



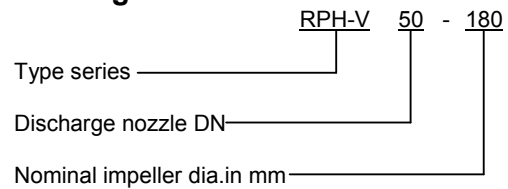
## 1. Application

RPH-V pumps are mainly used in refineries as well as in chemical and petrochemical plants.

## 2. Design

Vertical, radially split volute casing pumps to API 610 11<sup>th</sup> edition, and ISO 13709 (heavy duty), with radial impeller, single-flow, single-stage.

## 3. Designation

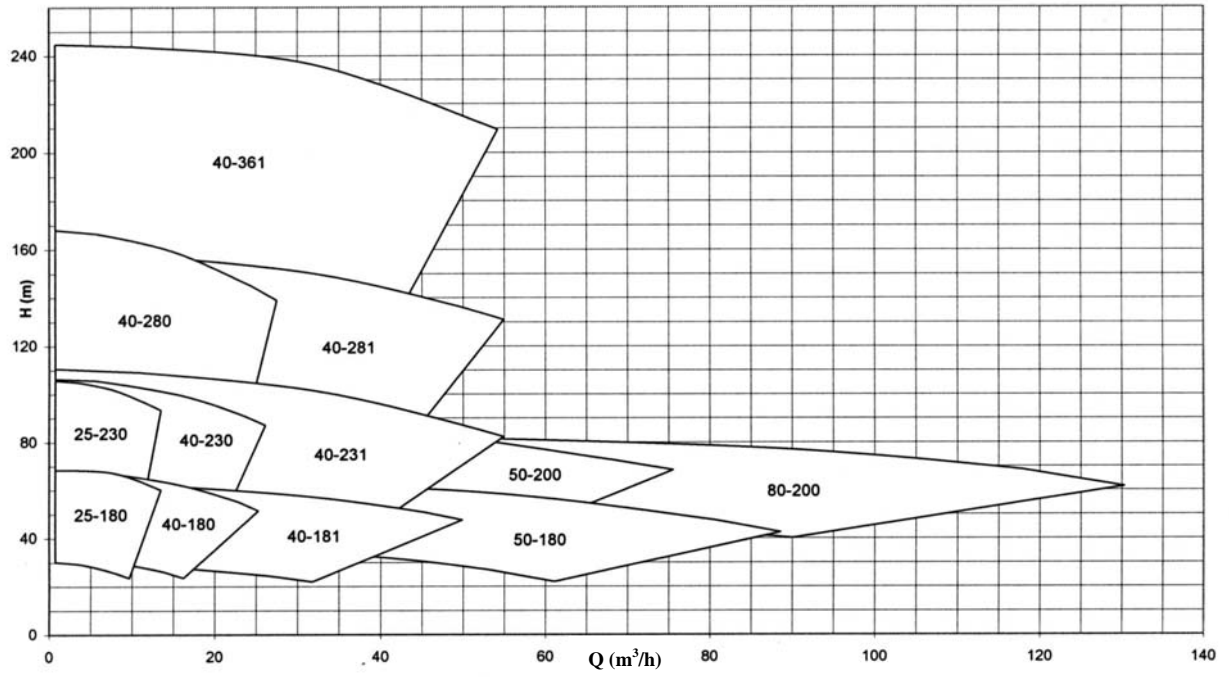


## 4. Operating Data

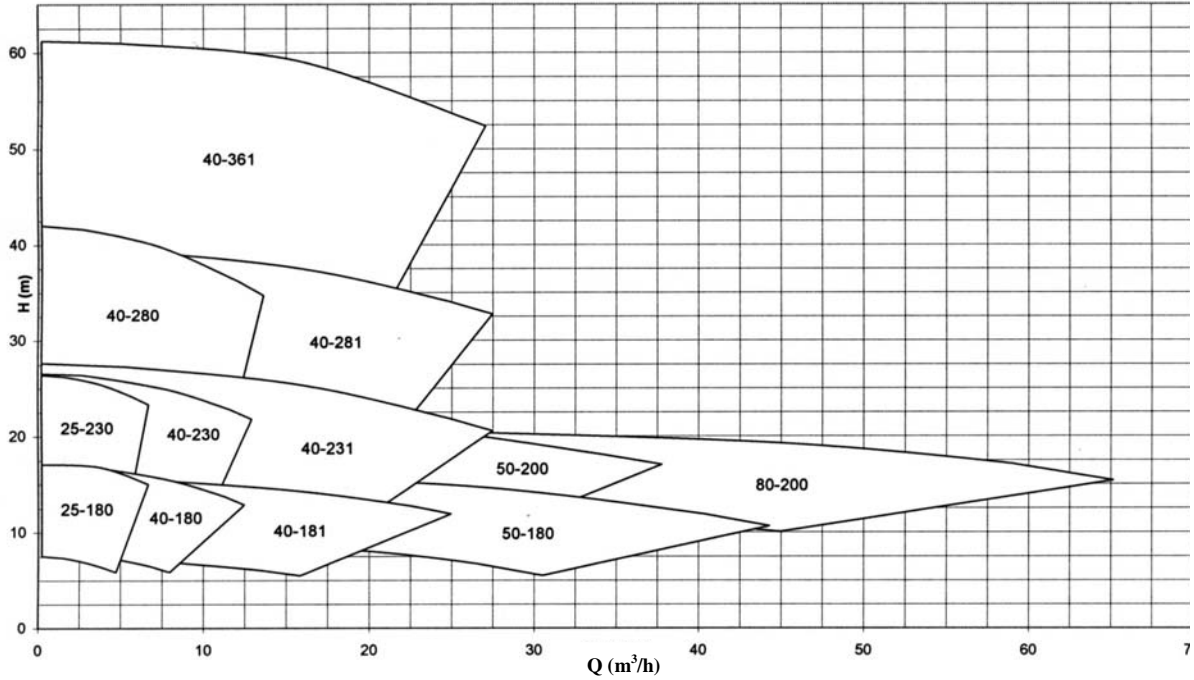
Pump sizes	DN	40 to 150
Capacities	Q	up to 80 m <sup>3</sup> /h
Heads	H	up to 240 m
Operating pressures	p	up to 35 bar for piping in material ASTM A106
Operating temperatures	t	-30 to +230°C
Standard installation depth	ET	from 630 to 3985 mm

Other operating data on request.

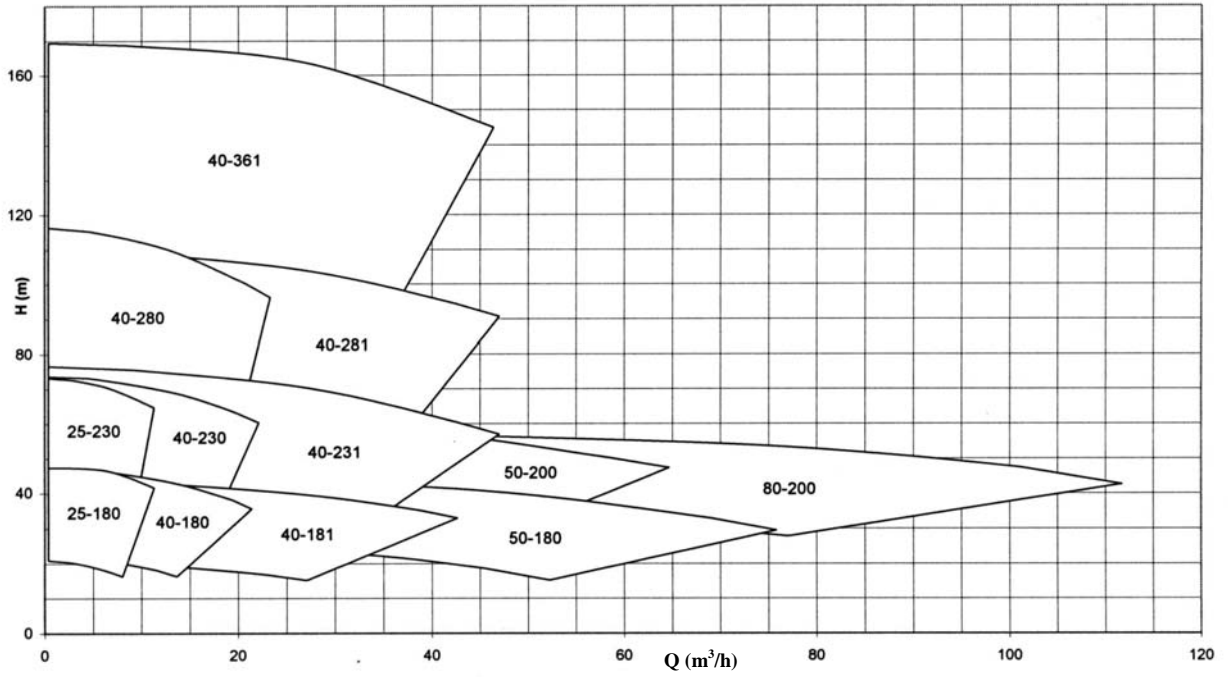
## 5.1 Selection chart 3.500 1/min



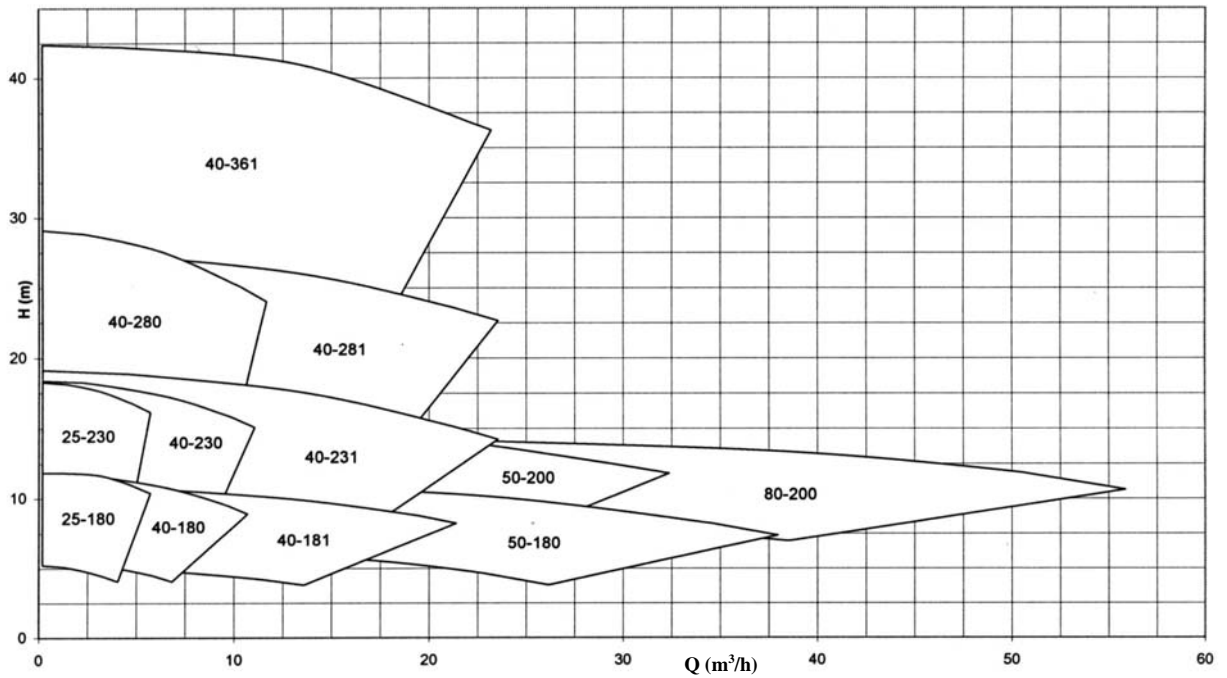
## 5.2 Selection chart 1.750 1/min



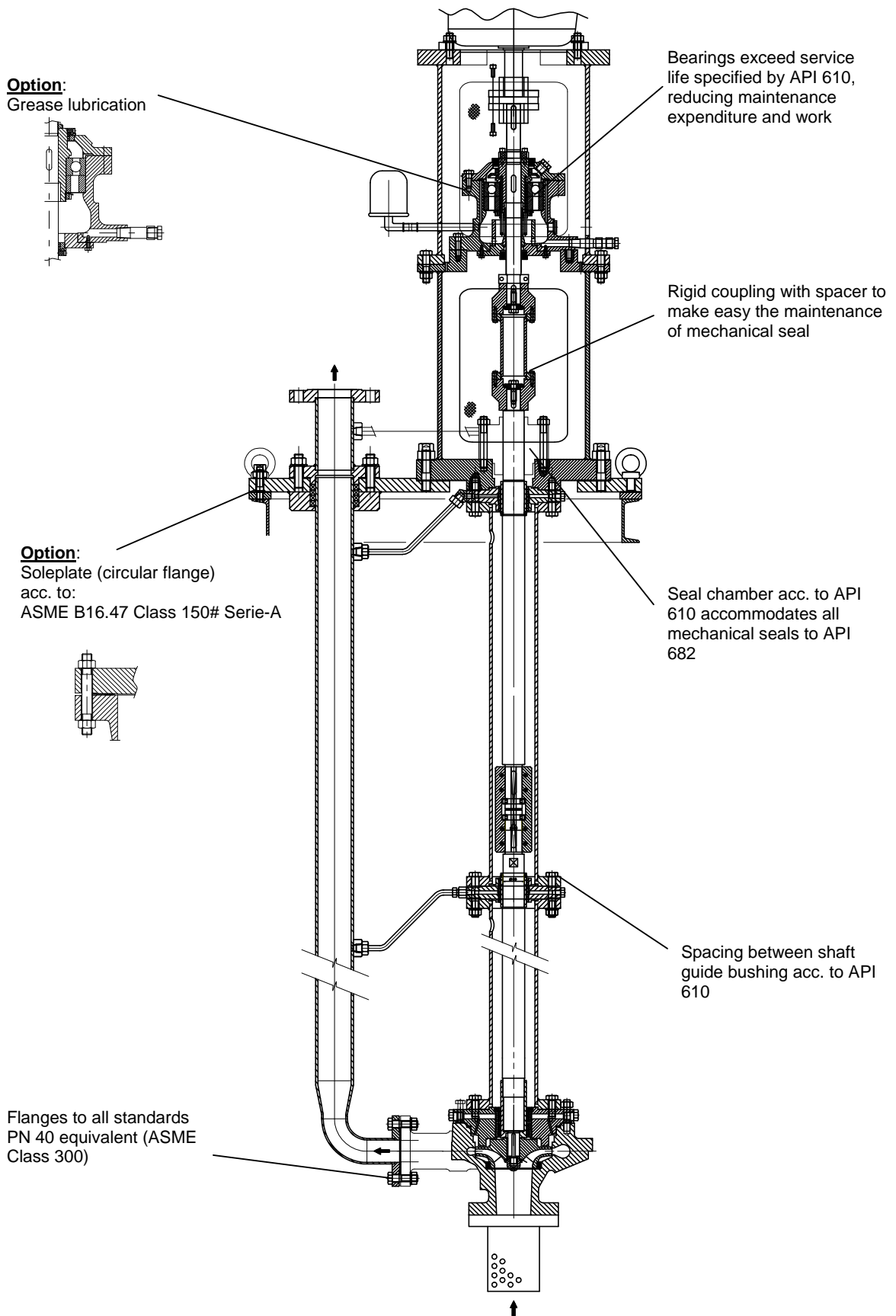
### 5.3 Selection chart 2.900 1/min



### 5.4 Selection chart 1.450 1/min



## 6. Product features / Benefits



## 7. Technical data

Pump Size		Unity	25-180	25-230	40-180	40-230	50-200	80-200	40-181	40-231	40-280	40-281	40-361	50-180
Volute type		--	Simple											
Impeller	- Outlet width	mm	6	6	6	6,2	10,5	14	7,8	7,7	7,5	7,7	7,9	10,9
	- Inlet diameter		48	48	58	57	88	105	75	75	61	71	69	88
	- maximum diam.		179	224	180	224	205	207	180	230	278	278	343	180
	- minimum diam.		120	180	130	180	164	166	130	180	220	230	280	140
Sealing chamber size (Acc.to API 682 Table 1)		--	4											
Bearing type / Lubrication			6313C3 / oil											
Shaft diameter	- in the sealing chamber (D)	mm	50											
	- in the bearing		65											
	- in the coupling		32											
	- in the impeller		24						27					
Shaft deflection			As per API 610 11 <sup>th</sup> edition											
Pressure limits	Max.operating pressure	bar	35 <sup>2)</sup>											
	Max.test pressure	bar	1,5 times the operating pressure or as per API 610 11 <sup>th</sup> edition											
Flanges		--	ASME B16.5 Class 300 RF											
Temp.limit	Max.fluid temp.	°C	230 <sup>3)</sup>											
Driver	Maximum Value P/n <sup>1)</sup>	kW / rpm	0,019						0,032					
Motor	n = 1450 rpm	kW	28						47					
	n = 1750 rpm		33						56					
	n = 2900 rpm		55						93					
	n = 3500 rpm		67						112					

<sup>1)</sup> Values indicated refer to shaft in material A434 4140CL.BB and impeller in A216WCB & temperature < 100°C.

<sup>2)</sup> Pressure limit refers to piping in material A106.

<sup>3)</sup> Temperature limit refers to bearing bushes in material Peek.

For other condition, please consult KSB.

## 8. Materials table

(reference for main parts)

Part No.	Description	Variant S5	Variant S6	Variant A8
102	Volute casing	A 216 Grade WCB	A 216 Grade WCB	A 351 Grade CF8M
161	Casing cover	A 216 Grade WCB / A 516 Grade 65	A 216 Grade WCB / A 516 Grade 65	A 351 Grade CF8M
210	Shaft	A 434/4140CL.BB	A 434/4140CL.BB	A276 Type 316
230	Impeller	A 216 Grade WCB	A 743 Grade CA6NM	A 743 Grade CF8M
350	Bearing housing	A 216 Grade WCB	A 216 Grade WCB	A 216 Grade WCB
411.10	Joint ring	Spiral SS316 -Graphite	Spiral SS316 -Graphite	Spiral SS316 -Graphite
502 / 503	Wear ring	AISI 420 Hard	AISI 420 Hard	AISI 316 Hard Faced
711	Rising	A106 Grade B	A106 Grade B	AISI 316
902.01 / 920.01	Casing bolts / hex.nut	A193 Grade B7 / A194 Grade 2H	A193 Grade B7 / A194 Grade 2H	A193 Grade B7 / A194 Grade 2H

Other materials acc. to API 610 are available on request.

## 9. Design details

### 9.1 Pump casing

Radially split, consisting of volute casing and casing cover. Volute casing with casing wear rings. Casing cover with casing wear rings, depending on axial thrust balancing.

### 9.2 Impeller

Closed radial impeller, impeller wear ring on the suction side. Discharge side wear ring only on hydraulically balanced impellers.

### 9.3 Balancing

Balancing of axial thrust by sealing gap and balancing holes (if required).

### 9.4 Minimum flow

Unless specified otherwise in the individual characteristic curves, the following applies:

$Q_{\min} = 0,1 \cdot Q_{\text{opt}}$ , for short operation

$Q_{\min} = 0,3 \cdot Q_{\text{opt}}$ , for continuous operation

### 9.5 Bearing lubrication

Bearing bracket – oil fill in 0,5 l.

Lubricating oil types C 46 DIN 51 517 or SAE 20 W/20 HD shall be used.

On the standard pump design, the bearing bracket is uncooled.

NPT threads are provided for constant-level oiler, oil drain and vent plug.

The bearings are designed for at least 25,000 operating hours as per API 610 11<sup>th</sup> edition.

During pump standstill the oil level can be checked against the center of the oil level sight glass.

### 9.6 Shaft

Depending on installation following shafts are necessary: pump shaft, intermediate shaft and drive shaft.

The shafts are coupled by split coupling.

### 9.7 Shaft sealing

The pump is fitted with mechanical seals or gland packing (special variant). The mechanical seal chamber is designed in acc. to API 610 11<sup>th</sup> edition. Mechanical seals are provided in cartridge design only (API 682)!

Sealing plans with an external source (plans 32,52,53,54) to lubricate mechanical seal faces in order to avoid dry run during start-up.

For other sealing plans and gland packing applications consult KSB.

### 9.8 Direction of rotation

Clockwise, viewed from the drive end.

### 9.9 Bearing guides

Sliding type in Peek material with shaft protecting sleeve.

### 9.10 Bearing guides lubrication

The following possibilities are available:

#### a) Pumped liquid:

When the product have lubricant characteristics, with a maximum of 20 p.p.m. of impurity and particle with 10 µm. Each bearing receives injection through a piping connected to the rising pipe.

#### b) Clean water of external source (optional):

Water injection is done in all bearings through an external connection located above the mounting plate.

### 9.11 Soleplate sealing

Flexible graphite packing rings with wire reinforcement to control fugitive emissions - Teadit Style 2000IC:

- Temperature: -240 ~ 450 °C
- Pressure: up to 400 bar
- pH: 0 ~14

### 9.12 Surface Coating

Type A1 – Standard surface coating for material variants S5 e S6 up to 90°C.

Preparatory treatment	Grease-free / steel shot blasting ISO 8501-1 SA 2 ½.	
Primer	1 coat - 100 µm thick (dry) – Zinc phosphate epoxy.	
Finish coat	Internal surfaces:	External surfaces: Acrylic aliphatic polyurethane RAL 5002 blue
	Without	1 coat - 70 µm thick (dry).

Type A2 – Standard surface coating for material variants S5 e S6 from 90°C up to 230°C.

Preparatory treatment	Grease-free / steel shot blasting ISO 8501-1 SA 2 ½.	
Primer	1 coat - 50 µm thick (dry) - Zinc inorganic silicate.	
Finish coat	Internal surfaces:	External surfaces: Monocomponent modified silicate Aluminum 800
	Without	1 coat - 35 µm thick (dry).

Notes:

- Material combinations C6, A8 and D1 do not have coating.
- Special surface coating available on request.

## 10. Pump selection

RPH-V pumps use the same published curves as horizontal version RPH, however items 10.1 until 10.4 should be considered for the correct pump selection.

### 10.1 Pump head

The reference line to define the pump head and capacity is the pump discharge flange (DN2).

The performance curve does not consider pressure losses in the suction strainer, discharge curve, column bearings, rising piping and internal circulation for bearing lubrication.

The pump total head is the sum of following items:

- Installation head,
- loss in the straight discharge column.
- loss in the discharge curve (elbow) , and
- loss in the strainer.

## 10.2 Pressure losses

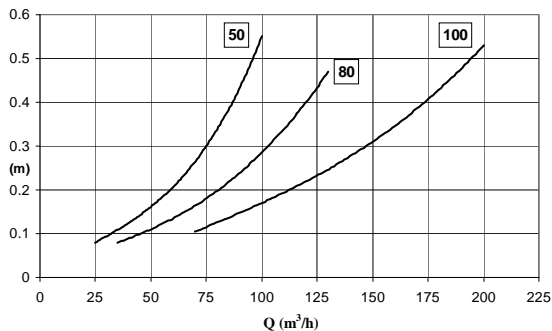
Piping losses – Head losses in straight pipes in 100 m of pipe (in m)

Nominal flow m <sup>3</sup> /h	Nominal diameter				
	40	50	80	100	150
1	0,22	0,08			
1,5	0,50	0,17			
2	0,80	0,28			
3	1,80	0,60	0,05		
4	3,00	1,05	0,10		
5	4,70	1,60	0,15	0,05	
6	6,60	2,20	0,20	0,07	
8	11,50	3,90	0,35	0,13	
10	17,00	5,70	0,50	0,20	
12,5	26,00	8,50	0,80	0,28	
15	37,00	12,50	1,10	0,40	0,05
17,5	47,00	16,00	1,40	0,50	0,06
20	63,00	21,50	2,00	0,70	0,09
25	95,00	33,00	3,00	1,10	0,13
30		45,00	4,20	1,50	0,20
35		61,00	5,70	2,00	0,24
40		78,00	7,00	2,50	0,30
45		100,00	9,00	3,10	0,40
50			11,00	3,80	0,50
60			16,00	5,50	0,70
70			21,00	7,20	0,90
80			26,50	9,20	1,20
90			34,00	12,00	1,40
100			40,00	14,00	1,80
120			58,00	20,00	2,50
140			80,00	27,00	3,30
160				35,00	4,25
180				43,00	5,30
200				50,00	6,50

Piping losses – Head losses at 90° elbow (in m)

Nominal flow m <sup>3</sup> /h	Nominal diameter at pump discharge nozzle			
	25	40	50	80
3	0,02			
4	0,04			
5	0,07	0,01		
6	0,10	0,02		
8	0,18	0,03	0,01	
10	0,28	0,04	0,02	
12,5	0,43	0,07	0,03	
15	0,62	0,10	0,04	
17,5	0,85	0,13	0,05	
20	1,11	0,17	0,07	0,01
25	1,73	0,26	0,11	0,02
30	2,50	0,38	0,16	0,02
35		0,52	0,21	0,03
40		0,68	0,28	0,04
45		0,86	0,35	0,05
50		1,06	0,43	0,07
60		1,52	0,62	0,10
70		2,08	0,85	0,13
80			1,11	0,17
90			1,41	0,21
100			1,73	0,26
120			2,50	0,38
140				0,52
160				0,68
180				0,86
200				1,06
250				1,65
300				2,38

Strainer losses (in m) – curves refer to suction nozzle nominal diameter DN1.



## 10.3 NPSH

The NPSH values indicated in the individual performance curves were measured on impellers without hydraulic balancing. They correspond to a 3 % drop of the pump head.

Generally a value of  $NPSH_{available} - NPSH_{pump} \geq 0,5$  m is desirable (for hot water applications please contact KSB).

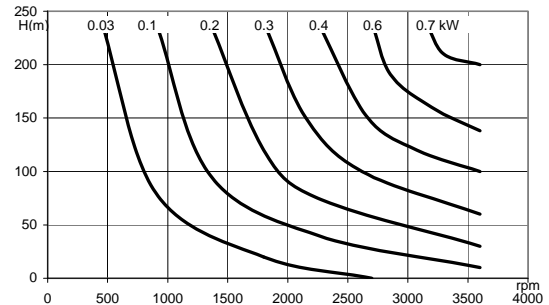
## 10.4 Efficiency

The efficiencies specified in the performance curves refer only to the hydraulic pump without losses. Axial thrust balancing of the impeller, fluid viscosity, a larger impeller clearance gap, the shaft seal type, drive shaft and thrust bearing losses reduce the pump's overall efficiency.

Efficiency was measured using a clearance gap to AN 1501, group 2 and an inlet pressure of 2 to 3 bar.

The efficiency is stated in the individual performance curves of horizontal version (RPH).

### 10.4.1 Power consumption per guide bearing



**Note:**

Power consumption of mechanical seal should also be considered.

## 10.5 Drive

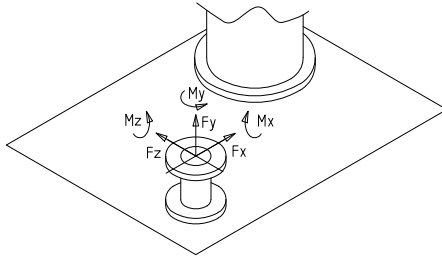
Direct or indirect by electric motor, engine or turbine, if an internal combustion engine has been specified, special care shall be taken when selecting the type of coupling to be used.

## 10.6 Motor selection

When determining the motor size, consideration shall be given to the efficiency determined and the power margins as per API 610.

Motor rating	Power margin
up to 22 kW	25 %
22 to 55 kW	15 %
above 55 kW	10 %

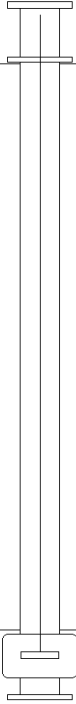


## 10.7 External nozzle forces and moments

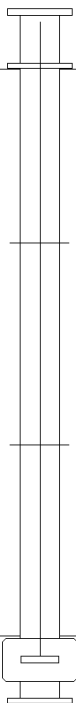




Pump sizes	Discharge nozzle							
	Forces (in N)				Moments (in Nm)			
	$F_x$	$F_y$	$F_z$	$F_{res}$	$M_x$	$M_y$	$M_z$	$M_{res}$
25-180	710	580	890	1280	460	230	350	620
25-230								
40-180	710	580	890	1280	460	230	350	620
40-230								
40-280								
40-181								
40-231	710	580	890	1280	460	230	350	620
40-281								
40-361								
50-180	710	580	890	1280	460	230	350	620
50-200								
80-200	1070	890	1330	1930	950	470	720	1280

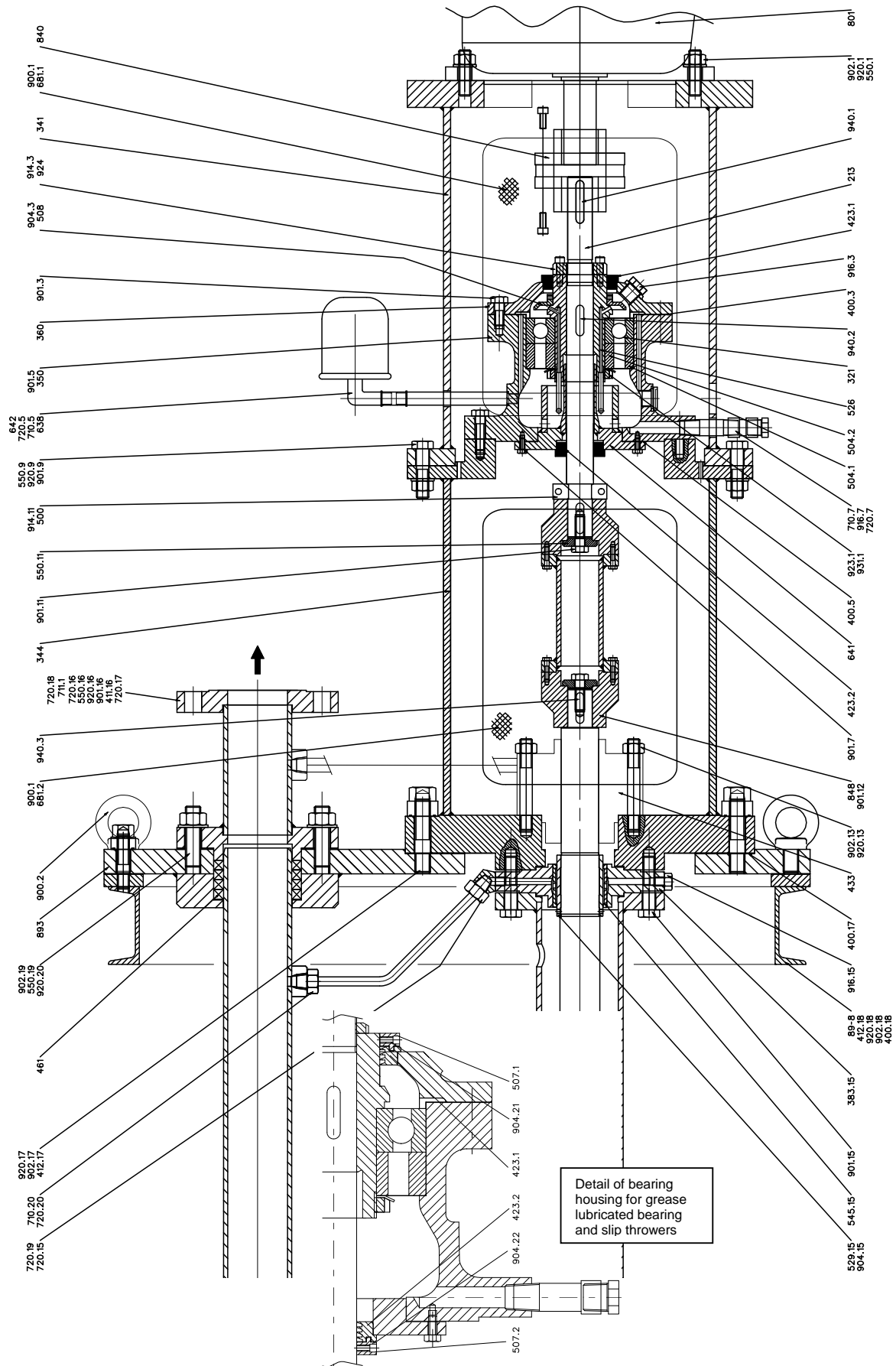


## 11. Installation depths

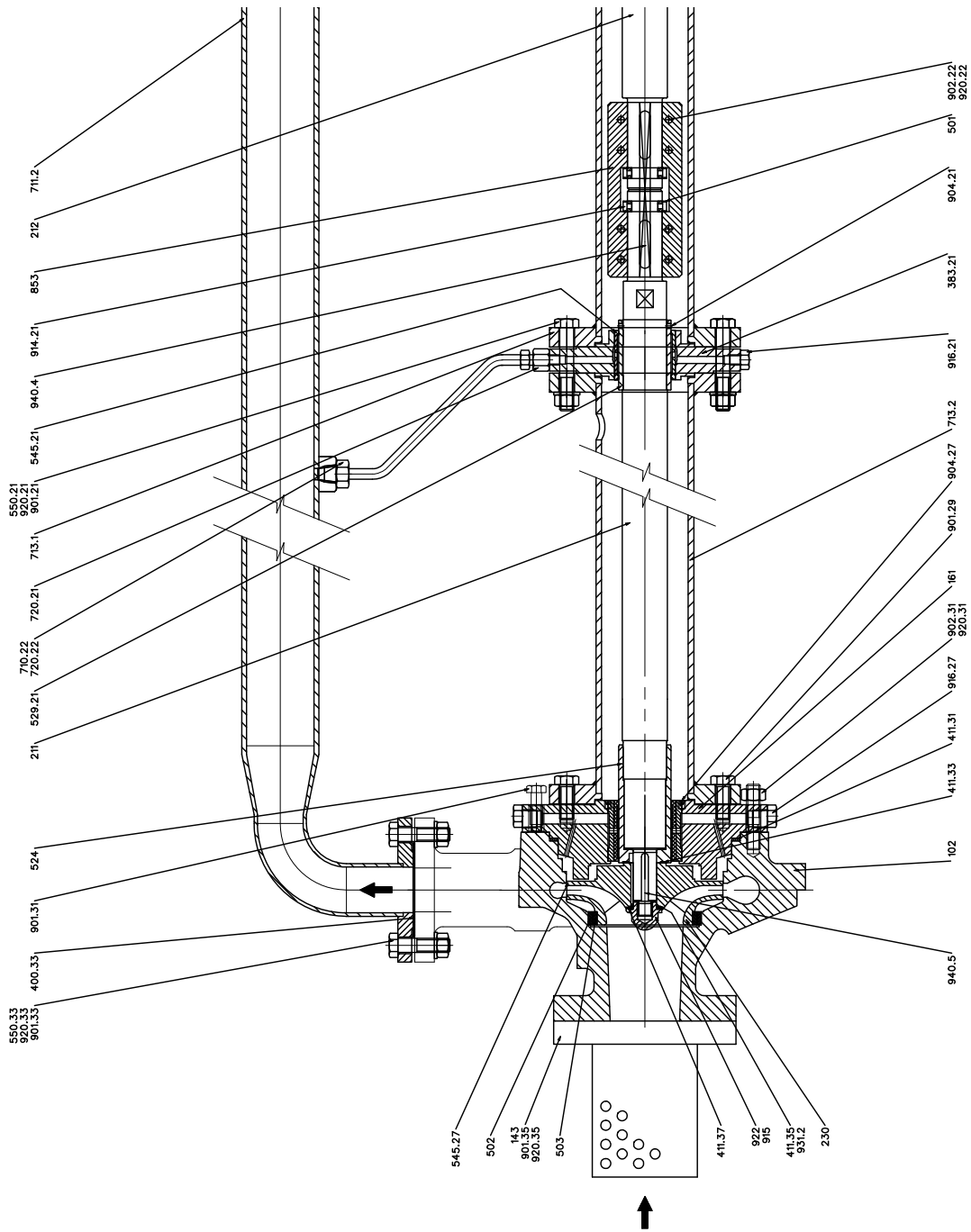
Column	Installation depth (ET-a), dimensions in mm.																	
	400	425	600	625	800	825	900	925										
											1355	1555	1755	1855				
											400	600	800	900				
Variation		01		02		03		04			05		06		07		08	

Column																		
	900		900		900		900											
											900	900	900	900				
	900	2285	900	2485	900	2685	900	2785			900	900	900	900				
											3215	3415	3615	3715				
	400		600		800		900				900	900	900	900				
											400	600	800	900				
Variation		09		10		11		12			13		14		15		16	

12. Sectional drawing (part 1/2) – reference only



## Sectional drawing (part 2/2)

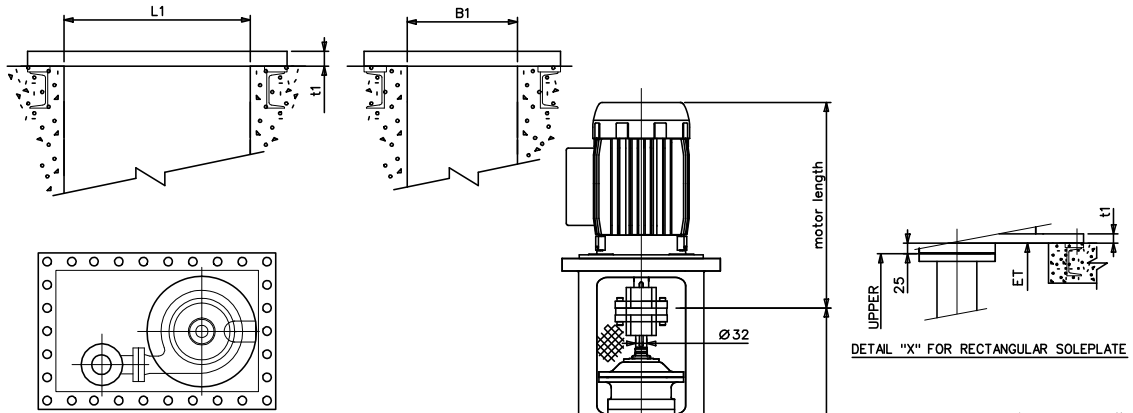


### 13. Main parts list

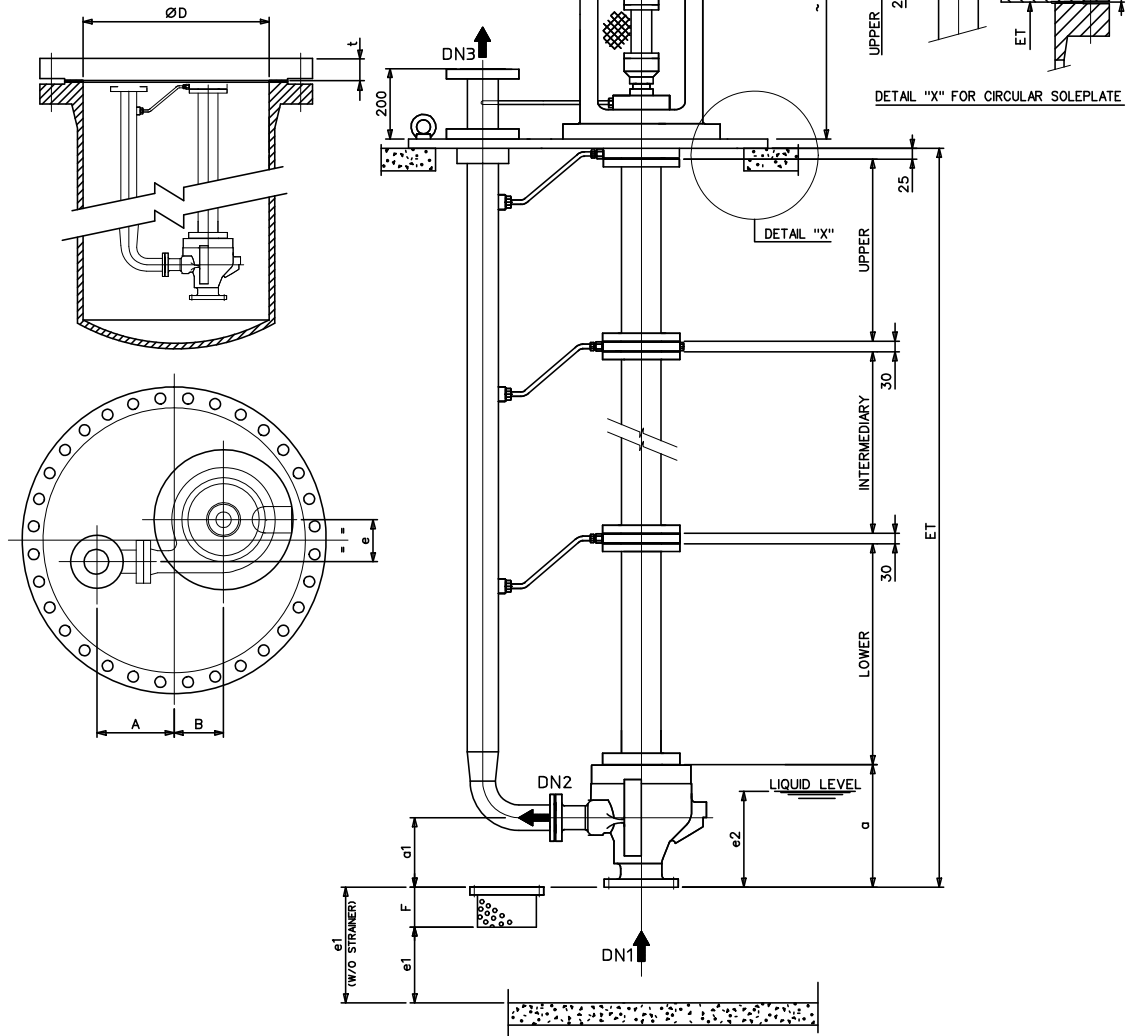
Description	Part n°	Description	Part n°	Description	Part n°
Volute casing	102	Bearing cover	360	Bearing sleeve	529.15
Strainer (optional)	143	Spider	383.15	Bearing sleeve	529.21
Casing cover	161	Spider	383.21	Constant level oiler	638
Pump shaft	211	Spiral wound	411.31	Rising	711.1
Intermediary shaft	212	Mechanical seal	433	Rising	711.2
Drive shaft	213	Lantern ring	458	Suspension piping	713.1
Impeller	230	Packing	461	Suspension piping	713.2
Bearing	321	Wear ring	502	Soleplate	893
Drive lantern	341	Impeller wear ring	503	Impeller nut	922
Bearing bracket lantern	344	Shaft prot,sleeve	524	Bearing nut	923
Bearing casing	350	Center sleeve	526		

## 14. Pump dimensions – General arrangement drawing

### 14.1 Rectangular soleplate



### 14.2 Circular flange



**15. Pump dimensions <sup>1)</sup>**
**15.1 Table 1**

PUMP SIZE	PUMP								
	NOZZLES			a	a1	e	e1 (min)	e2 (min)	F
	DN1	DN2	DN3						
25-180	40	25	40	214	120	105	65	240	140
25-230	40	25	40	206	120	125	65	240	140
40-180	50	40	80	224	130	105	80	260	160
40-181	50	40	80	228	130	110	80	260	160
40-230	50	40	80	216	130	130	80	260	160
40-231	50	40	80	230	140	135	80	280	160
40-280	50	40	80	234	140	160	80	280	160
40-281	50	40	80	235	140	160	80	280	160
40-361	50	40	80	242	150	195	80	300	160
50-180	80	50	80	248	150	120	100	300	160
50-200	80	50	80	236	150	125	100	300	160
80-200	100	80	150	271	185	130	125	370	200

**15.2 Table 2**

PUMP SIZE	SOLEPLATE							
	CIRCULAR FLANGE <sup>2)</sup>					RECTANGULAR		
	Nominal pipe size	A	B	D (min.) <sup>3)</sup>	t	L1 (min.)	B1 (min.)	t1
25-180	26"	247	125	610	66,7	690	470	31,7
25-230	28"	247	150	660	69,9	720	470	31,7
40-180	28"	252	160	660	69,9	760	470	31,7
40-181	28"	252	160	660	69,9	760	470	31,7
40-230	30"	272	155	711	73,1	770	480	31,7
40-231	30"	272	155	711	73,1	770	480	31,7
40-280	32"	297	155	762	79,4	800	550	31,7
40-281	32"	297	155	762	79,4	800	550	31,7
40-361	36"	337	130	864	88,9	830	630	31,7
50-180	28"	257	165	660	69,9	770	470	31,7
50-200	26"	227	130	610	66,7	700	470	31,7
80-200	30"	235	170	711	73,1	800	530	31,7

<sup>1)</sup> Dimensions in mm, except where noted.

<sup>2)</sup> Dimensions according to ASME B16.47 Class 150# RF Serie A.  
 Standard materials for a maximum working pressure of 13,5 bar at 200°C:  
 - Casted: A216 WCB (CS) and A351CF8M (SS).  
 - Forged: A105 (CS) and A182 Gr. F316 (SS).

Others materials, rating class or different flange thickness upon request.

<sup>3)</sup> D is the minimum pipe inside diameter.



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