maximum permissible peripheral speed of the impeller, which corresponds to 48 m/s.

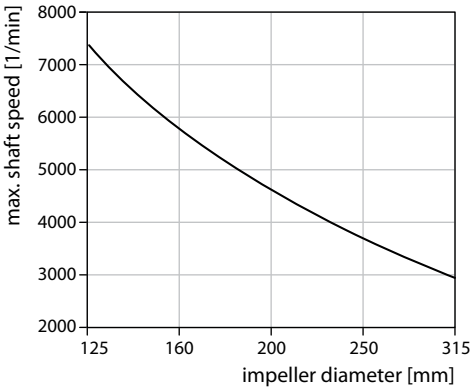


Fig. 2: Maximum permissible shaft speed

Denomination

The denomination of a centrifugal pump of the TOE-MI series with bearing bracket is illustrated in the following example:

TOE – M I 40 – 160 / 150

- Actual impeller diameter in mm
- Nominal impeller diameter in mm
- Nominal width of outlet nozzle
- Inline design
- Magnetic coupling
- Denomination of series

Design details

Pumps of the TOE-MI series are magnetically-coupled horizontal or vertical, single-stage, single-entry centrifugal pumps with volute casing, radial inlet and radial outlet in process design (disassembly of the plug-in unit while the volute casing remains in the conduit).

The hydraulic power ratings and all dimensions are in accordance with EN 733, 1995 issue.

The tolerances of the mating dimensions are subject to the EN 735 standard.

Allocation of components

Pumps of this series are part of a modular system, whose components can also be used for other pump series.
The complete plug-in unit including the impeller is used in the following series:

TOE-MN - base plate pumps with volute casing featuring axial inlet

TOE-MA - close coupled pumps with volute casing featuring axial inlet

TOE-MI - close coupled pumps with volute casing in inline design

For the parts allocation, refer to page 11.

Materials

Volute casing	EN-GJS-400-15	EN-GJS-400-18-LT
Casing cover	EN-GJS-400-15	EN-GJS-400-18-LT
Impeller	EN-GJL-250	
Bracket	EN-GJS-400-15	EN-GJS-400-18-LT
Bearing casing	EN-GJL-250	
Shafts	1.4122	
Plain bearing	S SiC	
Magnets	Sm_2Co_{17}	
Separating can	1.4571 / 2.4610	

EN-GJS-400-15 = EN-JS1030 = GGG-40
EN-GJS-400-18LT = EN-JS-1025 = GGG-40.3
EN-GJL-250 = EN-JL1040 = GG-25

Tab. 1: Materials

Volute casing

The nominal pressure of the volute casing is PN 16.

The outlet and inlet nozzles are fitted with bosses to allow for the subsequent connection of pressure gauges. These ports are only drilled upon request of the customer.

The volute casings are self-venting and may be provided with a plugged drain (G 3/8) when positioned vertically.

Nozzle positions and flanges

Inlet nozzle	radial to the bottom
Outlet nozzle	radial to the top
Flange dimensions	EN 1092-2 (for the corresponding dimensions, refer to the dimension chart)

Tab. 2 : Nozzle positions

Plain bearing bracket

The plain bearing bracket consists of the casing cover, the plain bearing cartridge, the internal rotor and the separating can.

Casing cover

The casing cover accomodates the plain bearing cartridge and the separating can. Depending on the torque to be transferred, the design of the casing cover allows for the use of different magnetic coupling sizes.

Plain bearing cartridge

The plain bearing cartridge carries the internal rotor and consists of the plain bearing casing, the bearing bushings and the bearing sleeves, which support the radial load and the remaining axial thrust.

Internal rotor

The internal rotor consists of the impeller, the shaft and the internal magnetic rotor. Most of the axial forces generated during operation are hydraulically compensated by the impeller.

Via a flow control system, the internal magnetic rotor is continuously cooled with the medium to be pumped to dissipate the heat additionally generated during operation by eddy current, viscosity and bearing friction loss. This way, light ends are prevented from accumulating in the area of the magnetic drive and the plain bearings.

The internal rotor is equipped with a start-up safety device, preventing the separating can from being internally destructed by the rotor in case of a plain bearing failure.

Separating can

Together with the casing cover and the volute casing, the separating can hermetically seals the part of the pump which is in contact with the media to be pumped.

Plug-in unit

= plain bearing bracket + impeller
The plain bearing bracket and the volute casing form the pump part which is in direct with the medium.

External rotor

The external rotor consists of the shaft and the external magnetic rotor. It transfers the torque exerted by the drive via the magnetic coupling to the internal rotor.

The external rotor is equipped with a start-up safety device, preventing the separating can from being externally destructed by the rotor in case of a ball bearing failure.

Magnetic coupling

The magnetic coupling consists of the following components:

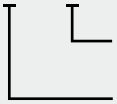
- internal magnetic rotor
- separating can
- external magnetic rotor

Four different coupling sizes with different magnetic lengths are available.

The transferable torques range between 10 and 500 Nm at ambient temperature.

Designation example of a magnetic coupling:

135 - 70



Magnetic length (mm)

Nominal magnetic coupling diameter (mm)

Allocation of the magnetic coupling sizes to be used for the different pump sizes:

Sizes	Nominal impeller diameter in mm		
	160	200	250
	possible magnetic coupling sizes		
32	-	-	-
40	75 / 110	75 / 110	-
50	-	75 / 110 / 135	-
65	-	75 / 110 / 135	-
80	-	-	-

Each magnetic coupling is sized individually by means of an EDP sizing program.

Bracket

In its function as variant carrier of the different pump types TOE-MN, TOE-MA and TOE-MI, the bracket accomodates on one side the inner part and, on the other side, the outer part of the pump. The bracket is provided with radial cooling slots, which support the heat dissipation in the area of the magnetic coupling.

Utility connections

For the exact positions and dimensions of the utility connections, refer to the dimension drawings of the pump on pages 8 and 9.

Accessories

Separating can temperature monitoring

The bracket features threaded connections for the installation of a temperature sensor (PT 100) in case the separating can´s surface temperature is to be monitored. The temperature sensor can be supplied with the pump. Non-required threaded connections are closed by a screw plug.

Load monitor

A load monitor with start-up override and release delay can be optionally supplied to monitor the pump for underload and overload or as dry running protection. This load monitor allows for the monitoring of the power factor (cos φ) or the active power of the motor and, hence, of the pump aggregate´s operating state.

Drives

Surface-cooled three-phase asynchronous motors for low voltages with cage rotor

- design IM B5
- degree of protection IP 54
- insulation class F
- power ratings and dimensions in acc. with DIN 42673 / IEC 72
- make according to our choice

Other motor versions are available upon request.

If the motors are provided by the customer, a sufficient cooling power of the motor fan must be ensured (> 3 m/s flow rate measured at the motor's bearing shield at the pump side).

Tests

If required, test certificates in acc. with DIN 55350-18 can be provided for the individual tests, which, however, has to be indicated in the order.

Material tests in acc. with EN 10204

The exact scope of the tests (which test for which parts) as well as the type of certificate (certificate of compliance with the order, factory certificate, inspection certificate) must be specified in the order.

Non-specific material tests do not have any impact on the delivery time of the pump.

If specific material tests are required, the delivery time of the pump depends on the availability of raw materials and will be checked on a case-to-case basis.
Test certificates for specific material tests cannot be provided after the raw materials and/or semi-finished goods have been negotiated.

Gas pressure tests

All pressure bearing parts, e.g.

- volute casing
- casing cover

are subject to a gas pressure test (leakage test).

The gas pressure test is carried out by applying forming gas at 2 bar. The holding time is 15 minutes. By means of this test, the tightness of the parts is proven.

Hydrostatic pressure test

All pressure bearing parts are subject to a pressure test, during which the hydrostatic test pressure (p_{test}) corresponds to 1.3 times the basic design pressure (p_N) at 20° C, following the recommendations of prEN 12162. The holding time is 10 minutes.

If pressure tests are to be carried out in acc. with other criteria, such criteria must be indicated in the inquiry.

By means of this test, the strength of the parts is proven.

Hydraulic tests (performance curves)

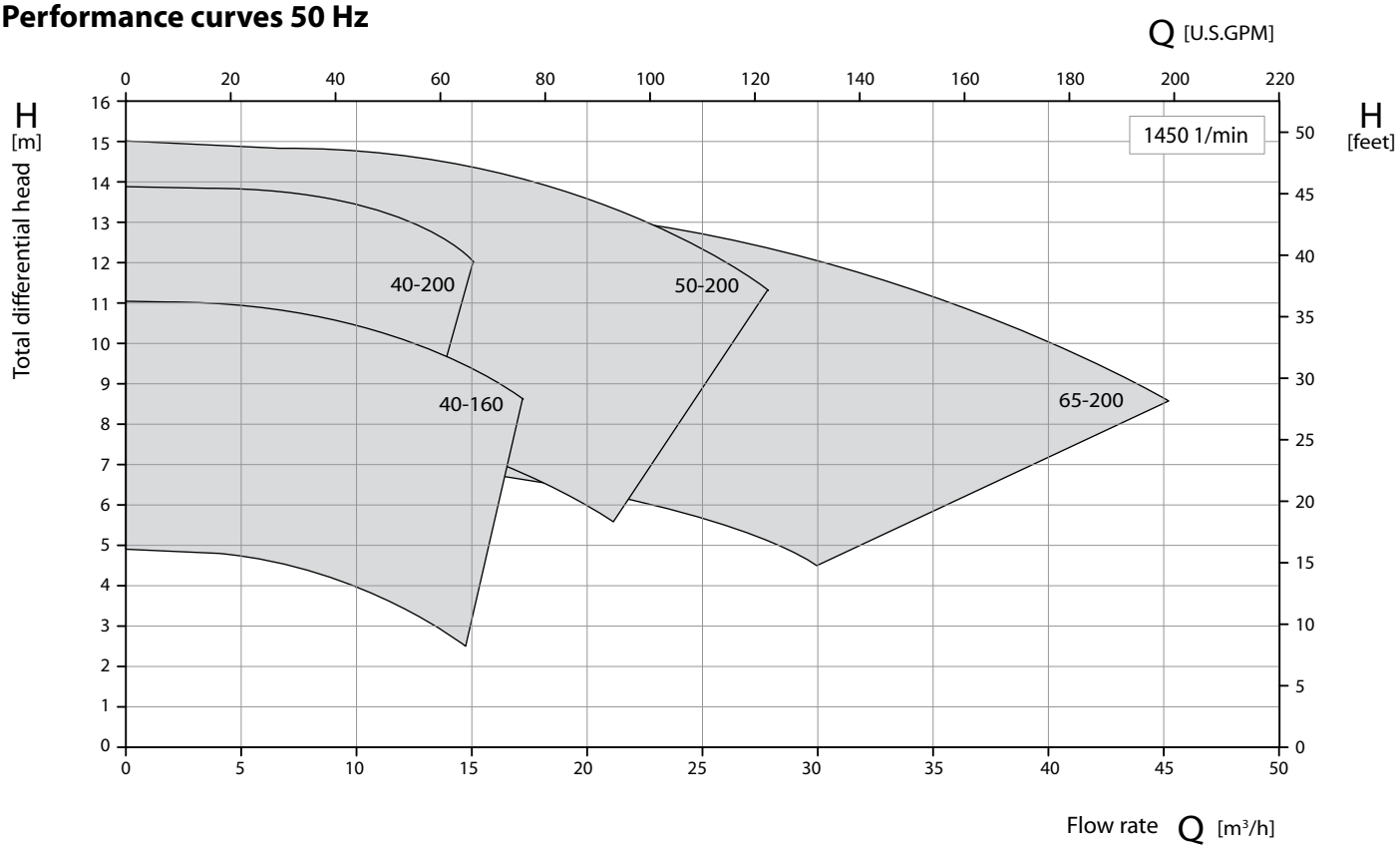
If required, hydraulic tests in acc. with ISO 9906, accuracy class II, can be implemented and the performance curves measured for the corresponding impeller diameter documented.

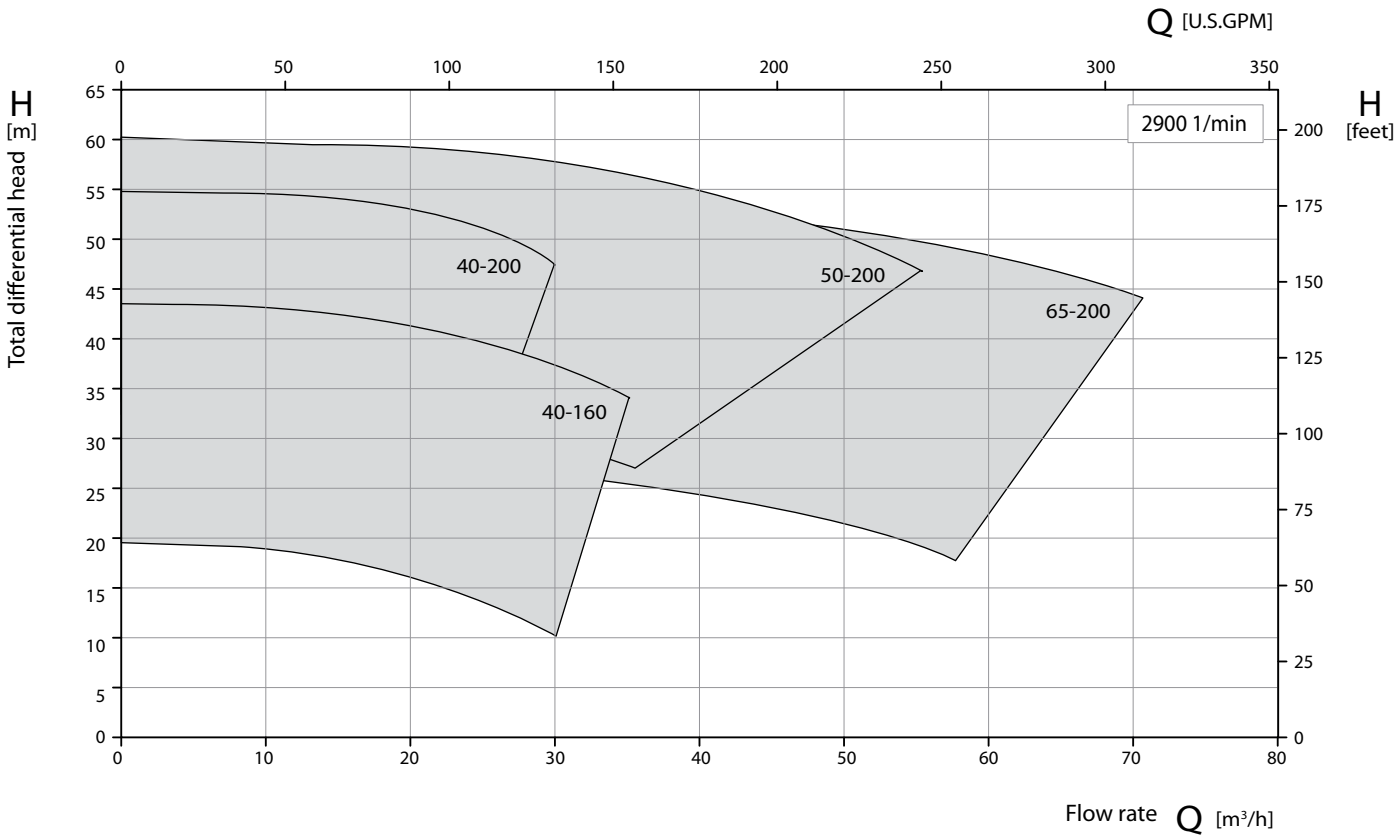
This option has to be indicated accordingly in the order. The purpose of this test is to verify that the duty point of the manufactured pump complies with the contractual duty point.

Painting

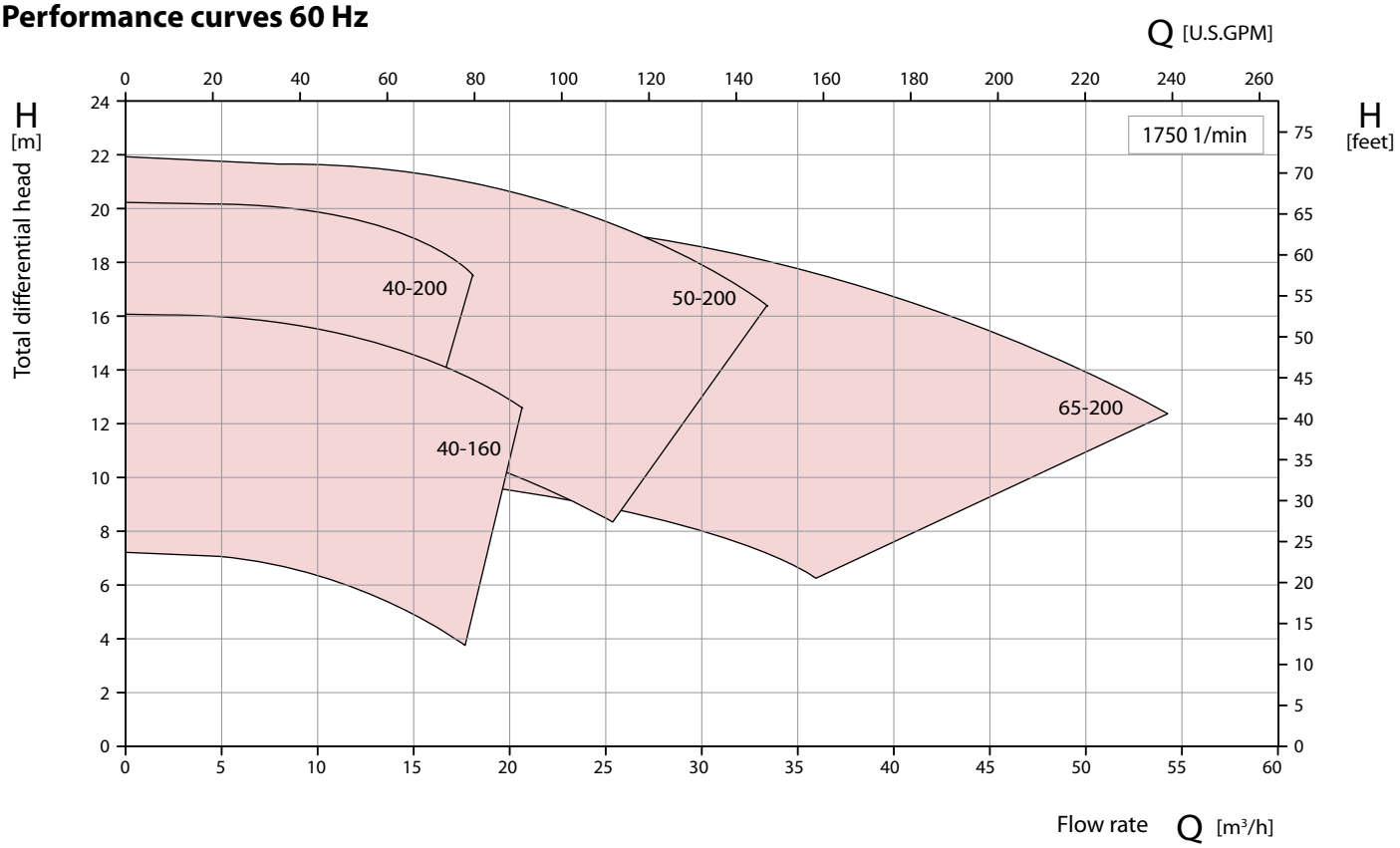
The pumps are coated with highly heat-resistant white aluminium paint, colour code RAL 9006.

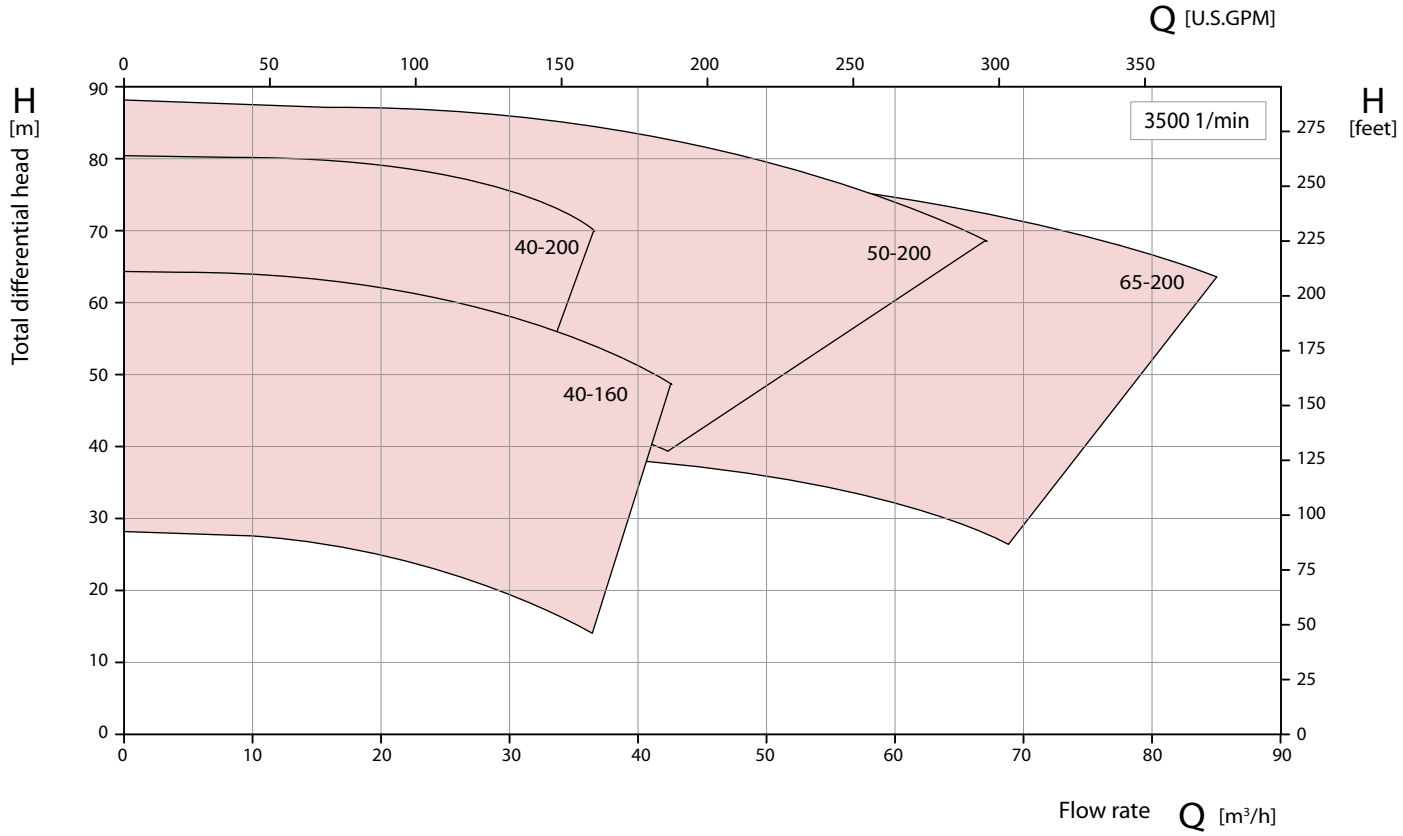
Performance curves 50 Hz



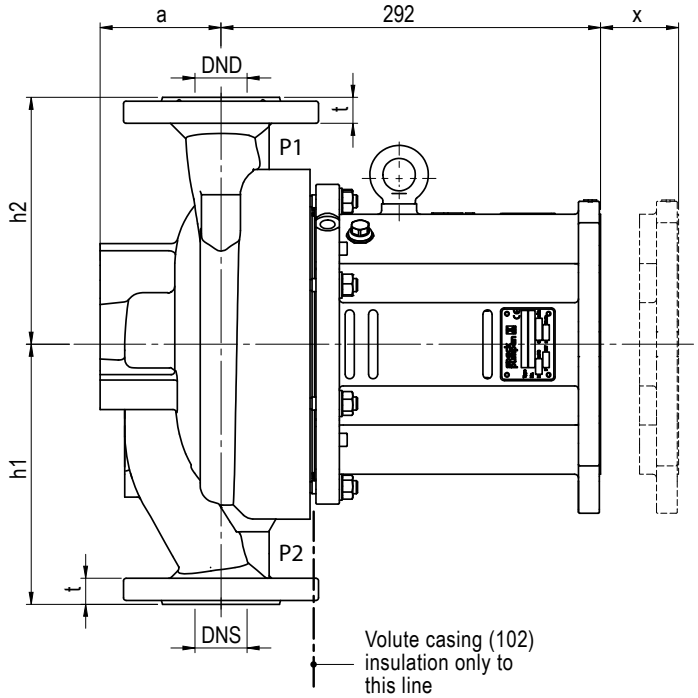


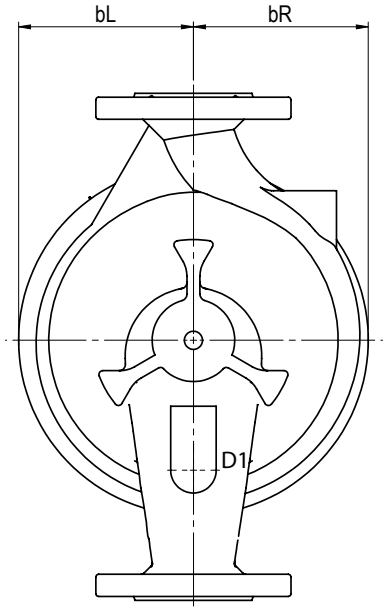
Performance curves 60 Hz

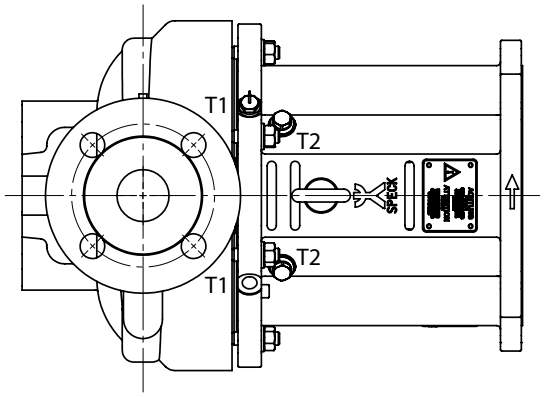




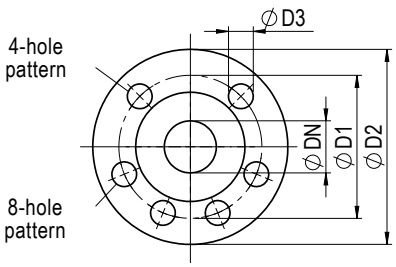
Pump dimensions







Flange dimensions EN 1092-2



Pump	Pump dimensions							Pull-out
Size	DNS	DND	a	bL	bR	h1	h2	x
40-160	40	40	97	116	116	200	190	110
40-200			93	135	135			
50-200	50	50	102	126	139	220	205	
65-200	65	65	112	131	151	240	225	

Utility connections and flange dimensions

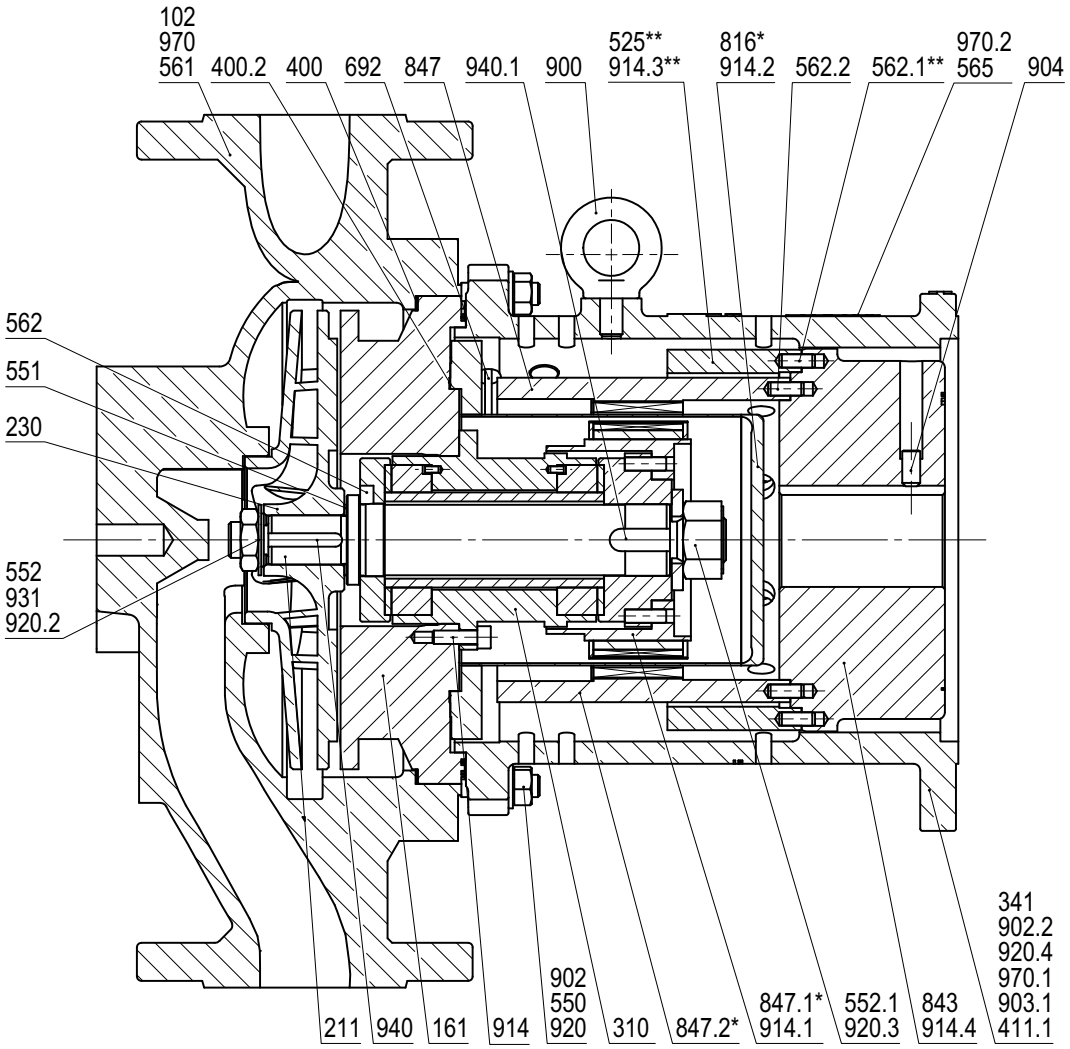
Utility connections

P1	Outlet pressure indicator connection (not drilled)	G 1/4
P2	Inlet pressure indicator connection (not drilled)	G 1/8
D1	Volute casing drain	G 3/8
T1	Temperature sensor PT 100 MK 110 / 135	G 1/4
T2	Temperature sensor PT 100 MK 75	G 1/4

Flange dimensions in acc. with DIN EN 1092-2

øDN	øD2	øD1	t	øD3	Qt. Holes
32	140	100	18	19	4
40	150	110	18		
50	165	125	20		
65	185	145	20		
80	200	160	22		8
100	220	180	24		

Cross-sectional drawing and part list



Standard design with nominal impeller diameter 160 and 200 mm

102	Volute casing
161	Casing cover
211	Shaft
230	Impeller
310	Bearing complete
341	Bracket
400, 400.2	Flat gasket
411.1	Ring gasket
525**	Distance sleeve
550	Washer

551	Shim washer
552 - 552.1	Disk spring
561	Grooved pin
562-562.1**, 562.2	Parallel pin
565	Rivet
692	Temperature sensor
816*	Separating can
843	Coupling insert
847	Magnetic coupling, complete
847.1*	Internal rotor

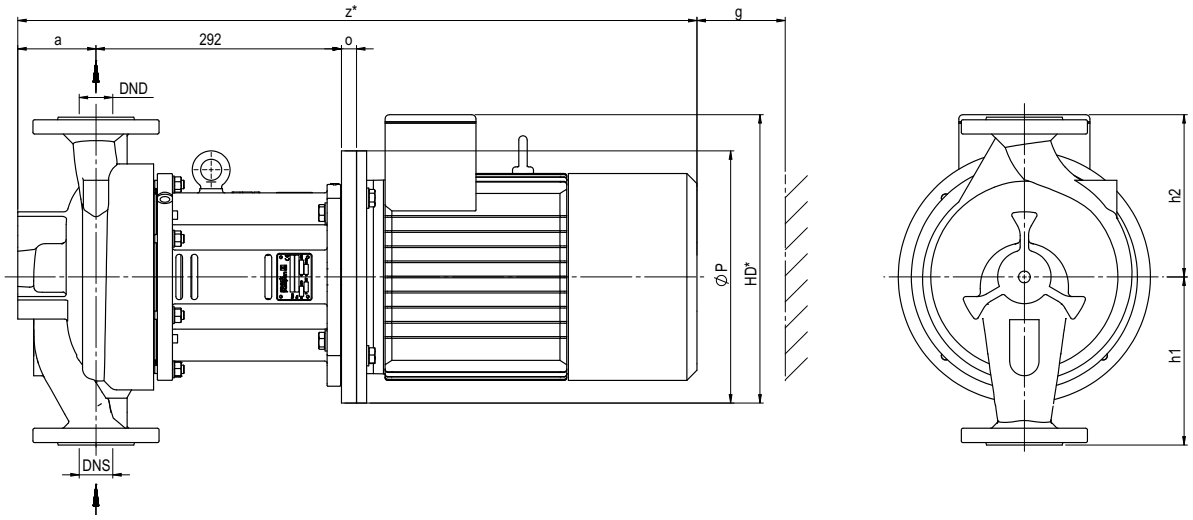
847.2*	External rotor
900	Ring bolt
902, 902.2	Stud
903.1	Screwed plug
904	Set screw
914-914.3**, 914.4	Socket head cap screw
920, 920.2-920.4	Hexagon nut
931	Lock washer
940-940.1	Key
970-970.2	Plate

* Single components of magnetic coupling (847)
** Execution with MK 75 / 110 only

Interchangeability of parts in between TOE-MN / MA / MI series

Component	Position	Pump type	Pump size											
			32-160	32-200	32-250	40-160	40-200	40-250	50-160	50-200	50-250	65-160	65-200	80-160
Volute casing	102	TOE-MN / MA	1	2	3	4	5	6	7	8	9	10	11	12
		TOE-MI	0			1	2	0		3	0		4	0
Casing cover	161	TOE-MN / MA	1	2		1	2	2	1	2	2	1	2	2
		TOE-MI	0			1	2	0		2	0		2	0
Shaft	211	TOE-MN / MA / MI	1											
Shaft	212	TOE-MN	1											
		TOE-MA / MI	0											
Impeller	230	TOE-MN / MA	1	2	3	4	5	6	7	8	9	10	11	12
		TOE-MI	0			1	2	0		3	0		4	0
Bearing	310	TOE-MN / MA / MI	1											
Ball bearing	320	TOE-MN	1											
		TOE-MA / MI	0											
Bearing housing	330	TOE-MN	1											
		TOE-MA / MI	0											
Bracket	341	TOE-MN / MA / MI	0											
Bearing cover	360	TOE-MN	1											
		TOE-MA / MI	0											
Shaft sealing	420	TOE-MN	1											
		TOE-MA / MI	0											
Counter flange	720	TOE-MN / MA	0		1	0		1	0		1	0		
		TOE-MI	0											
Flat gasket	400	TOE-MN / MA / MI	1											
Flat gasket	400.1	TOE-MN / MA	0		1	0		1	0		1	0		
		TOE-MI	0											
Flat gasket	400.2	TOE-MN / MA / MI	1											
Distance sleeve MK 75 / 110	525	TOE-MN / MA / MI	1											
Distance sleeve MK 135	525	TOE-MN / MA / MI	0											
Coupling insert	843	TOE-MN / MA / MI	1											
Magnetic coupling	847	TOE-MN / MA / MI	1											
Other parts		TOE-MN / MA / MI	1											

Dimensional drawing



Pump	Motor			Power kW		Pump dimensions					Pump set dimensions				
Size	Frame size	De-sign	P,ø	4-pole	2-pole	DNS	DND	a	h1	h2	øD	HD*	g	o	z*
				1450 / 1750	2900 / 3500										
	80		250	0.55 / 0.75	0.75 / 1.1						19	254	30	-	744
	90 S		250	1.1	1.5						24	273	35	-	733
	90L		250	1.5	2.2							273		-	758
	100L		250	2.2 / 3	3						28	280	50	-	792
40-160	112M	B5	250	4	4	40	40	97	200	190		293		-	809
	132 S		250	5.5	5.5 / 7.5						38	313	100	-	915
			300									343		18	912
	132M		250	7.5	-							313		-	915
			300									343		18	912
	80		250	0.55 / 0.75	0.75 / 1.1						19	254	30	-	740
	90 S		250	1.1	1.5						24	273	35	-	729
	90L		250	1.5	2.2							273		-	754
	100L		250	2.2 / 3	3						28	280	50	-	788
40-200	112M	B5	250	4	4	40	40	93	200	190		293		-	805
	132 S		250	5.5	5.5 / 7.5						38	313	100	-	911
			300									343		18	908
	132M		250	7.5	-							313		-	911
			300									343		18	908
	80		250	0.55 / 0.75	0.75 / 1.1						19	254	30	-	749
	90 S		250	1.1	1.5						24	273	35	-	738
	90L		250	1.5	2.2							273		-	763
	100L		250	2.2 / 3	3						28	280	50	-	797
50-200	112M	B5	250	4	4	50	50	102	220	205		293		-	814
	132 S		250	5.5	5.5 / 7.5						38	313	100	-	920
			300									343		18	917
	132M		250	7.5	-							313		-	920
			300									343		18	917
	90 S		250	1.1	1.5						24	273	35	-	748
	90L		250	1.5	2.2							273		-	773
	100L		250	2.2 / 3	3						28	280	50	-	807
	112M		250	4	4							293		-	824
65-200	132 S	B5	250	5.5	5.5 / 7.5	65	65	112	240	225		313		-	930
			300								38	343	100	18	927
	132M		250	7.5	-							313		-	930
			300									343		18	927

*Dimensions can differ depending on the motor supplier.

Pump data sheet

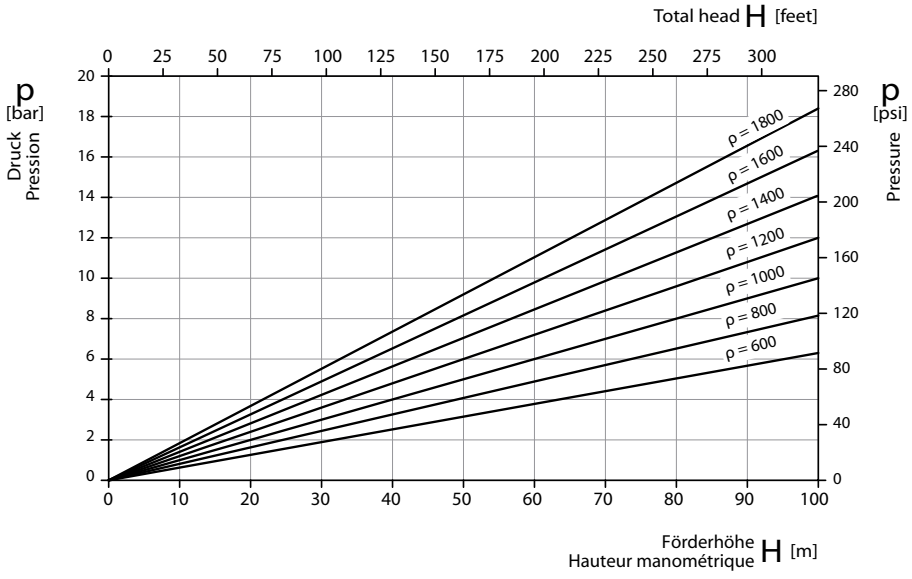
	speck pumpen	**Heat Transfer Pump Technical Data Sheet**							Quotation				
		Pump Model							Date				
									Item				
	SPECK PUMPEN Systemtechnik GmbH												
	Regensburger Ring 6 - 8 D-91154 Roth Tel.: 09171/809-0 Fax: 09171/809-10 www.speck-pumps.de												
1	**Pump Model:**			**Quantity:**									
2	Customer			Location					Page:		of:		pages
3	Phone			Fax					Iss. / Dpt.:				
4	Contact			E-Mail					Phone:				
5	PO			dated					Fax:				
6	Project			Pump No.					E-Mail				
	Installation / Environment												
7	Building / Outside			Altitude		m	Amb. temp		Start-up temp.		rel. Humidity		
8	under roof yes/no			Hazardous area		-	min.:	max:	min.:	°C	%		
	Operating (Contractual) Data												
9	Fluid			Flow rate	rated		m³/h		Reference Speed			1/min	
10	corrosive matters		Wght.-%		min / max		m³/h		direction of rotation 1)			-	
11	abrasive matters		Wght.-%	Pressure	Inlet		bar (ü)		Hydr. efficiency			%	
12	Solid content		Wght.-%		Disch.		bar (ü)		hydr. power cons.			kW	
13	**Oper. Temp. tA**		°C	Tot. Diff. Head rated			m		power loss			kW	
14	**Density @ tA**		kg/m³	pressure differential			bar		Total abs. power			kW	
15	**Kin. viscosity @tA**		mm²/s	NPSH	available		m		abs. power at cold start			kW	
16	**Vapor press. @ tA**		bar (a)		required		m		Duty point data to		DIN EN ISO 9906 Cl. 2		
	Pump design												
17	Impeller-Ø		mm	Inlet-nozzle	nom. diam. DN				Bearings	impeller side	coupling side		
18	No of stages		-		location				Type				
19	nom. pressure PN		bar		machined to				Lubrication				
20	max. all. Cas. press. @ tA		bar	Outlet-nozzle	nom. diam. DN				Shaft seal	Mechanical seal			
21	Cooling 'C' / Heating 'H'				location				Type				
22	Volute casing	Casing cover	Bearing bracket		machined to				Size				
23	-	-	-	Sound pressure level 2)		-	dB(A)		Quench yes/no				
	Accessories												
24	AC Electric Motor	Power	kW	Frame		Ex-protection			Coupling	Size/Spacer	/	mm	
25		Frequency	Hz	Enclos.		Make				Make			
26		Voltage	V	Construct.		Delivered by				Type			
27		Nom. Speed	1/min	Current		mounted by			Baseplate				
	Materials												
28	Volute casing			bearing bracket					containm. shell				
29	Casing cover			motor lantern					sleeve bearing				
30	Impeller			cas. wear ring					coupl.+guard		/		
31	Shaft			imp. wear ring					Baseplate				
	Tests and Inspections												
32	**1. Material Tests:**	**Kind of Test**		**Test Certificate** 3)		**4. Other Tests Tests:**			**Wittnessed by:**			**Test Certif.**	
33	1.1 volute casing					4.1 **Hydrost. Pressure Test** 4)							
34	1.2 Cas. Cover					4.2 **Gas Pressure Test**							
35	1.3 Bearing frame					4.3 **Performance curve** 5)							
36	1.4 Impeller					4.4 **Final check**							
37	1.5 Shaft					4.5							
38	1.6					4.6							
	Shipping data 6)												
39	Total net weight appr. kg / Total gross weight appr. kg												
	Documentation												
40	**Dimensional drwg.**	**Cross sect. drwg**		**Performance curve**		**Oper. & Instruct. Man.**			**Other (see attached)**		**Qty each**	**fold**	
41											Language		
	Remarks												
42	◥ = min. information required for quotation												
43	1) = seen from driver to pump 2) = calcul. to EUROPUMP												
44	3) = acc. to EN 10204 4) = volute casing & casing cover												
45	5) = without NPSH-Test 6) = scope of supply see price sheet												
46	Revision:		Issued:						Date:				

Substance data of heat transfer media

	Water		Marlotherm® SH		Syltherm® XLT		Galden® HT 200	
Temperature	ρ Density	v Kinematic viscosity	ρ Density	v Kinematic viscosity	ρ Density	v Kinematic viscosity	ρ Density	v Kinematic viscosity
[°C]	[kg/m³]	[mm²/s]	[kg/m³]	[mm²/s]	[kg/m³]	[mm²/s]	[kg/m³]	[mm²/s]
-40	–	–	–	–	–	–	1935	80,00
0	1000	1,789	1058	321,00	862	2,40	1845	5,20
40	992	0,658	1030	16,50	827	1,34	1755	1,80
100	958	0,294	987	3,10	769	0,73	1625	0,86
150	917	0,201	951	1,60	714	0,50	1520	0,41
160			944	1,40	702	0,48	1490	0,38
180			930	1,20	678	0,43	1445	0,36
200			915	0,92	652	0,40		
220			901	0,77	624	0,37		
240			887	0,65	595	0,35		
260			873	0,57	563	0,34		
280			858	0,50				
300			844	0,45				
320			830	0,40				
340			815	0,36				

Conversion

Reference between height and pressure at different gravities



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- Heat Transfer Pumps with mechanical seal
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- Pumps - Standard EN 734
- With NPSH-Stage
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