Contents

1. Design

CPK pumps are horizontal, radially split single stage, single entry , back pullout type, volute casing process pumps with radial flow impeller, to EN 22858 / ISO 2858 / ISO 5199. Complemented by pumps of DN 200 and above.

2. Application

CPK pumps are used for pumping hot water and organic and inorganic fluids in chemical, food and other branches of industries. The application areas are Chemical, Refinery, Paper & Pulp Industries, Food Industries, Sugar Industries etc.

3. Pump Designation

CPK E Y 40 - 250 (s)

- Pump type
- Material of wetted parts
- Additional designation
- Nominal size of discharge nozzle DN (mm)
- Nominal impeller diameter (mm)
- Suffix

Material of wetted parts can be :
(for details, refer pt. no. 7)

i) Cast Iron : G / GC
ii) Cast steel : E / EG / EC
iii) Stainless steel : C / GC / EC - with S.S. Impeller
EG - with C.I. impeller

Additional designations can be :

Y - Pump with intensively cooled stuffing box (refer Annexure I)
m - Pump with mechanical seal

Suffix can be :

s - Pump with heavy bearing bracket
c - Pump with cooled bearing bracket

4. Operating Parameters

4.1 Capacity and total head

CPK pumps are available in the following range.

Supply frequency		**50 Hz**	**60 Hz**
Pump sizeDN		32 to 250 mm	32 to 250 mm
Capacity	Q	Up to 1200 m^3/hr.	1500 m^3/hr.
Total Head	H	Up to 150 m	220 m

4.2 Differential head

The differential head depends on the speed and impeller diameter. (Refer family curves fig. no.1 & individual performance curves).

Limitation of end pressure should be taken care of.

4.3 NPSH

The NPSH values given in the individual performance curves are the minimum values which corresponds to the cavitation limits. They are valid for water without gases. As a safety margin, committed NPSHr values must therefore be higher than that on the curve by atleast 0.5m.

In general (NPSHa-NPSHr) should be > 0.5m, and for hot water should be >1m.

The values given in the individual curves are measured values based on 3% pressure drop.

Limitations

For Q< 0.3Qopt. (where Qopt. corresponds to flow at the best efficiency point) measurement of NPSH is difficult. The values given in the NPSH curves can be fully considered. NPSH testing for Q < Qopt. is however is not possible.

5. Selection of Pump

Selection of pump is based on -

Capacity	:	Q m^3/hr.
Total head	:	H mtrs of water column
NPSHa	:	mtrs of water column
Pumping Liq.Temp.	:	^{0}C
Density	:	r kg/dm^3

and several other factors like pH of liquid, solid content, viscocity etc.

An initial selection of the pump size can be done from the Family Curves (Fig.1). The exact selection is to be finalised as per individual performance curve of the respective pump.

5.1 Family Curves

Fig. 1 shows the family curves for nominal speed at 50Hz of supply frequency. Initial selection of the pump is to be done from these curves. If the required operating speed is different from the nominal speed, then the operating parameters should be converted to the nominal speed and then the selection is to be done. The pump models shown in dotted lines are not yet developed in KSB India.

5.2 Sizes / Bearing brackets / impeller

Present programme available for **CPK G**

CPK G	Impeller nominal diameter							Bearing Bracket
	125	160	200	250	315	400	500	
Size								P 25 / 62
32	A	A	A	A				P 35 / 80
40		A	A	A	A			
50		A	A	A	A			P 45/120as
65			A	A	A[1]			P 45 / 120
80		A	A	A *	A *	A		
100			A	A	A[1]	A *		
125				A	A *	A *		
150				A	A *	A[1]		P 55 / 140
200				A[2]	A	A*[1]	A*[2]	P 65/160 s
250					A *[2]	A *[2]	A *[2]	

Table no. 1

For Cast Iron material

Only CPK GC pumps are to be offered for models ranging from 32-125 to 150-315.

From model 150-400 and above CPK G or CPK GC pumps can be offered.

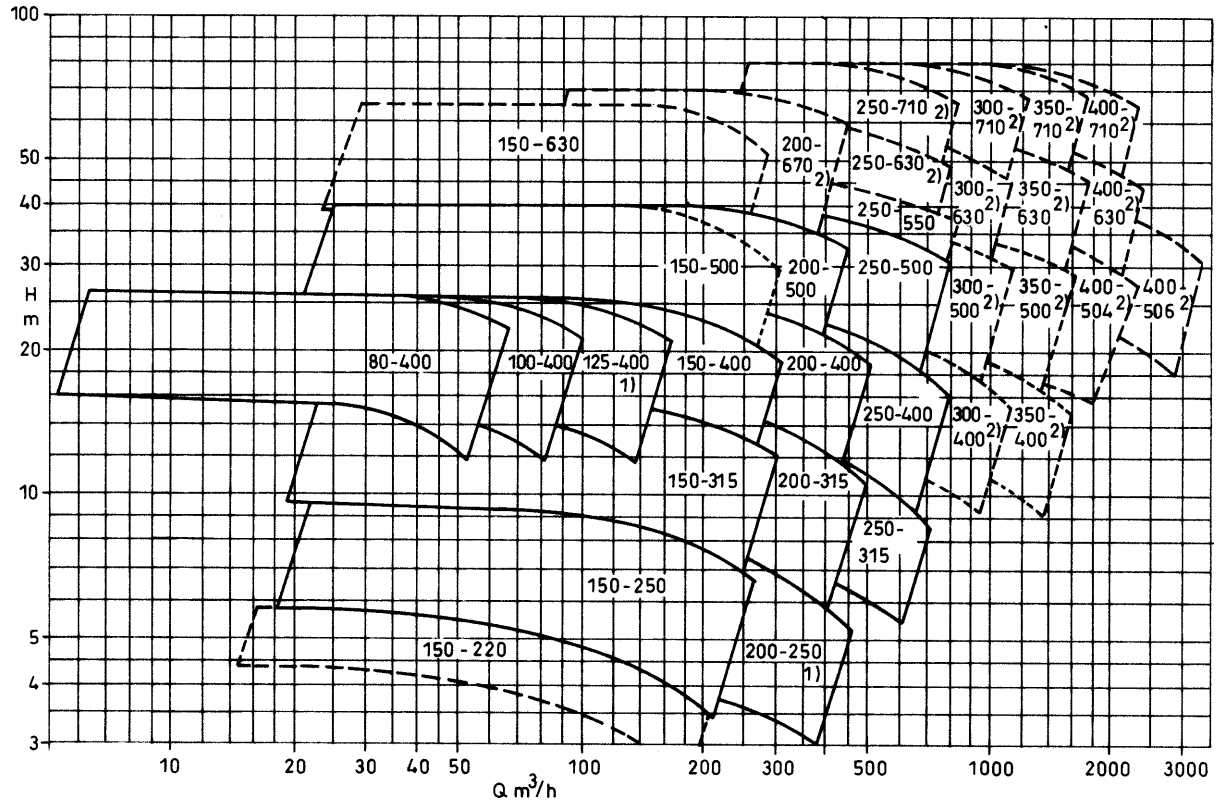
* With double volute casing only.

1. When Ho x γ = 12. 5 bar, double volute casing of Cast Steel should be offered. (Ho = Shut off head in bar, γ = Specific gravity)

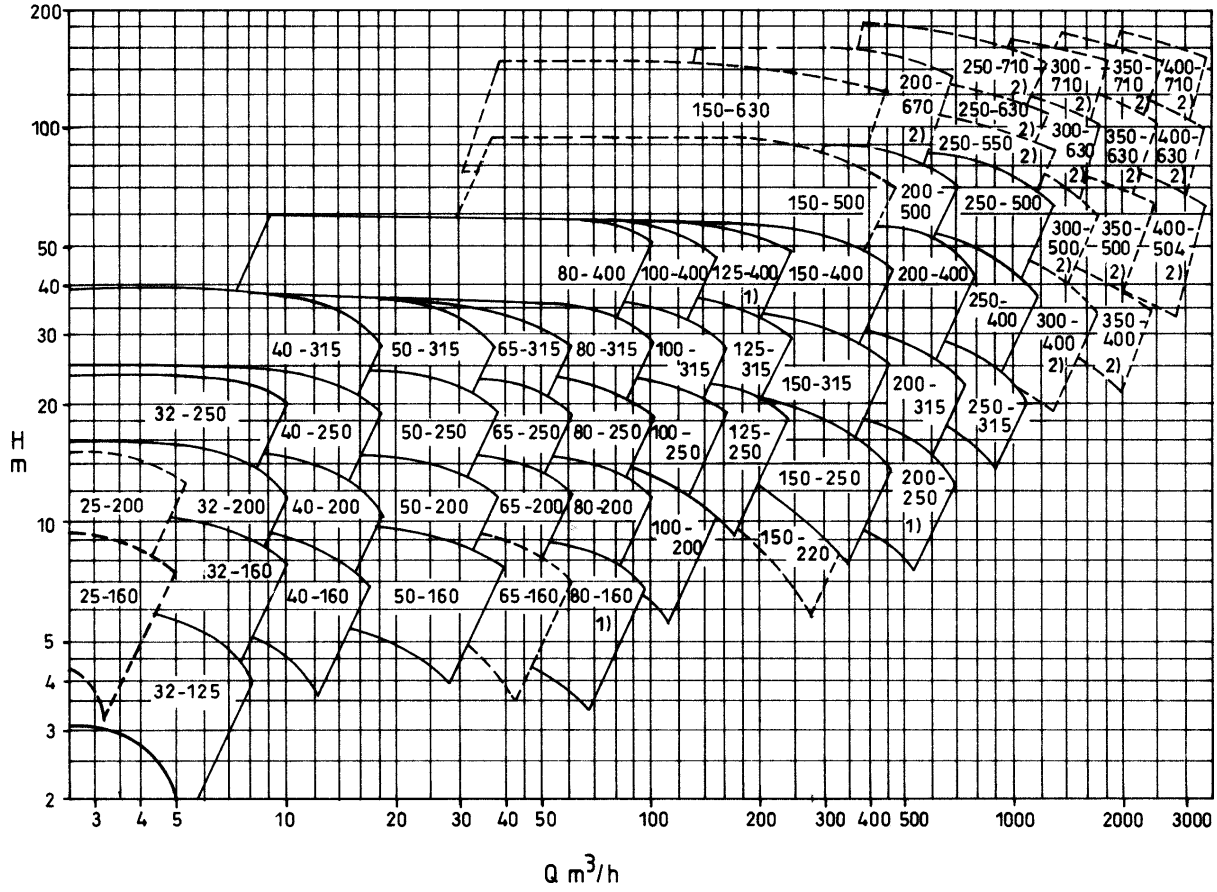
2. Maximum permissible end pressure = 10 bar.

Family Curves - 50 Hz

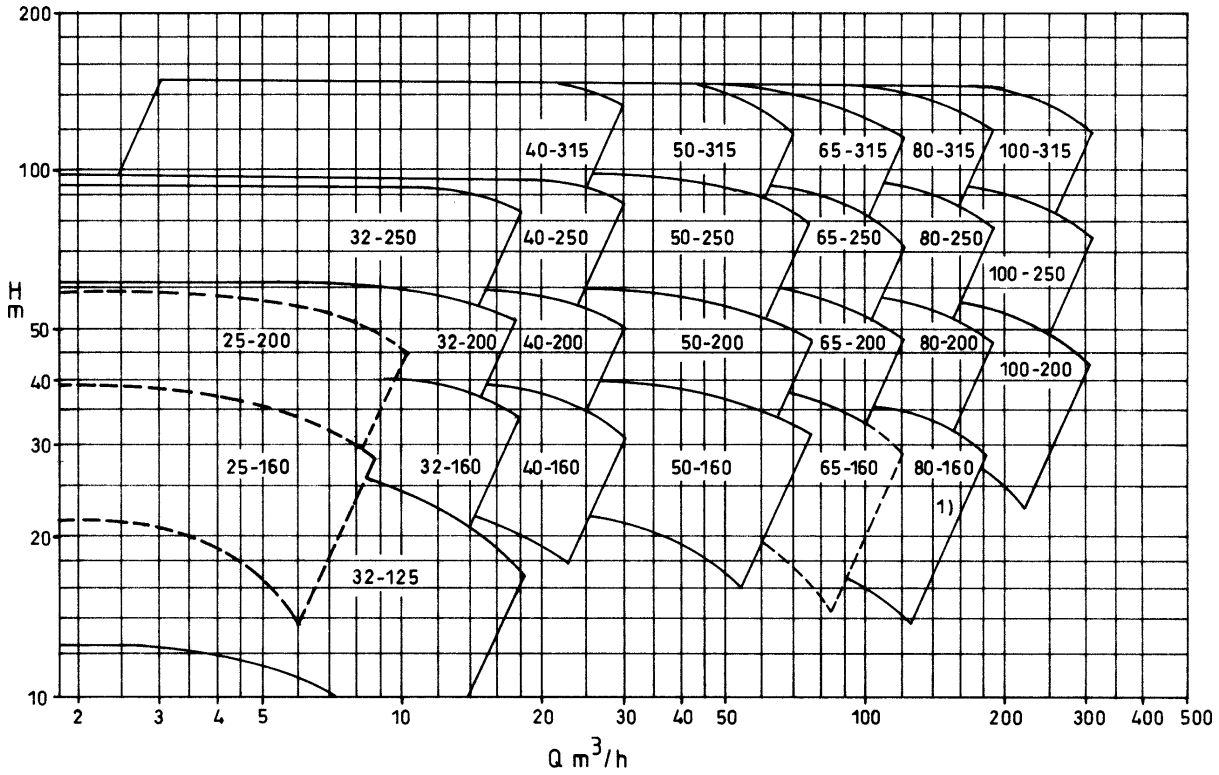
960 rpm



1450 rpm

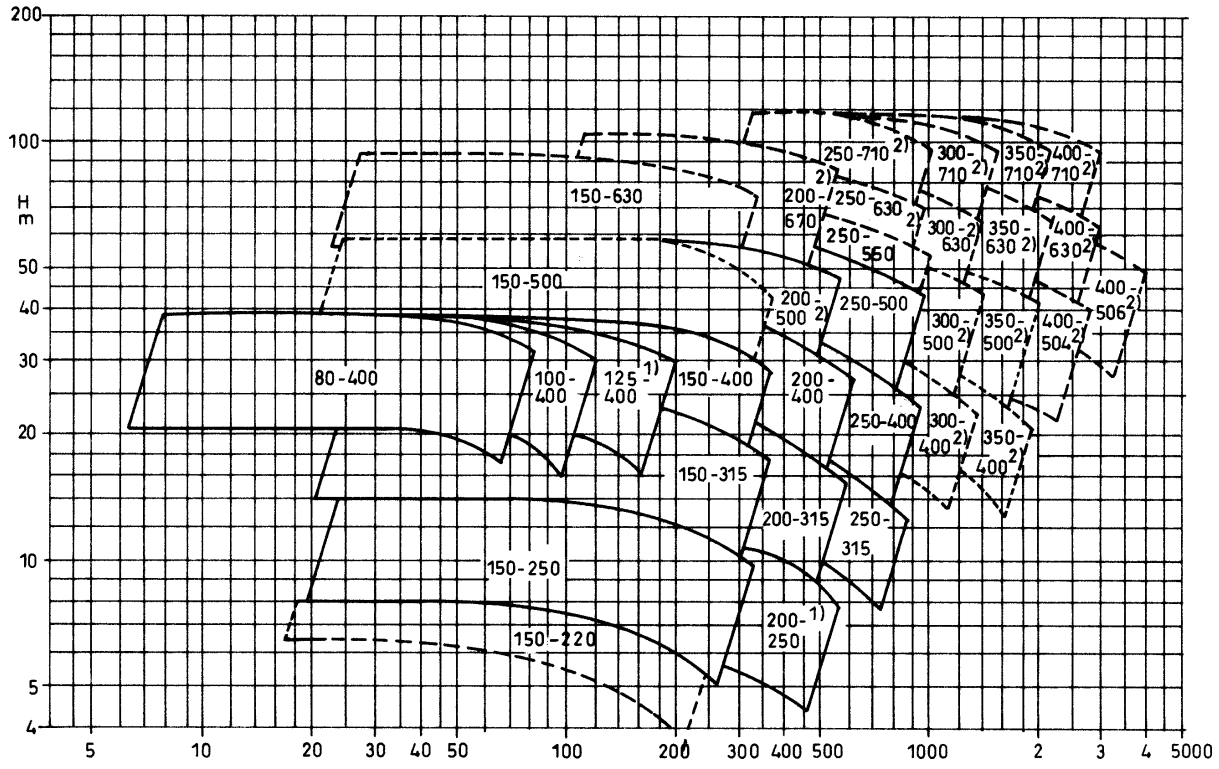


2900 rpm



Family Curves - 60 Hz

1160 rpm



For CPK E

CPK E	Impeller nominal diameter							Bearing Bracket
	125	160	200	250	315	400	500	
Size								P 25 / 62
32	A	A	A	A				P 35 / 80
40		A	A	A	A			
50		A	A	A	A			P 45/120as
65			A	A	A *			P 45 / 120
80			A	A *	A *	A *		
100			A	A	A *	A *		
125				A	A			
150				A	A *	A *		P 55 / 140
200					A *	A *	A *	P 65/160 s
250					A *	A *	A *	

Table no. 2

* With double volute casing only.

For CPK C

CPK C	Impeller nominal diameter							Bearing Bracket
	125	160	200	250	315	400	500	
Size								P 25 / 62
32	A	A	A	A				P 35 / 80
40		A	A	A	A			
50		A	A	A	A			P 45/120as
65			A	A	A *			P 45 / 120
80			A	A *	A *	A *		
100			A	A	A *	A *		
125				A[1]	A			
150				A	A *	A *		P 55 / 140
200					A *	A[*1]	A *	P 65/160 s
250					A *	A *	A *	

Table no. 3

* With double volute casings only

1 Max. end pressure of 12.5 bar

5.3 Individual Performance Curves

The total head and power curves are valid for the pumping medium of density r = 1.0 kg / dm³. In case r is not equal to 1.0 kg / dm³, then the power must be multiplied by r. The measured values in performance curves are guaranteed in accordance with **ISO 2548/C.** All the individual performance curves are plotted for the nominal speed, hence the same should be converted to effective speed of the drive using affinity laws.

5.4 Capacity

Q minimum = 0.1 (Q optimum) - provided no limitation is given in table no. 14

Q maximum = 1.1 (Q optimum) - for 2 pole drive

Q maximum = 1.2 (Q optimum) - for 4 pole drive

5.5 Capacity of pumps fitted with mechanical seal

If the pumps are fitted with a single mechanical seal with product circulation (circulation line from discharge nozzle via the seal back into the pump casing), then, up to 20 m³/hr.; 1m³/hr. should be added to actual pump capacity.

Example :

If desired capacity is 15 m3/hr. & single mechanical seal is used all the values should be read off the curve at Q = 15+1 = 16 m³/hr.

5.6 Efficiency

Over & above the standard performance curves, following correction factors are to be considered (if applicable).

a. If stuffing box pressure is >4 bar, losses in stuffing box packing are to be added to BkW. Refer fig. 17a.

b. Power loss in mechanical seal - add power loss as shown in fig. 17.

c. For wearing ring clearances as per group II, correction factor of 0.97 should be applied. Refer table no. 10 & 11.

5.7 Impeller diameter selection

The characteristic curves indicate the minimum and maximum impeller diameters. The impeller diameter obtained from the curve for the operating point is to be increased by 2 mm for impellers of Cast Steel and Stainless Steel.

5.8 Pressure-temperature limits

5.8.1 For CPK-G

A. Without special regulations

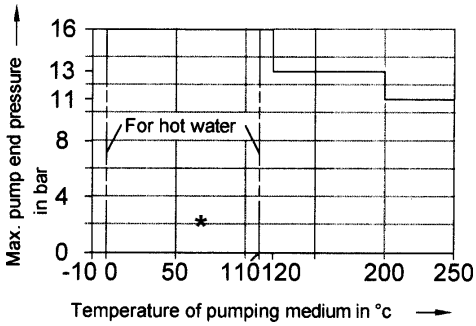


Fig.2 : Applicable for all mediums including hot water & organic heat transfer media.

*Applicable for hot water, but not for heating plants i.e. for applications governed by regulations for pressure vessels (IBR & ASME Boiler code). For applications outside the specified limits, refer to H.O.

B. With special regulations : For special applications e.g. as per regulations of pressure vessel as well as for excessive corrosion and errosion conditions; CPK G pumps are not allowed.

5.8.2 For CPK-C and CPK-E

- For pumped liquids above 200 °C, following points should be considered.

Correct material of shaft, distance piece, casing studs and nuts as indicated in the footnote of 7.2, 7.3 should be selected.

Cooling should be provided to stuffing box, bearing bracket & pedestal (for cooling refer section 9.0)

- The application limits of mechanical seals shall be checked in each individual case on the basis of the manufacturer's catalogue, taking into account the actual operating conditions.

5.8.2.1 Pressure Temperature limits for CPK-C

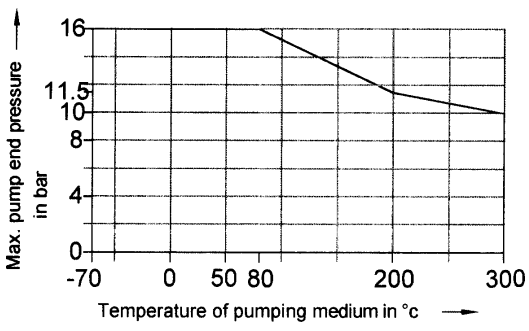


Fig.4

5.8.2.2 Pressure Temperature limits for CPK E

For pump sizes

50-315, 65-315, 80-250, 80-315, 80-400, 100-315, 100-400, 125-315, 150-250, 150-315, 150-400, 200-315, 200-400 250-315, 250-400, 250-500

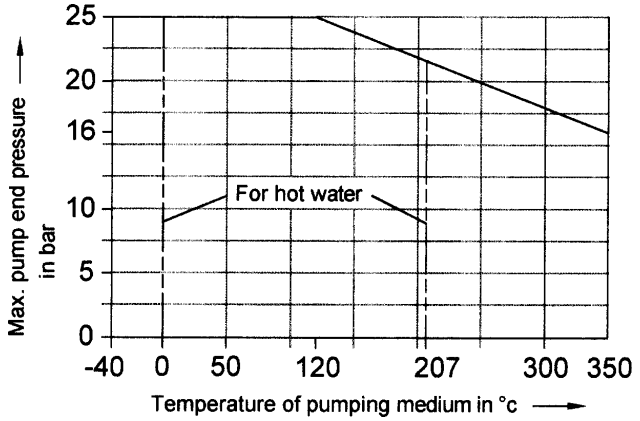


Fig.5 : Applicable for all liquids including organic heat transfer media including hot water.

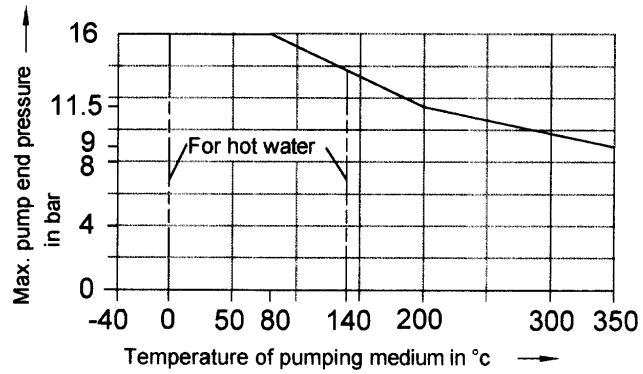


Fig.6 : Applicable for all liquids including organic heat transfer media including hot water for sizes mentioned in table no. 4.

32-125	40-250	65-250	200-250
32-160	40-315	80-160	200-500
32-200	50-160	80-200	
32-250	50-200	100-200	
40-160	50-250	100-250	
40-200	65-200	125-250	

Table no. 4

Note :

——— Applicable for hot water only but not for water heating plants i.e. not for applications governed by regulations for pressure vessels (IBR or ASME Boiler code). For applications outside the specified limits; refer to H.O.

5.9 Suction pressure

Maximum permissible suction pressure (Ps max.) is difference between permissible discharge pressure and shutoff head.

Thus $Ps_{max.} = Pd - Ho \times r /10$

Where Pd = pump discharge pressure in bar
Ho = Head at Q = 0 in m i.e. shut off head
ρ = density of liquid in kg/dm^3

5.10 Hydrostatic test pressure

Minimum = 6 kg/cm^2
Normal = 1.5 X Working pressure
Maximum = 1.5 X maximum permissible discharge pressure at room temperature. Refer table no. 5.

5.11 Flanges

1) CPK G / GC pumps are available with flanges according to ANSI B 16.1 Class 125 FF only.

2) CPK C pumps are available with flanges according to ANSI B 16.5 class150 RF only.

3) CPK E pumps applicable for fig. 5 are available with flanges according to ANSI B 16.5 class 300 RF only. All other CPK E pumps are available with flanges according to ANSI B 16.5 class 150 RF.

5.11.1 Hydrostatic test pressure for flanges

Pump type	Matl. of const.	Part name	Flange execution	Test pressure in kg/cm2
CPK G	C.I.	volute casing	ANSI 125 FF	24
CPK E	WCB		ANSI 150 RF	
			ANSI 300 RF	37.5
CPK C	CF8M		ANSI 150 RF	24

Table no. 5

5.12 Speed

The family curves (fig. 1) are to be refered for maximum permissible speed of individual models. However, this speed is permissible only for the sizes shown in table no. 14. In any case the maximum permissible peripheral velocity for the impeller (see fig. no. 8) as well as the max. permissible P/n value (see table no. 8) should also be taken into account.

5.13 Specific speed

Specific speed is the true rotational speed of a model pump similar in vane geometry and in velocity planes to deliver 1m^3/sec. against a total head of 1m.

Specific speed (NS) is worked out based on the formula -

$$\frac{\text{RPM} \times [\text{Qopt. with full impeller diameter}]^{1/2}}{(\text{Head at Qopt. with full impeller diameter})^{3/4}}$$

Suction specific speed (NSS) is worked out based on the formula

$$\frac{\text{RPM} \times [\text{Q opt. with full impeller diameter}]^{1/2}}{(\text{NPSHr at Qopt. with full impeller diameter})^{3/4}}$$

Where Q in m^3/sec. or GPM or USGPM
H in m or feet

Note : NPSHr is considered as NPSHr on curve with +0.7 m margin.

Max. permissible peripheral velocity for the impeller

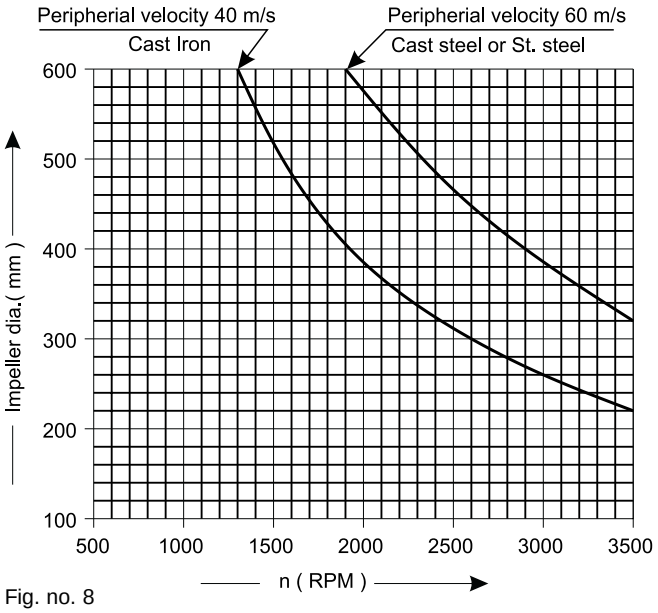
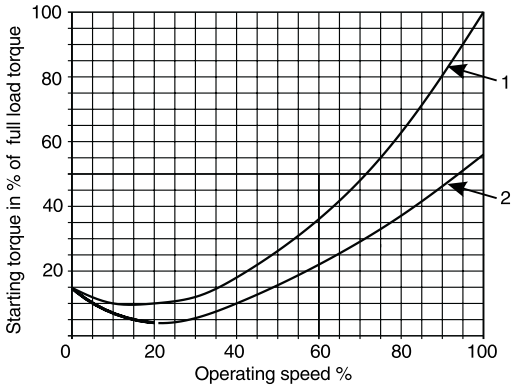


Fig. no. 8

5.14 Torque speed characteristics



1. Starting with discharge valve open.
2. Starting with discharge valve closed.

Fig. no. 9

5.15 Maximum permissible P/n value

Bearing Bracket	P/n = kW / RPM	Maximum permissible drive power in kW					
		n = 960	n = 1450	n = 2900	n = 1160	n = 1750	n = 3500
P 25/62	0.009	8.6	13	26.1	10.4	15.7	31.5
P 35/80	0.021	20.1	30.4	60.9	24.3	36.7	73.5
P 45/120	0.05	48	72.5	145	58	87.5	175
P 45/120 as							
P 55/140	0.11	105.6	159.5	-	127.6	192.5	-
P 65/160	0.22	211.2	319	-	255.2	385	-

Table no. 8

5.16 Power Reserves for Drives

Motor Power	Power reserve
Up to 7.5 kW	About 20%
7.5 - 37 kW	About 15%
Above 37 kW	About 10%

Table no. 9

Note : Motor power should never be less than 1kW.

5.17 Suction piping

The suction piping size should be at least equal to the suction nozzle diameter of the pump. In case pipeline size is bigger than the suction nozzle, the connection should be done by means of eccentric reducer, to avoid air pockets.

6. Design Features

Direction of Rotation of the pump is clockwise (as seen from the drive end).

6.1 Casing

It is a radially split volute casing with end suction and top discharge. Single or double volute depends on size. Generally the casing is offered with bottom feet mounting. Centre feet mounting is given for operating temperatures above 200^{0}C. (Applicable only for CPK C & E pumps .) For CPK GC, only bottom feet mounting is offered. For sizes of connections provided on the casing refer Annexure III.

Other parts

The casing cover and bearing bracket lantern combine to form a chamber which can be used for heating or cooling with superheated steam or water. A "Y" type i.e. a jacketed casing cover is also available. Refer annexure I.

6.1.1 Branch orientation

Suction branch is axial and discharge branch is radially upwards.

6.2 Impeller

It is a closed type, radial flow, single suction impeller with three dimensionally twisted vanes. For outlet width and impeller diameter refer individual performance curve. For hydraulic balancing, backvanes are provided on the impeller. For backvane diameter refer table no. 25.

6.3 Wearing Rings

CPK C & E pumps have no wear ring on impeller and casing as a standard execution. Single wearing ring is provided for CPK G / GC pumps.

CPK C & E pumps can be supplied with double wear ring execution on request.

6.3.1 Wear ring material combination groups

Pump type	Casing wear ring material	Impeller wear ring material	Group
CPK E	Cr. Hard 400	1.4024.19	I / II
CPK E	CF8M Colomony coated	CF8M	
CPK C			
CPK G	C.I.	N.A.	I
CPK GC	CF8M	N.A.	II

Table no. 10

Note : For pumped liquid temperature > 250 ^{0}C; always use Group II clearance.

6.3.2 Wear ring clearances (diametral)

Pump size (DN) in mm	Clearances in mm	
	Group I	Group II
Up to 65	0.4+0.1	0.6+0.1
80 to 200	0.5+0.1	0.65+.01
250 and above	0.65+0.1	0.75+0.1

Table no. 11
DN corresponds to discharge nozzle size of the pump.

6.4 Bearings

Bearings used for a pump depending upon type of bearing bracket used. Standard execution is with normal bearing bracket having two deep groove ball bearings. Heavy bearing bracket is provided with one heavy duty cylindrical roller bearing at pump side and two angular contact ball bearings at motor side (in "O" arrangement). Refer table no. 12 & 13 for the bearings used. Selection of bearing bracket depends upon the radial & thrust load of individual pumps. The subsequent table no. 14 illustrates recommended bearing brackets for CPK pumps.

For normal bearing bracket

Bearing bracket	Pump & motor side	Oil fill (ltr.)
P 25/62	6305 C3	0.2
P 35/80	6307 C3	0.5
P 45/120	6409 C3	0.5
P 55/140	6411 C3	1.5

Table no. 12

For Heavy Bearing Bracket

Bearing bracket	Pump side	Motor side	Oil fill (ltr.)
P 25/62 s	NU 305 C	2 X 7206 BG	0.2
P 35/80 s	NU 307 C3	2 X 7307 BG	0.5
P 45/120 s	NU 311 C3	2 X 7311 B TVP UA 80	0.5
P 55/140 s	NU 313 C3	2 X 7313 B TVP UA 80	1.5
P 65/160 s	NU 413	2 X 7315 B TVP UA 80	1.8

Table 13

Note : BG is BECBP for SKF make & B.TVP.UA for FAG make B.TVP.UA 80 is BEC86P for SKF make.

6.4.1 Selection of Bearing Brackets

In table no. 14, wherever "N" bearing bracket is mentioned, the data is valid for normal bearing bracket for following specifications. For conditions other than mentioned below; heavy bearing bracket "S" should be used.

Density = 1kg/dm^3

Suction pressure ≤ 4 bar

Max. speed 2900 rpm + +				Max. speed 1450 rpm			
Pump Sizes	Q / Q opt.			Pump Sizes	Q / Q opt.		
	< 0.5	1#	1.1$		< 0.5	1#	1.2 @
32-125	N	N	N	80-160	S	N	N
32-160				80-200			
32-200				80-250			
32-250	S			80-315			
40-160	N			100-200		S	
40-200	S			100-250	N		
40-250				100-315	S	N	
40-315				125-250	N		
50-160				125-315			
50-200				125-400	S	N	
50-250				200-250			
65-200				200-315			
65-250				200-500		S	
65-315				250-315		N	

Table no. 14

+ + These pumps are executed with normal brg. bracket for 1450 rpm

\# 0.5 < Q/Qopt. < 1

$ 1 < Q/Qopt. < 1.1

@ 1 < Q/Qopt. < 1.2

- 50-315 pump at 1450 rpm with P 45-120as bearing bracket
- For 60Hz supply frequency heavy (s) bearing bracket should be used irrespective of Q/Qopt. ratio.

6.5 Shaft sealing

Shaft sealing can be done by either gland packing or mechanical seals depending upon the service conditions. Change over from gland packing execution to single mechanical seal or vice-versa is possible by using corresponding set of interchangeable parts also ksnown as **"Conversion kit"**. Refer 6.5.3 for further details.

6.5.1 Stuffing box packing

Generally gland packings are used up to a maximum suction pressure of 5 bar. Dimensions of standard gland packings are given in the table no. 15. Grade of gland packings used for CPK pumps are :

Style 1094 (TIWA)* CPK G, E, C

Grafoil CPK EY

* Teflon Impregnated White Asbestos)

Gland packing execution is available with or without lantern ring. For CPK EY pump no lantern ring is provided.

Bearing bracket	No. of rings	Dimensions d1/d2XS	Length of packing chamber L	Clearance for removal
P 25/62	4	35 / 51 X 8	53	67
P 35/80		45 / 65 X 10	64	79
P 45/120		55 / 75 X 10	64	77
P 55/140		70 / 95 X 12.5	79	88
P 65/160S		80 / 105 X 12.5	79	88

Table no. 15 : All dimensions are in mm

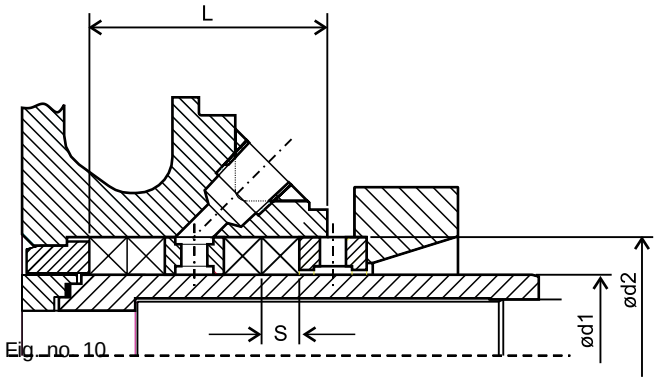


Fig. no. 10

6.5.2 Mechanical Seal

Mechanical seal is used as a sealing device in the following condition.

1. For pumping expensive, toxic, inflamable and corrosive liquids.
2. Generally for a chemical, refinery, fertilizers, pharmaceuticals and nuclear applications.
3. For hot water / DM water services
4. For special process requirements.

Commercially available mechanical seals of single, double & tandom type in cartridge construction are fitted. Single acting mechanical seals may be fitted with a quenching medium, sealing against atmospheric influence is effected by means of a throttling bush or a secondary mechanical seal.

Note : For standard mechanical seal arrangements refer fig. no. 10a & Annexure II. The charts indicate standard seal types, seal sizes, seal face materials and API flushing plans. All offers should be made as per these charts only. For any deviations from these charts refer H. O. before making offers.

6.5.3 Conversion kit

A. Parts required for changeover from gland packing to single mechanical seal :

1. Shaft protection sleeve.
2. mechanical seal
3. Seal cover with throttle bush & flushing line.
4. Casing cover (if applicable)
5. 4 no. of studs & nuts or 4 nos. od allen head screw
6. Set of gaskets & O-rings.

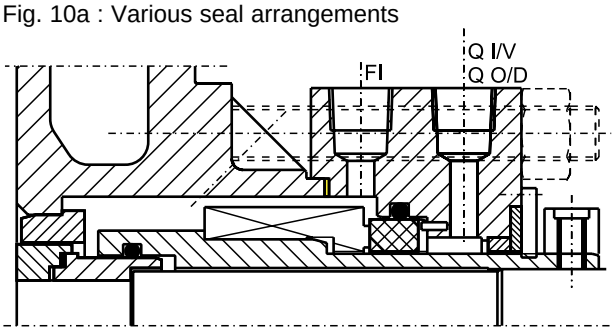
B. parts required for changeover from single mechanical seal to gland packing :

1. Shaft protection sleeve.
2. Gland packing
3. Lantern ring
4. Stuffing box pressure ring
5. Stuffing box gland
6. Casing cover (if applicable)
7. 2 nos. of studs, nuts and washers
8. Set of gaskets and O-rings

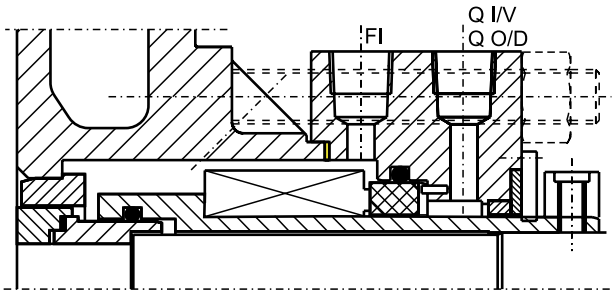
Refer Annexure II for further details on casing cover interchangeability.

7 Materials

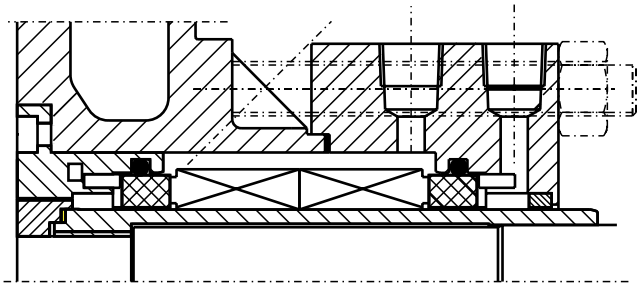
Fig. 10a : Various seal arrangements



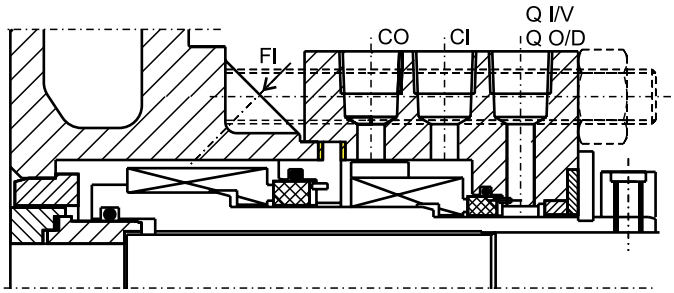
Shaft seal : single-acting mechanical seal, balanced,cartridge.



Shaft seal : single-acting mechanical seal, unbalanced, cartridge.



Shaft seal : double-acting mechanical seal (back to back), both sides unbalanced, non cartridge.



Shaft seal : double-acting mechanical seal (tandem), both sides balanced ,cartridge.

Following tables indicate different material combinations available in CPK G, CPK E, and CPK C models.

Refer Annexure IV for reference standards and grades of materials.

7.1 Material Combinations for CPK G

Part name	Material executions		
	G	GC	GC
	0	2	4
Volute casing	C.I.	C.I.	
Casing cover			
Stuffing box pr. Ring			
Lantern ring			
Neck ring (packing)			
Stuffing box gland			
Shaft protection sleeve (packing)		Type 316	Type 410
Impeller		CF8M / Type 316	
Impeller nut			
Wearing ring			
Brg. Bkt. Lantern		C.I.	
Studs & nuts	Class 6.8 / 6		
Shaft	C-45		Type 410
Key			
Splash ring	Al.		
Labyrinth ring	C.I.		

Table no. 16

Note :

1. When Vu>40m/s; use CF8M for impeller
2. For mechanical seal
   Material of Sleeve : Type 316
   Material of Seal cover : Type 316
   Material of throttle bush : Carbon
3. For size 200-250 bearing bracket lantern is given in WCB.

7.2 Material Combinations for CPK E

Part name	Material executions					
	EGY	E	EC	EY	E	EC
	0	1	2	3	4	5
Volute casing	WCB					
Casing cover						
Stuffing box pr. Ring	C.I.	C.I.		C.I.	C.I.	
Lantern ring	-			-		
Neck ring (packing)	-			-		
Stuffing box gland	C.I.			C.I.		
Shaft protection sleeve (packing)	C45/CH	Type 410				
Impeller	C.I.	WCB	CF8M	WCB		CF8M
Impeller nut		CF8M/Type 316				
Wearing ring	-	Chrome Hard 400				
Impeller ring	-	1.4024.19				
Bearing Bracket Lantern	C.I.			WCB	C.I.	
Studs & nuts	B7/2H	Cl. 6.8 & 6		B7/2H	Cl. 6.8 & 6	
Shaft	C 45			Type 410		
Key						
Splash ring	Al.					
Labyrinth ring	C.I.					

Table no. 17.

Note :

1. For mechanical seal
   Material of Sleeve : Type 316
   Material of Seal cover : Type 316
   Material of throttle bush : Carbon
2. Material of wearing ring and impeller ring is applicable only when details of construction indicates double wearing ring execution. Combination no. "0" is always offered without wearing rings.
3. Shaft can given in C45 for operating temp. in the range of -10 to +250 ^{0}C.
4. Bearing bracket lantern is given in WCB if operating temp. is more than 200 ^{0}C or when pumping hot water above 180 ^{0}C and where special regulations are applicable. Bearing bracket lantern is given in CF8M for operating temperature < -30 ^{0}C.
5. When Vu>40 m/sec. or operating temp. 250 ^{0}C to 300 ^{0}C use CF8M for Impeller.
6. CH. is Chrome plated.
7. Fastners of grade B7/2H should be offered if operating temperature > 250 ^{0}C.

7.3 Material combinations for CPK C

Part name	Material executions			
	C	C	C	C
	0	4	6	8
Volute casing	CF8M			
Casing cover				
Stuffing box pr. Ring				
Lantern ring				
Neck ring (packing)	Type 316			
Stuffing box gland	CF8M			
Shaft protection sleeve (packing)	Type 316			
Impeller	CF8M			
Impeller nut	CF8M/Type 316			
Wearing ring	CF 8 M + Colomony Coating			
Impeller ring	CF8M			
Bearing Bracket Lantern	C.I.			WCB
Studs & nuts	B7/2H			
Shaft	C 45	AISI 329	Type 410	
Key		Type 316		
Splash ring	Al.			
Labyrinth ring	C.I.			

Table no. 18

Note :

1. For mechanical seal
   Material of Sleeve : Type 316
   Material of Seal cover : Type 316
   Material of throttle bush : Carbon
2. Shaft is given in C45 for operating temperature in the range -10 ^{0}C to +250 ^{0}C. For temperature > 250 ^{0}C; shaft material is A 276 Type 410. For temperature -10 to -40 ^{0}C; shaft material is AISI 329.
3. Bearing bracket lantern is given in WCB if operating temperature > 200 ^{0}C & for hot water above 180 ^{0}C. Bearing bracket lantern in CF8M if operating temperature < -30 ^{0}C.

8 Technical data

8.1 Dynamic moment of inertia, volumetric content and weight of pump

Pump size	Dynamic moment of inertia - J in kg-m^2	Volumetric content of pump in liters	Weight of pump in kg.	
			CPK G	CPK E,C
32-125	0.005	0.6	33	39
32-160	0.009	0.7	33	39
32-200	0.019	1	39	48
32-250	0.047	1.7	75	84
40-160	0.009	1	35	41
40-200	0.019	1.2	40	48
40-250	0.047	1.9	75	84
40-315	0.105	2.7	85	106
50-160	0.01	1.6	38	44
50-200	0.023	1.9	44	49
50-250	0.051	2.5	75	85
50-315	0.105	3	100	114
65-200	0.023	2.7	66	81
65-250	0.05	3.2	80	90
65-315	0.107	4.6	117	121
80-160	0.015	4	71	80
80-200	0.025	4.1	71	85
80-250	0.056	4.7	97	100
80-315	0.125	5.7	122	130
80-400	0.3	7.6	151	162
100-200	0.03	6.3	88	100
100-250	0.07	6.9	117	120
100-315	0.14	7.9	131	140
100-400	0.32	9.5	162	175
125-250	0.089	10.3	132	138
125-315	0.173	11.1	149	160
125-400	0.4	12.6	177	193
150-250	0.1	18	170	180
150-315	0.23	19	240	250
150-400	0.47	20	275	290
200-250	0.15	29	230	240
200-315	0.28	30	270	280
200-400	0.7	31	314	335
200-500	1.5	33	496	511
250-315	0.32	70	447	475
250-400	0.9	70	485	515
250-500	1.6	70	570	610

Table 8.1.1

8.2 Forces and moments

The permissible forces and moments for CPK pumps are given in 8.2.1, 8.2.2 & 8.2.3 for CPK G, E, C respectively. When the operating temperature is above 120 ^{0}C; use temperature correction chart 8.2.4.

Note : In case the piping loads are to be in accordance with DIN 24256 / ISO 2858 the values as mentioned in 8.2.5 are to be used.

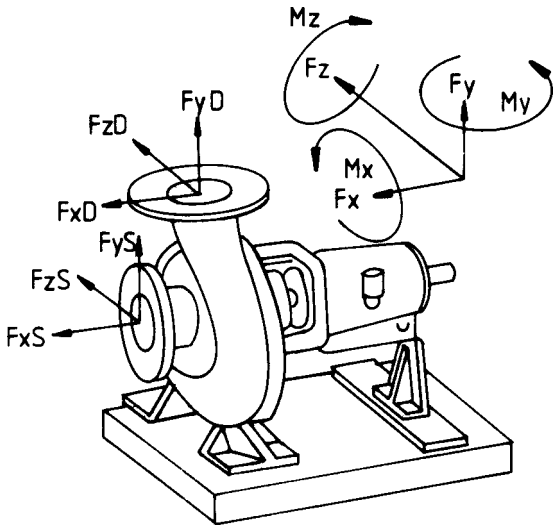
The permissible resultant forces and moments are determined as per the formulae given below.

$Fres(D) < (Fx^2 + Fz^2)^{1/2}$
$Fres(S) < (Fy^2 + Fz^2)^{1/2}$

Suffixes "S" & "D" denote suction and discharge respectively. The moments are along the principal axes and are to be added in the same direction. Data for forces and moments is valid for static pipe line loading only.

1daN = 10N i. e. approx. 1kg.

8.2.4 Correction of Forces and moments for



8.2.1 Forces and moments for CPK G

Pump size		Forces									Moments		
		At Suction in daN				At Discharge in daN					About main axis in daNm		
		Fx	Fy	Fz	Fres	Fx	Fy+ve tens.	Fy -ve comp.	Fz	Fres	Mx	My	Mz
32	125	90	60	70	90	45	30	55	35	60	75	60	40
	160												
	200												
	250												
40	160	115	75	90	120	55	35	70	45	75	110	85	55
	200												
	250												
	315												
50	160	140	95	115	150	70	45	90	60	90	150	115	75
	200												
	250												
	315												
65	200	180	115	140	180	95	60	115	75	120	210	155	105
	250												
	315												
80	160	245	160	195	250	115	70	140	95	150	285	215	145
	200												
	250												
	315												
	400												
100	200	245	160	195	250	140	90	180	115	180	315	240	160
	250												
	315												
	400												
125	250	310	205	250	320	195	120	245	160	250	410	315	210
	315												
	400												
150	250	490	310	380	490	250	155	310	205	320	585	435	295
	315												
	400												
200	250	490	310	380	490	380	235	490	310	490	705	515	350
200	315	670	445	535	695	380	235	490	310	490	855	640	420
	400												
	500												
250	315	800	535	670	855	535	335	670	450	700	1110	840	545
	400												
	500												

Table no. 20

8.2.2 Forces and moments for CPK E

Pump size		Forces									Moments		
		At Suction in daN				At Discharge in daN					About main axis in daNm		
		Fx	Fy	Fz	Fres	Fx	Fy+ve tens.	Fy -ve comp.	Fz	Fres	Mx	My	Mz
32	125	135	90	110	140	70	45	85	55	90	115	90	60
	160												
	200												
	250												
40	160	175	115	140	180	85	55	110	70	110	170	130	85
	200												
	250												
	315												
50	160	215	140	170	220	110	70	135	90	140	220	170	110
	200												
	250												
	315												
65	200	270	175	215	275	140	90	175	115	180	315	235	160
	250												
	315												
80	160	370	240	295	380	170	110	215	140	220	430	325	220
	200												
	250												
	315												
	400												
100	200	370	240	295	380	215	135	270	175	280	470	360	240
	250												
	315												
	400												
125	250	470	310	375	485	295	185	370	240	380	620	470	320
	315												
	400												
150	250	735	470	570	740	375	235	470	310	485	875	650	440
	315												
	400												
200	250	735	470	570	740	570	355	735	470	740	1060	770	530
200	315	1000	670	800	1045	570	355	735	470	740	1280	960	630
	400												
	500												
250	315	1200	800	1000	1280	800	500	1000	670	1045	1670	1260	815
	400												
	500												

Table no. 21

8.2.3 Forces and moments for CPK C

Pump size		Forces At Suction in daN				Forces At Discharge in daN					Moments About Main axis in daNm		
		Fx	Fy	Fz	Fres	Fx	Fy+ve tens.	Fy -ve comp.	Fz	Fres	Mx	My	Mz
32	125	115	80	95	125	60	35	75	50	80	100	75	50
	160												
	200												
	250												
40	160	150	100	120	155	75	45	95	60	95	145	110	75
	200												
	250												
	315												
50	160	185	120	145	190	95	60	115	75	120	195	145	95
	200												
	250												
	315												
65	200	230	150	185	240	120	75	150	100	155	270	205	140
	250												
	315												
80	160	320	210	255	330	150	95	185	125	195	370	280	190
	200												
	250												
	315												
	400												
100	200	320	210	255	330	185	115	230	150	240	410	310	210
	250												
	315												
	400												
125	250	405	265	325	420	255	160	320	210	330	535	410	275
	315												
	400												
150	250	635	405	495	640	325	200	405	265	420	760	565	380
	315												
	400												
200	250	635	405	495	640	495	305	635	405	640	920	670	460
200	315	865	580	695	905	495	305	635	405	640	1110	830	545
	400												
	500												
250	315	1040	695	870	1110	695	435	870	580	905	1445	1095	705
	400												
	500												

Table no. 22

temperature above 120 ^{0}C

For temperatures more than 120 ^{0}C; the values of forces and moments are to be multiplied by correction factor "K". The factor "K" for the material and temperature is to be taken from the following graphs.

Note : These graphs are to be used for table no. 8.2.1, 8.2.2 & 8.2.3 respectively.

K for CF8M

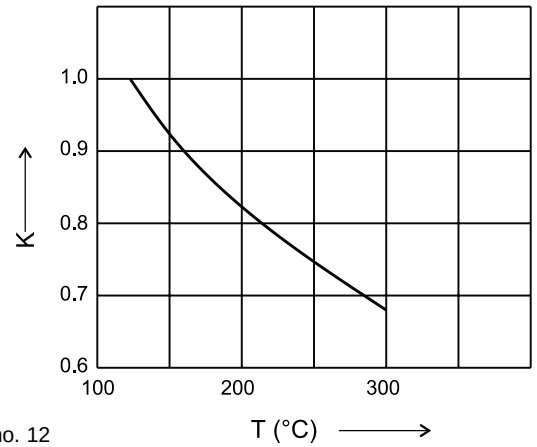


Fig. no. 12

K for WCB

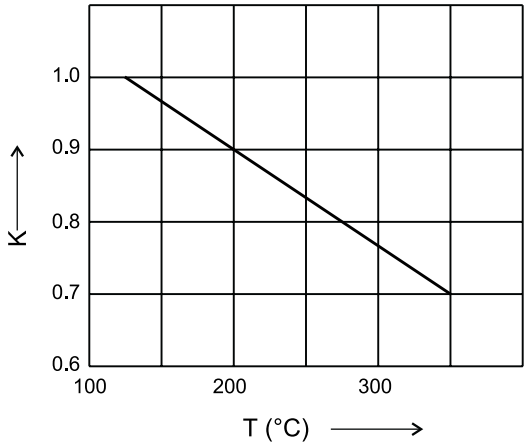


Fig.13

K for C.I.

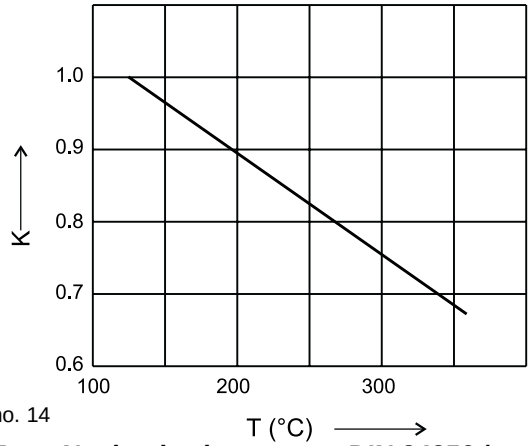


Fig. no. 14

8.2.5 Net load values as per DIN 24256 / ISO 2858

Pump size		Fv max. In daN 2)	Fh max. in daN 3)	M max. in daN 4)
32	125	450	320	90
	160	440	310	70
	200	440	300	85
	250	460	320	105
40	160 1)	430	300	80
	200	450	330	110
	250	500	360	130
	315	50	350	125
50	160	470	330	110
	200	500	370	130
	250	550	410	165
	315	550	400	160
65	200	630	480	220
	250	630	480	220
	315	650	500	235
80	160	650	500	235
	200	740	590	300
	250	750	590	310
	315	750	600	310
	400	810	650	350
100	200	950	780	440
	250	980	800	460
	315	930	770	430
	400	880	710	395
125	250	1210	1080	680
	315	1150	1000	580
	400	1130	980	575
150	250	1300	1200	700
	315	1300	1200	700
	400	1300	1200	700

Table no. 23

1) Interpolated from 'EUROPUMP' data.

2) Σ 2/3 $|FVD| + |Fvs| \leq Fv_{max.}$

3) $\Sigma (|Fhs| + |Fhd|) \leq Fh_{max.}$

4) $\Sigma (|Ms| + |Md| \leq M_{max.}$
(Acting in plane of flange only)

Note : Piping forces and moments calculated by the purchaser for the piping system can be checked for acceptability as per ISO 5199 / EUROPUMP.

No matter how the forces and moments are applied and distributed at the pump flanges, their admissible values should meet the following requirement.

$$\frac{(\Sigma|Fv|)^2}{(|Fv_{max.}|)^2} + \frac{(\Sigma|Fh|)^2}{(|Fh_{max.}|)^2} + \frac{(\Sigma|M|)^2}{(|M_{max.}|)^2} < 1$$

Where
Fv = Vertical forces (Y axis)
Fh = Horizontal forces (X & Z axis)
M = Moments in all directions (in the plane of flange)

Note : The values given in the table no. 23 are valid for Cast Steel (CPK E i.e. WCB) up to 50 ^{0}C only. In case of different material of construction and operating temperature above 50 ^{0}C, these values need to be reduced using the reduction factor from fig. 15.

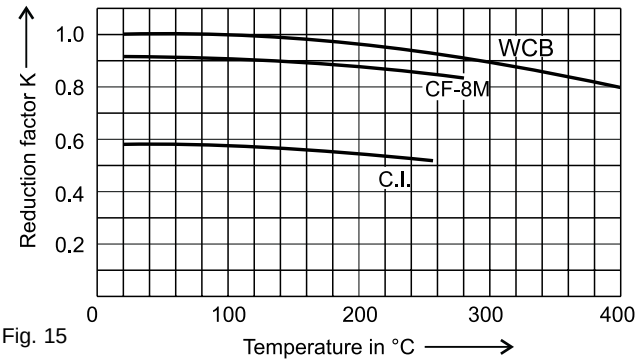


Fig. 15

8.2.6 Displacement between pump and drive shaft

Displacement between pump 7 drive shaft under the application of forces should not exceed following values.

Bearing bracket	Value in mm
P 25/62	0.15
P 35/80	0.2
P 45/120 as	0.25
P 55/140	0.25
P 65/160	0.25

Table no. 24

8.3 Determination of pressure in stuffing box

Pressure in stuffing box can be calculated using the following formula,

$$Pw = \frac{K \times Ho \times \rho}{10} + Pz$$

Where,

Pw = pressure in stuffing box in bar
K = Constant as per fig. 16
Ho = Differential pressure in m at shut off
r = Density in kg/dm³
Pz = suction pressure in bar

Example :

Capacity Q = 41 lps (148 m³/hr.)
Head H = 128 mlc
Speed n = 2900 rpm
Density r = 0.9 kg/dm³
Temperature t = 90 °C
Suction pressure Pz = 0 bar
Selected pump size = CPK 80-315
Impeller diameter D2 = 300 mm
Back vane diameter Drm = 260 mm (from table no. 25)
Value for K = 0.23 (from fig. no. 16)

Therefore,

$$Pw = \frac{0.23 \times 128 \times 0.9}{10} + 0$$

Pw = 2.65 bar

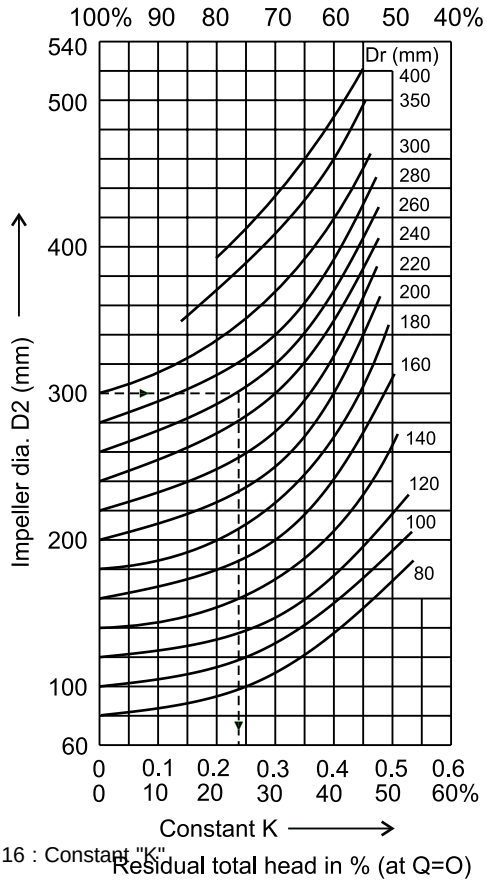


Fig. no. 16 : Constant "K"

Pump Size	Back vane diameter in mm		Pump Size	Back vane diameter in mm	
	DR max.	DR min. +		DR max.	DR min. +
32-125	120	120	150-250	260	220
32-160	120	120	200-250	220	
40-160	120	120	40-315	210	210
50-160	169	150	50-315	240	240
80-160	160	150	65-315	280	220
32-200	120	120	80-315	260	260
40-200	140	140	100-315	280	280
50-200	180	160	125-315	280	
65-200	180	180	150-315	280	
80-200	209	185	200-315		
100-200	180	180	250-315		
32-250	150	150	80-400	290	
40-250	190	160	100-400		
50-250	200	175	125-400		
65-250	220	200	150-400	360	
80-250	260	240	200-400		
100-250	220	220	250-400		
125-250	260	220	200-500	450	
			250-500		

+ For Pw < 4 bar

Table no. 25 : Backvane diameter

8.4 Determination of power loss in stuffing box

In case of single mechanical seal frictional losses are included in the individual performance curves. In case of double seals, the losses for the atmospheric side of mechanical seal are to be added as per fig. 17.

1. Gland pack execution, pressure v/s power loss at 1450 rpm : refer fig. 17a.

2. Pressure v/s power loss at stuffing box with double & tandom seal at 1450 rpm : refer fig. 17.

3. For other speeds, power loss can be calculated using following formula,

Power loss at "N" rpm = Power loss at 1450 X

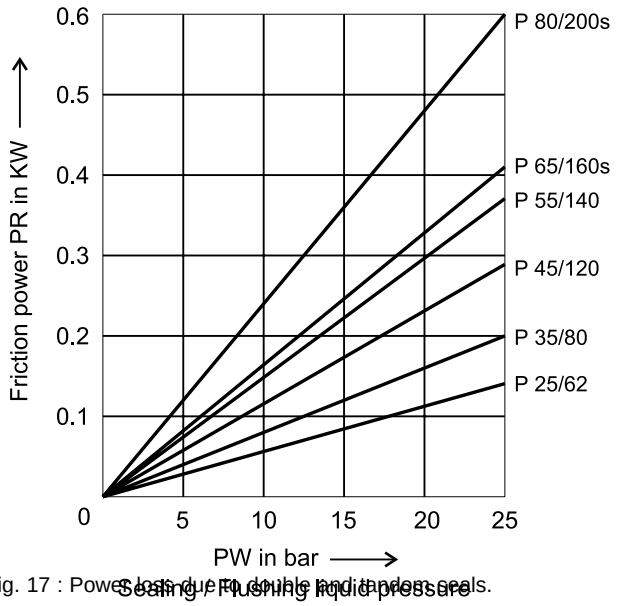


Fig. 17 : Power loss due to double and tandom seals.

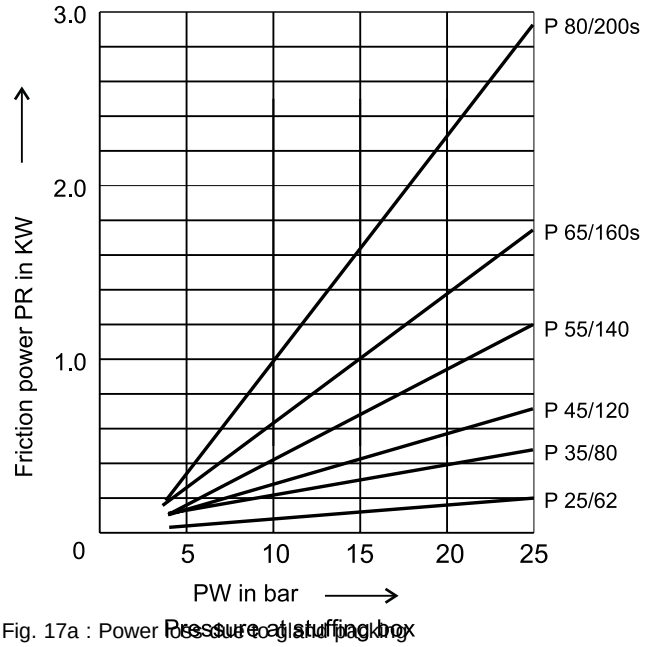


Fig. 17a : Power loss due to gland packing

9. Cooling

When the working temperature is above 90 ^{0}C; cooling to stuffing box is required.

Data

Pressure of cooling water : 10 bar max.
Temp. of cooling water inlet : 10 to 30 ^{0}C
Temp. of cooling water outlet : 45 ^{0}C max.
Temp. rise (max. allowed) : 15 ^{0}C
Test pressure for cooling chamber : 15 kg/cm^2 max.

Clean, clear and non aggressive water is recommended for cooling. Recommended pH value is 7.

9.1 Quantity of cooling water in lpm

Bearing bracket	Temp. of pumped liquid in ^{0}C		
	<150	150-250	> 250
P 25/62	5	6	8
P 35/80	6	8	9
P 45/120	9	11	12
P 55/140	12	14	15
P 65/160s	15	17	18

Table no. 26

Note : Above data is for a temperature of 15 ^{0}C

9.2 Sealing liquid/cooling of stuffing box gland

For stuffing box with packing, clean, solid free liquid at a pressure of 1 bar above the pressure in the stuffing box and at a flow rate of about 2 to 3 lpm is recommended.

9.3 Cooling of bearing bracket

No cooling is required to the bearing bracket up to a working temperature of 200 ^{0}C.

For working temperature > 200 ^{0}C use following data

Cooling water quantity : 3 lpm
Pressure (max.) : 10 bar

9.4 Cooling to pedestal

In case of centre feet mounted CPK pumps, cooling to pedestal is recommended for working temperature above 250 ^{0}C. The cooling can be arranged in parallel or in series with bearing bracket.

Cooling water quantity :
In series with brg. bkt. (e.g. API plan G) : 5 lpm
In parallel with brg. bkt. (e.g. API plan G1) : 3 lpm

10 Heating

The space between casing cover and bearing bracket lantern can also be used for heating by hot water, steam or any other suitable transfer media.

	Heating with hot water/steam	
Execution	Max. temperature	Max. pressure
Normal	183 ^{0}C	10 bar

Table no. 27

11 Accessories

Following accessories are supplied with pumps.

1. Auxillary piping (when specified)
2. Couplings
3. Coupling guards
4. Base frame with foundation bolts
5. Prime mover (if asked by the client)
6. Vacuum balance line

11.1 Auxillary piping

It consists of pipe line for flushing, quenching, cooling, circulation, drain etc. with necessary valves.

11.2 Couplings

The couplings between the pump and prime mover can be either flexible or all metal type or gear type. Preferably spacer type couplings are recommended for ease of maintenance and to take maximum advantage of back pull out feature of CPK pumps i.e. maintenance without disturbing the mounting of pump casing in the pipe line and mounting of prime mover. Spacer length should be suitably selected. For minimum spacer length refer dimension "y" in table 33 & 34. While selecting a coupling following care is to be taken :

1. Maximum rated speed of the coupling should be more than the actual running speed.

2. Maximum rated power to be transmitted by the coupling should be more than the drive rating.

3. Permissible P/n value of the coupling should be more than the actual ratio of power to be transmitted to the running speed.

4. Permissible maximum bore of the coupling should be more than the diameter of shaft of the pump or prime mover (in prescribed tolerance).

11.3 Coupling guard

Any type of coupling has to be provided with a suitable coupling guard in accordance with accident prevention regulations. If the customer states specifically that the coupling guard is to be provided by customer, then the same should be fitted on the coupling before putting the pump in operation.

Standard materials for coupling guard are :
1. Mild Steel for standard execution
2. Aluminium sheet for Non-Sparking execution

A heavy duty coupling guard design is also available.

11.4 Base frame

Generally common base frames are provided for mounting pump, coupling with guard and primemover. The base frames are steel fabricated having drain tray and pedestals (in case of centre feet models) welded to it. Base frame is optional and is supplied only against order.

11.5 Prime Mover

The prime mover can be an electric motor, steam turbine or an internal combustion engine. The prime mover can be coupled either directly through a flexible coupling or indirectly through a gear box.

11.6 Vacuum balance line

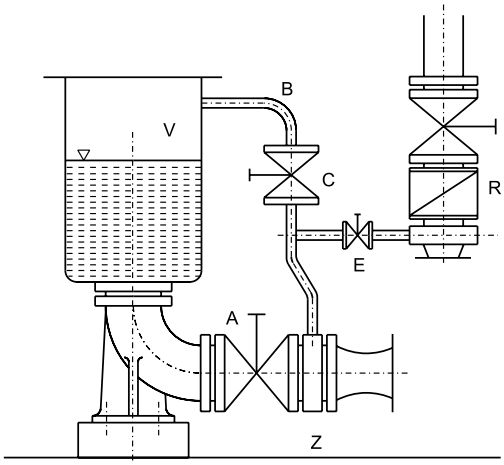


Fig. 18

A. Main isolating valve
B. Vacuum balance line
C. Isolating valve
E. Vacuum tight isolating valve
R. Check valve
V. Vessel under vacuum
Z. Intermediate flange

If the pump has to pump a liquid out of vessel under vacuum, it is advisable to install a vacuum balance line. This line should have a nominal size of 25 mm atleast. It should be arranged to lead back into the vacuum vessel at a point above the permissible liquid level. An additional line starting at the pump discharge nozzles facilitates venting of the pump before start up. The vacuum tight isolating valve E in the connecting line should be closed after the venting procedure and should remain closed while the pump is running. The main isolating valve C in the vacuum balance line must remain open at all times when the pump is running and should be closed when the pump is shut down. See fig. 18.

12. Painting

Painting of the pump is done with enamel paints as per internal standard ok KSB.

13. Testing

Performance testing of the pump is carried out as per IS:5120 or DIN 1944/III. Testing as per any other standard is possible by applying correction factors for tolerance of capacity, head, efficiency and NPSH.

14.0 Spare parts

14.1 Interchangeability of spare parts

Bearing Bracket	Pump Sizes	Designation	Casing Cover	Support Foot	Shaft	Angular contact ball bearin	Deep Groove ball bearing	Cylindrical roller bearing	Bearing bracket	Bearing bracket lantern	Mechanical seal	Stuffing box gland	Stuffing box pressure ring	Neck ring	Lantern ring	Gland Packing	Seal Cover	Wearing ring	Splash ring	Shaft protection sleeve	Drip tray	Impeller nut
		Part No.	161	183	210	320.02	321.01 / 321.02	322.01	330	344	433	452.01	454.01	456.01	458.01	461.01	471.01	502.01	507.01	524.01	648	922
P 25 / 62	32-125		1	1	1	1			1									1	1	1		
	32-160		2	2						2								2				
	40-160																	3				
	50-160			3														1				
	32-200		3							3								2				
	40-200																	3				
	50-200																					
P 35 / 80	80-160		4	5						4								10	2			
	65-200		5							5								8				
	80-200																	10				
	100-200			6														12				
	32-250		6	5						6								6				
	40-250																	5				
	50-250																	4				
	65-250			6														8				
	80-250			7														11				
	40-315		7	6						7								5				
	50-315			7														7				
P 45 / 120	100-250		8	8						6								13	3		2	3
	125-250			9														15				
	150-250			10														16				
	65-315		9	8						7								9				
	80-315			9														12				
	100-315			9														14				
	125-315			10														16				
	80-400		10							8								12				
	100-400																	14				
	125-400			11														15				
P 55 / 140	200-250		11	13	4	4				9								17	4		3	4
	150-315		12	12						10								18				
	200-315			13														19				
	250-315			16	5													21				
	150-400		13	12	4					11								18				
	200-400			13														20				
P 65 / 160	200-500		16	17	6	5		5		12		5						20	5		3	5
	250-400		15							11								22				
	250-500		16	15						12								23				

Table no. 28

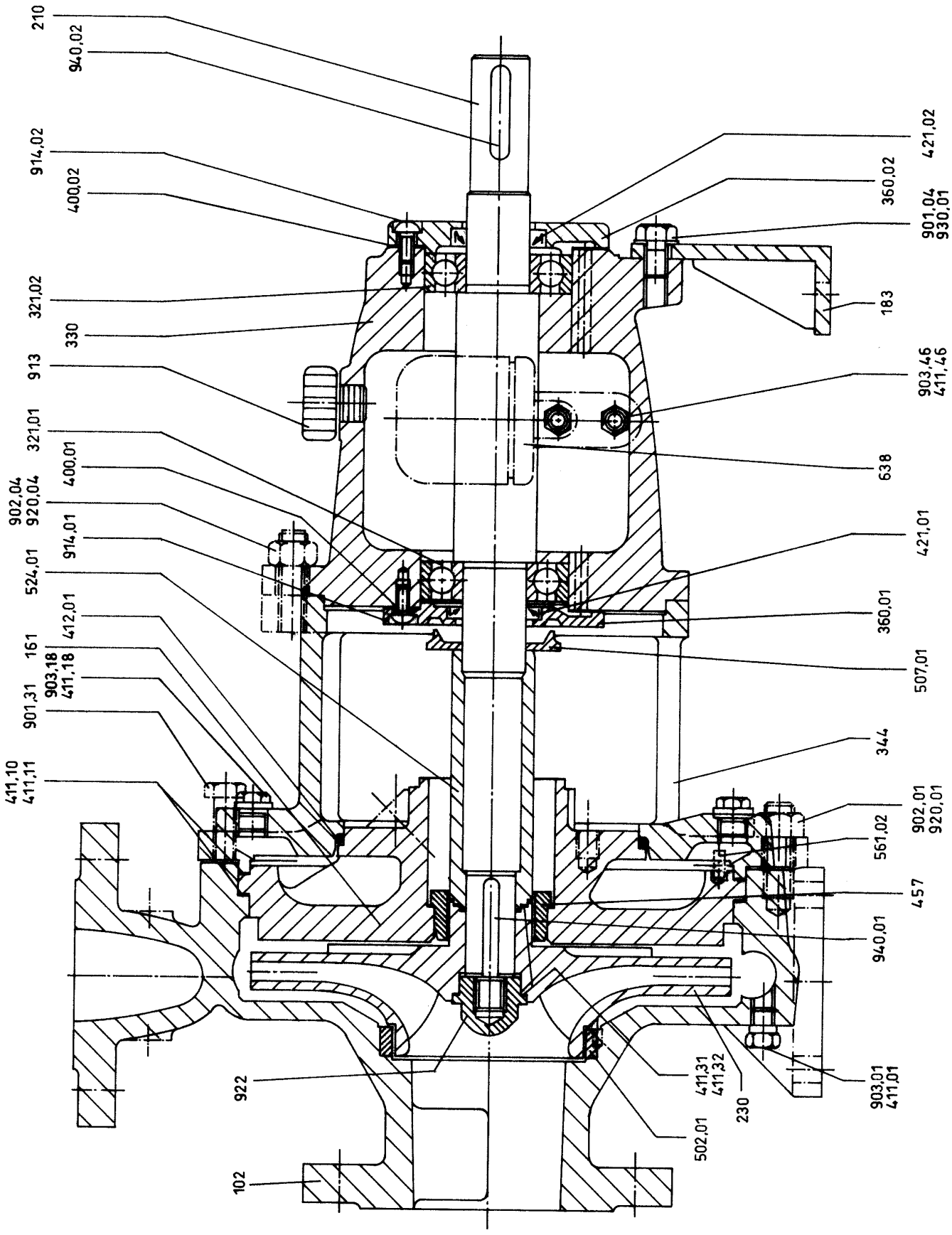
Note : Volute casing (part no. 102) & impeller (part no. 230) are not interchangeable

14.2 Recommended stock of spare parts for two years of operation

Part no.	Description	No. of pumps (Including standby pumps)						
		2	3	4	5	6	8	10 & more
		Qty. in nos.						
210	Shaft	1	1	2	2	2	3	30%
230	Impeller	1	1	2	2	2	3	30%
320.02	Angular contact ball bearing	1	1	2	2	2	4	50%
321.01/02	Deep groove ball bearing	1	1	2	2	2	4	50%
322.01	Cylindrical roller bearing	1	1	2	2	3	4	30%
330	Bearing bracket	-	-	-	1	1	1	2 per 10 nos.
433	Mechanical seal	Refer works						
454.01	Stuffing box pressure ring	1	1	2	2	2	3	30%
456.01	Neck ring	1	1	2	2	2	3	30%
458.01	Lantern ring	1	1	2	2	2	3	30%
461.01	Gland packing	2	2	3	3	3	4	40%
502.01	Wearing ring	2	2	2	3	3	4	50%
524.01	Shaft protection sleeve	2	2	2	3	3	4	50%
-	Set of Gaskets & o-rings	4	6	8	8	9	12	150%

Table no. 29

15 Cross sectional drawing

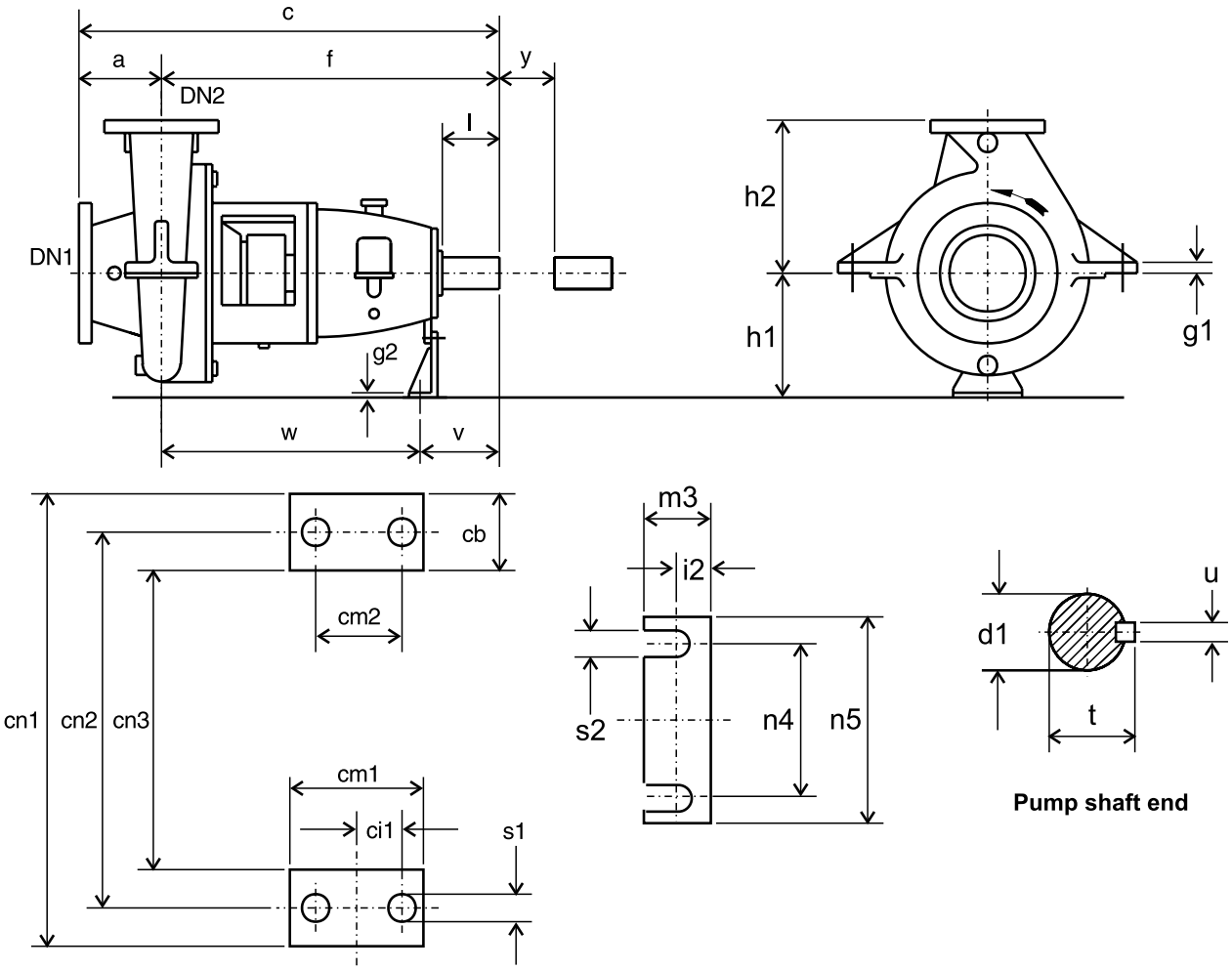


15.1 List of components

Part no.	Description	Part no.	Description
102	Volute casing	503.01	Impeller ring
161	Casing cover	507.01	Splash ring
183	Support foot	524.01	Shaft protection sleeve
210	Shaft	550.23	Spacer disc
230	Impeller	561.02	Cylindrical pin
320.02	Angular contact ball bearing	638	Constant level oiler
321.01/02	Deep groove ball bearing	901.04	Hex. Bolt - Support foot
322.01	Cylindrical roller bearing	901.31	Hex. Bolt - Dismantling
330	Bearing bracket	902.01	Stud - Bearing bracket lantern
344	Bearing bracket lantern	902.04	Stud - Bearing bracket
360.01	Bearing cover	903.01	Hex. Head plug - Casing drain
360.02	Bearing end cover	903.18	Hex. head plug - Casing cover
400.01	Flat gasket - Bearing cover	903.46	Hex. Head plug - Bearing bracket drain
400.02	Flat gasket - Bearing end cover	913	Vent plug- Bearing bracket
~~411.18~~	Gasket	914.02	Allen grub screw - Impeller ring
~~411.01~~	Gasket	920.01	Hex. Nut - Bearing bracket lantern
411.10/11	Flat gasket - Casing cover	920.04	Hex. Nut - Bearing bracket
411.31/32	Flat gasket - Impeller nut / impeller	920.21	Withdrawl nut
411.46	Flat gasket - Drain plug Brg. Bkt.	922	Impeller nut
412.01	O ring - Bearing bracket lantern	930.01	Spring washer - Support foot
421.01	Oil seal - Bearing cover	931.01	Lock washer
421.02	Oil seal - Bearing end cover	932.01/02	Circlip
456.01	Neck ring	940.01/02	Key
502.01	Wearing ring		

16 Pump dimensions

16.1 Centre feet pump dimensions

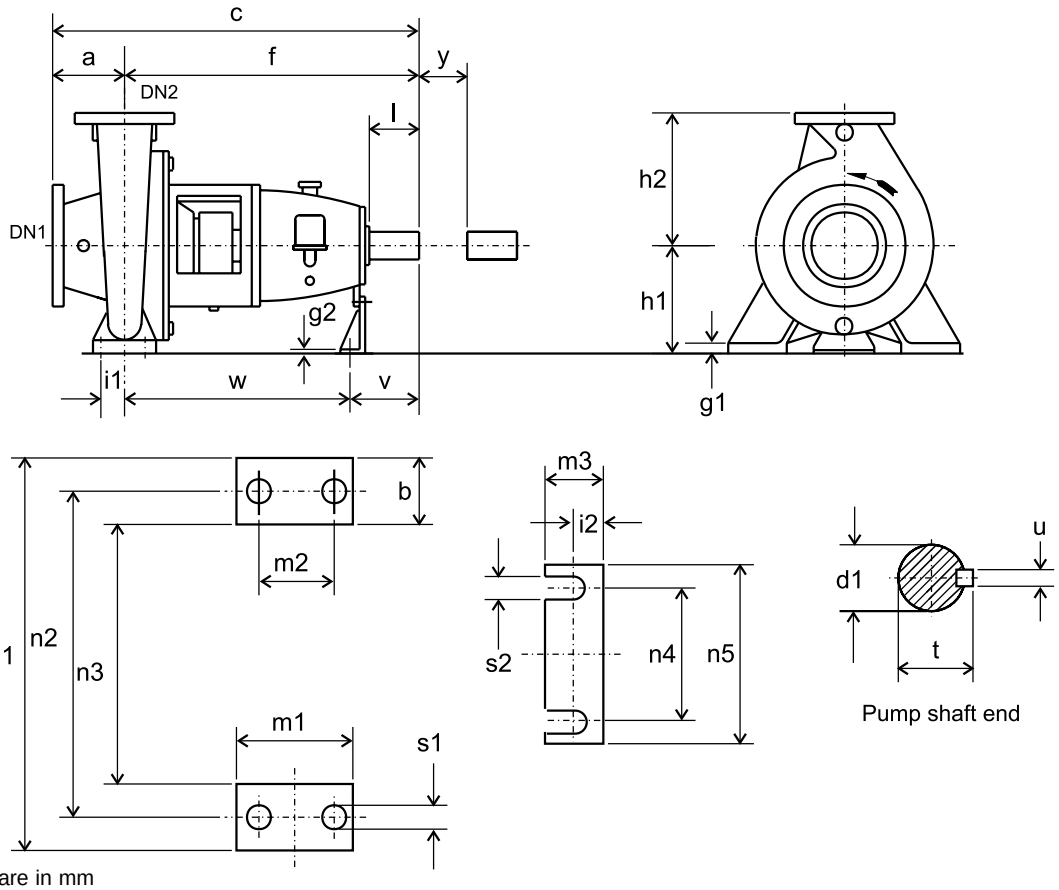


All dimensions are in mm

Pump Size		Bearing Bracket	Pump Dimensions							Mounting Bolts			
			DN1	DN2	cb	g1	cm1	cn1	cn3	ci1	cm2	cn2	s1
32	160	P 25/62	50	32	40	14	100	320	240	30	70	285	14
	200	P 25/62			45	16		360	270			315	
	250	P 35/80			50		115	440	340	40	80	400	
40	160	P 25/62	65	40	40	14	100	340	260	30	70	310	14
	200	P 25/62			45	16		375	285			340	
	250	P 35/80			50		115	440	340	40	80	400	
	315	P 35/80				20	130	500	400	38	90	460	
50	160	P 25/62	80	50	42.5	14	100	375	290	30	70	340	14
	200	P 25/62			45	16		410	320			370	
	250	P 35/80			50		115	460	360	40	80	420	
	315	P 45/120 as				20	130	525	425	37.5	90	485	18
65	200	P 35/80	100	65	45	16	110	425	335	38	80	375	14
	250				50	18	130	500	400		90	460	18
	315	P 45/120				20		590	490			550	
80	200	P 35/80	125	80	50	16	120	480	380	38	90	430	14
	250				42.5	18	130	525	440			485	18
	315	P 45/120			50	20		590	490	37.5		550	
100	200	P 35/80	125	100	50	16	120	510	410	38	90	460	18
	250	P 45/120				18	130	550	450	38		510	
	315					20		640	540	37.5		600	
125	250	P 45/120	150	125	50	18	130	590	490	38	90	550	18
	315					20	150	690	590		110	650	20
200	400	P 55/140	250	200	65	22	160	920	790	55	110	855	23

Note : For balance dimensions; refer dimension table of bottom feet pumps.

16.2 Bottom feet pump dimensions



All dimensions are in mm

Pump Size		Bearing Bracket	Pump Dimensions															Shaft end dimensions					Mounting Bolts								
			DN1	DN2	a	b	c	f	g1	g2	h1	h2	m1	m3	n1	n3	n5	d1 k6	l	t	u	y	l1	l2	m2	n2	n4	s1	s2	v	w
32	125	P 25/62	50	32	80	50	465	385	12	8	112	140	100	45	190	90	160	24	50	27	8	100	35	25	70	140	110	14		100	285
	160								14		132	160			240	140										190					
	200										160	180																			
	250	P 35/80			100	65	600	500	16		180	225	125	47	320	190		32	80	35	10		48	27	96	250				130	370
40	160	P 25/62	65	40	80	50	465	385	14	8	132	160	100	45	240	140	160	24	50	27	8	100	35	25	70	190	110	14		100	285
	200				100		485				160	180			265	165										212					
	250	P 35/80				65	600	500	16		180	225	125	47	320	190		32	80	35	10		48	27	96	250				130	370
	315				125		625		18		200	250			345	215										280					
50	160	P 25/62	80	50	100	50	485	385	14	8	160	180	100	45	265	165	160	24	50	27	8	100	35	25	70	212	110	14		100	285
	200											200																			
	250	P 35/80			125	65	625	500	16		180	225	125	47	320	190		32	80	35	10		48		96	250				130	370
	315	P 45/120 as							18		225	280			345	215							47.5	30	95	280					
65	200	P 35/80	100	65	100	65	600	500	16	8	180	225	125	47	320	190	160	32	80	35	10	140	48	27	96	250	110	14	14	130	370
	250				125	80	625		18		200	250	160		360	200							60		120	280		18			
	315	P 45/120					655	530		12	225	280		52	400	240		42	110	45	12			30		315				160	
80	160	P 35/80	125	80	125	65	625	500	15	8	180	225	125	47	320	190	160	32	80	35	10	140	47.5	25	95	250	110	14	14	130	370
	200								16	8	180	250	125	47	345	215								27		280					
	250								18		225	280	160		400	240							60		120	315		18			
	315	P 45/120				80	655	530		12	250	315		52				42	110	45	12			30						160	
	400								20		280	355			435	275										355					
100	200	P 35/80	125	100	125	80	625	500	16	8	200	280	160	47	360	200	160	32	80	35	10	140	60	27	120	280	110	18	14	130	370
	250	P 45/120			140		670	530	18	12	225			52	400	240		42	110	45	12			30		315				160	
	315										250	315																			
	400					100			20		280	355	200		500	300							75		150	400		23			
125	250	P 45/120	150	125	140	80	670	530	18	12	250	355	160	52	400	240	160	42	110	45	12	140	60	30	120	315	110	18	14	160	370
	315					100			20		280		200		500	300							75		150	400		23			
	400										315	400																			
150	250	P 45/120	200	150	160	100	690	530	20	12	280	375	200	52	500	300	160	42	110	45	12	180	75	30	150	400	110	23	14	160	370
	315	P 55/140					830	670	24		315	400		60	550	350	200	48		51.5	14			39		450	140		18	170	500
	400								22			450																			
200	250	P 55/140	200	200	180	100	850	670	22	12	355	425	200	60	550	350	200	48	110	51.5	14	180	75	39	150	450	140	23	18	170	500
	315		250		200		870					450																			
	400				180		850					500																			
	500	P 65/160 (s)			200		906	706			425	560			660	460		60	140	64	18					560				206	
250	315	P 55/140	300	250	250	130	920	670	26	12	400	560	260	60	690	430	200	48	110	51.5	14	180	95	39	190	560	140	28	18	170	500
	400	P 65/160 (s)			200		920	720			425	600			800	540		60	140	64	18					670				205	515
	500										475	670																			

17 Auxiliary connections on pump

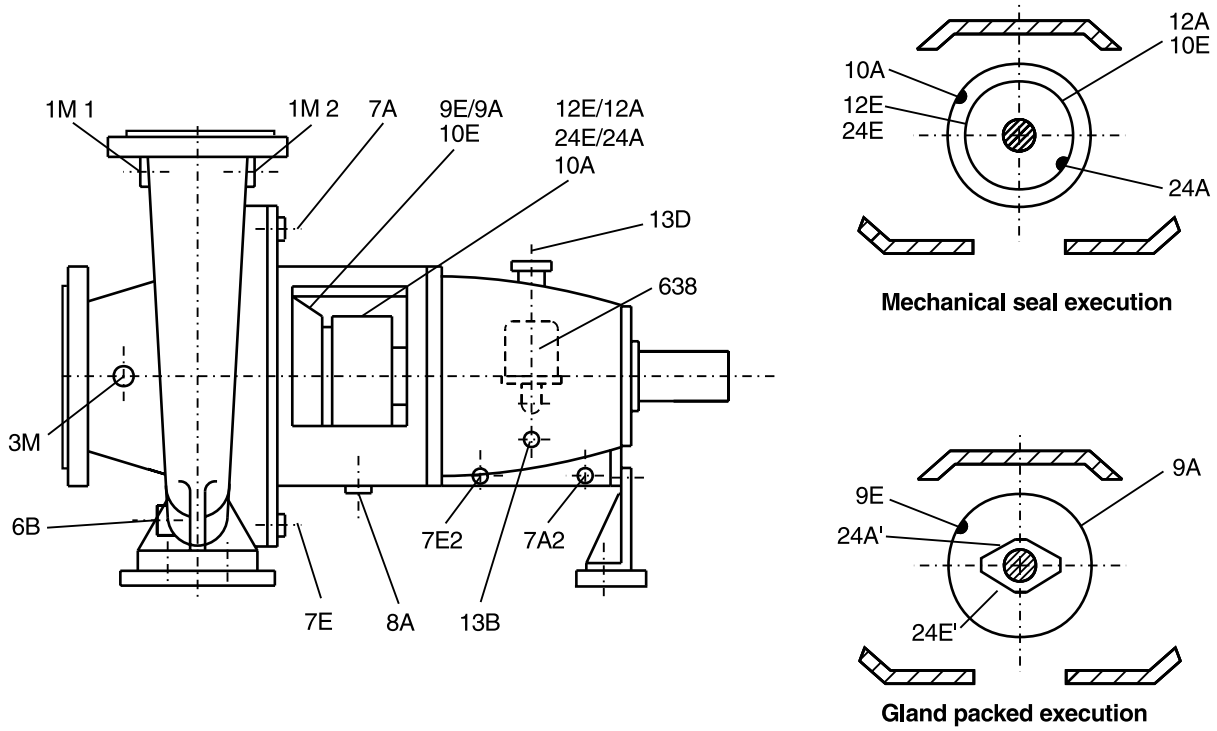


Fig. no. 23

Connection no.	Service/Description	Bearing bracket				
		P 25 / 62	P 35 / 80	P 45 / 120	P 55 / 140	P 65 / 160s
1M1 / 3M	Pressure guage cum connection for flushing	3/8" NPT 1/4" G		1/2" NPT 1/2" G		
1M2	Circulation line for flushing (not in use)	1/4" NPT 1/4" G				
6B	Casing drain*	3/8" NPT 1/4" G	1/2" NPT 3/8" G	1/2" NPT 1/2"G		
7E / 7A	Stuffing box inlet & outlet through bearing bracket lantern	1/2" NPT 3/8" G			3/4" NPT 1/2" G	
7E2/7A2	Brg. Bkt. cooling inlet and outlet	1/2" NPT			3/4" NPT	
8A	Bearing bracket lantern drain	3/4" NPT 1/2" G				
9E / 9A	Sealing liquid inlet & outlet to stuffing box (for gland packed pumps)	1/4" NPT 1/4" G				
10E / 10A	Flushing liquid inlet & outlet	1/4" NPT				
12E / 12A	Circulation liquid inlet & outlet					
13B	Bearing bracket oil drain	1/4" G				
13D	Vent connection on bearing bracket	5/8" G				
24E / 24A	Plan 61/62 inlet & outletconnection on seal cover	1/4" NPT			1/4" NPT	
24E' / 24A'	Cooling inlet & outlet to stuffing box gland	1/4" NPT 1/4" G				
638	Constant level oiler connection	1/4" G				
-	Cooling to pedestal (only for CF pumps)	1/2" NPT				

* For casing drain threaded and seal welded, termination of drain piping by DN 15 ANSI flanges for P 25/62 P 35/80. DIN 20 ANSI flanges for P 45/120, P55/140, P65/160.

Annexure I CPK Y Pumps

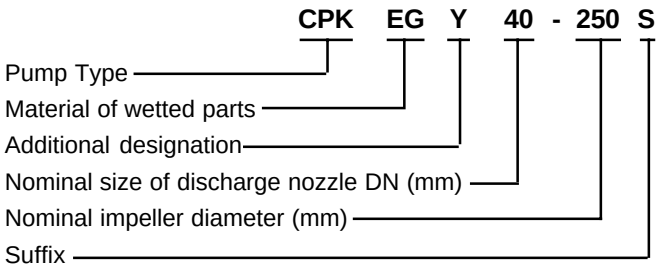
1 Design

CPK Y pumps are horizontal, radially split, back pull out type, single suction, single stage, process pumps with radial flow impeller, centre feet mounting and special jacketd casing cover. Except for the casing cover and bearing bracket lantern, all other components are same as standard CPK pump.

2 Application

CPK Y pumps are used for pumping hot water and organic heat transfer media.

3 Pump Designation



Material of wetted parts like casing and Casing Cover is Cast Steel and Impeller is Cast Iron or Cast Steel.

Additional designations can be

Y - Gland packed pump with intensively cooled stuffing box (`Y' type casing cover).

Ym - Pump with mechanical seal and intensively cooled stuffing box ('Y' type casing cover)

Suffix can be
s - Pump with heavy bearing bracket
c - Pump with cooled bearing bracket

4 Operating Parameters

CPK Y pumps are available in the following range

Q - up to 1000 m^3/hr.

H - up to 150 mtrs.

DN - From 32 mm to 250 mm

The operation of the pump at any point on the standard curve (within the permissible range) is possible as long as NPSHa>NPSHr and the maximum permissible pumping power and the pump end pressure is not exceeded.

5 Sizes/Bearing brackets/impeller Present programme available

CPK EY	Impeller nominal diameter						Bearing Bracket
	125	160	200	250	315	400	
Size							P 25 / 62
32		A	A	A			P 35 / 80
40		A	A	A	A		
50		A	A	A	A		
65			A	A	A *		P 45 / 120
80			A	A *	A *		
100			A	A	A *		
125				A	A		
150				A 2	A* 2	A*	P 55 / 140
200					A* 2	A*	
250					A* 2		

Table no. 35

* With double volute casing only
2 "Y" type casing cover available, but pump with bottom feet volute casing only.

6 Family curves

Refer fig. no.1 for family curves for different nominal speeds. Initial selection is to be done from these curves. If the required operating speed is different from the nominal speed; the operating parameters should be converted to the nominal speed and then the selection is to be done.

Annexure II : Mechanical Selas

1 Mechanical seals : Standard types & sizes

Seal arrangement	M/s EPIL				
	Seal type	MFR's code	API code	Seal faces	Secondary sealing
Single	E02	EGGB	USTGX	TC-Ni / SiC	Teflon
	E04	EGGC	BSTGX	TC-Ni / SiC	Teflon
	P11	NFAB	USTFN	C / SiC	Viton
	P12	NGAB	USTGN	C / SiC	Teflon
	P13	NFAB	BSTFN	C / SiC	Viton
	P14	NGAB	BSTGN	C / SiC	Teflon
	P13 Cld. seat	NFAX	BSTFN	C / SiC	Viton
	Y15	NADC	BSTRN	C / SiC	Graphite
		EADC	BSTRX	TC-Ni / SiC	Graphite
Double	P14	NGAB	BDTGN	C / SiC	Teflon

Seal arrangement	M/s Durametallic				
	Seal type	MFR's code	API code	Seal faces	Secondary sealing
Single	AROTT	EU4EF/VTT	USTGX	SiC / TC-Ni	Teflon
	APT	EU4EF/VTT	BSTGX	SiC / TC-Ni	Teflon
	RO	E45EF/VVV	BSTGN	SiC / C	Teflon
	ROTT	E45EF/VTT	BSTFN	SiC / C	Viton
	PTO	E45EF/VVV	BSTGN	SiC / C	Teflon
	PT	E45EF/VTT	BSTFN	SiC / C	Viton
	PT0 Cld. seat	E45EF/VVV	BSTFN	SiC / C	Viton
	PBS	CR4EF/VGG	BSTRN	SiC / C	Graphite
		CU4EF/VGG	BSTRX	SiC / TC-Ni	Graphite
Double	SBPT	E45EF/VTT	BDTGN	SiC / C	Teflon

Seal arrangement	M/s Burgmann				
	Seal type	MFR's code	API code	Seal faces	Secondary sealing
Single	M7N	U1Q1M1GG	USTGX	SiC / TC-Ni	Teflon
	H7N	U1Q1M1GG	BSTGX	SiC / TC-Ni	Teflon
	M74N	Q1AVMG	USTFN	SiC / C	Viton
		Q1AM1MG	USTGN	SiC / C	Teflon
	H75N	Q1AVMG	BSTFN	SiC / C	Viton
		Q1AM1MG	BSTGN	SiC / C	Teflon
	H75-G15 Cld. seat	Q1AVMG	BSTFN	SiC / C	Viton
Double	H74-D	Q1AM1MG	BDTGN	SiC / C	Teflon

Seal arrangement	Area of application	Type of seal		Seal size in D P 25/62	P 35/80	P 45/120	P 55/140	P 65/160	API Plan
EPIL									
Single	Normal temp.	E02 / P11 / P12	U	20	26	34	40	48	02/11/21/
		E04 / P13 / P14	B	24	30	38	44	52	23/32+61/62
	High temp.	Y15	B	18	22	30	38	44	02/32 + 61/62
Double	Normal	P12	U	20	26	34	40	48	53/54 + 61/62
back-to back	temp.	P14	B	24	30	38	44	52	53/54 + 61/62
Durametallic									
Single	Normal temp.	AROTT / RO ROTT	U	1.1/4"	1.7/8"	2.1/8"	2.1/2"	3"	02/11/21/23/32 + 61/62
		APT / PTO / PT	B	1.1/2"	1.7/8"	2.3/8"	2.3/4"	3.1/4"	
	High temp.	PBS	B	1.1/8"	1.1/2"	2"	2.3/8"	2.3/4"	02/32 + 61/62
Double	Normal temp.	ROTT	U	1.1/4"	1.7/8"	2.1/8"	2.1/2"	3"	53/54 + 61/62
Back-to back		SBPT	B	1.1/2"	1.7/8"	2.3/8"	2.3/4"	3.1/4"	
Burgman									
Single	Normal temp.	M7N / M74 N	U	30	40 mm	50 mm	60 mm	70 mm	02/11/21/23/32
		H7N / H75 N	B	30	40 mm	50 mm	60 mm	70 mm	+ 61/62
Double	Normal temp.	M74-D	U	30	40 mm	50 mm	60 mm	70 mm	53/54 + 61/62
Back-to-back		H74-D	B	30	40 mm	50 mm	60 mm	70 mm	

U : Unbalanced B : balanced

Note : For any other seal arrangement refer to Z.O. / B. O.
All mechanical seals in cartridge arrangements except Y 15 seal of EPIL

All mechanical seals in cartridge arrangement.

Non cartridge seals for

1. Double seals of all the above seal manufacturers.
2. Y 15 mechanical seals of M/s EPIL
3. All seals of M/s Durametallic

Stuffing box interchangeability : Gland packing to single mechanical seal and vice-versa

Seal Type		Pump sizes as indicated by bearing bracket P 25/62	P 35/80 P 45/120 as	P 45/120	P 55/140	P 65/160
EPIL						
E02 / P11 / P 12	U	Common (C1)	Common (C2)	Common (C3)	Common (C4)	Common (C5)
E04 / P 13 / P 14	B	Separate (S1)	Separate (S2)	Separate (S3)	Separate (S4)	Separate (S5)
Y 15	B	Common (C1)	Common (C2)	Common (C3)	Common (C4)	Common (C5)
Durametallic						
AROTT / RO / ROTT	U	Common (C1)	Common (C2)	Common (C3)	Common (C4)	Common (C5)
APT / PTO / PT	B	Separate (S1)	Separate (S2)	Separate (S3)	Separate (S4)	Separate (S5)
PBS	B	Common (C1)	Common (C2)	Common (C3)	Common (C4)	Common (C5)
Burgman						
M7N / M74N	U	Common (C1)	Common (C2)	Common (C3)	Common (C4)	Common (C5)
H7N / H75N	B	Separate (S1)	Separate (S2)	Separate (S3)	Separate (S4)	Separate (S5)

U : Unbalanced seal B : Balanced seal

Annexure III : Engineering Data

Pump type		32-125	32-160	32-200	40-160	40-200	50-160	50-200	32-250	40-250	40-315	50-250	50-315	65-200	65-250	80-160	80-200	80-250	100-200
Bearing bracket		**P 25/62, P 25/62s**							**P 35/80, P 35/80s**										
Volute casing																			
- Corrosion allowance (mm)		3																	
- Max. working pressure (bar)		Refer 5.8																	
- Test pressure (bar)		Refer 5.10																	
- Max. working temp. (^{0}C)		Refer 5.8																	
Impeller																			
- Outlet width (mm)		8	7	7	9	7	15	12	6	7	8	10	8	16	13	27	22	17	29
- Inlet width (mm)		52	52	52	65	65	82	82	52	65	65	84	84	96	96	100	114	114	122
- Min. diameter (mm)		Refer individual performance curves																	
- Max. diameter (mm)																			
Gland packing		Refer 6.5.1																	
Shaft diameter																			
- At impeller (mm)		20							27										
- Under sleeve at st. box (mm)		25							32										
- At bearings normal (mm)	Pump side	25							35										
	Motor side	25							35										
- At bearings heavy (mm)	Pump side	25							35										
	Motor side	30							35										
- At coupling (mm)		24							32										
Bearings																			
Normal	Pump side	6305 C3							6307 C3										
	Motor side																		
Heavy	Pump side	NU 305 C3							NU 307 C3										
	Motor side	2 x 7206 BG							2 x 7307 BG										
Shaft sleeve diameter (mm)	Packing	35							45										
	Mech. Seal	Depends on individual mechanical seal																	
Shaft deflection		Max. shaft deflection at shaft seal in accordance with ISO 5199 (0.05mm) is observed																	
Drive																			
- P/n value		Refer 5.15																	

Annexure III : Engineering Data

Pump type		65-315	80-315	80-400	100/250	100-300	100-400	125/250	125-315	125-400	150-250	150-315	150-400	200-250	200-315	200-400	250-315	200-250	250-400	250-500
Bearing bracket		**P 45/120, P 45/120s**										**P 55/140, P 55/140s**						**P 65-160s**		
Volute casing																				
- Corrosion allowance (mm)		3																		
- Max. working pressure (bar)		Refer 5.8																		
- Test pressure (bar)		Refer 5.10																		
- Max. working temp. (^{0}C)		Refer 5.8																		
Impeller																				
- Outlet width (mm)		10	14	11	23	19.5	15	32	26	20	46	38	29	62	50	40	73	32	63	43
- Inlet width (mm)		96	129	118	129	135	129	154	154	154	180	190	190	190	222	222	270	222	294	280
- Min. diameter (mm)		Refer individual performance curves																		
- Max. diameter (mm)																				
Gland packing		Refer 6.5.1																		
Shaft diameter																				
- At impeller (mm)		35										47						55		
- Under sleeve at st. box (mm)		42										54						65		
- At bearings normal (mm)	Pump side	45										55						-		
	Motor side	45										55						-		
- At bearings heavy (mm)	Pump side	55										65						65		
	Motor side	55										65						75		
- At coupling (mm)		42										48						60		
Bearings																				
Normal	Pump side	6409 C3										6411 C3						-		
	Motor side																			
Heavy	Pump side	NU 311 C3										NU 313 C3						NU 413		
	Motor side	2 X 7311 B TVP UA80										2 X 7313 B TVP UA80						2 X 7315 B TVP UA 80		
Shaft sleeve diameter (mm)	Packing	55										70						80		
	Mech. Seal	Depends on individual mechanical seal																		
Shaft deflection		Max. shaft deflection at shaft seal in accordance with ISO 5199 (0.05mm) is observed																		
Drive																				
- P/n value		Refer 5.15																		

Annexure IV : Material Specificatios

Material	Grade	Reference Standard	Material	Grade	Reference Standard
Cast Alloy Steel	CF8M	ASTM A 743	Aluminium	Gr. 63400	IS 733
Stainless Steel	Type 316	ASTM A 276	Cast Carbon Steel	WCB	ASTM A 216
Cast Iron	FG 260	IS 210	Carbon Steel	Type 6.6 / 6.8	IS 1367 part 3
Carbon Steel	C45	IS 2073	High tensile Alloy Steel	Gr. B7	ASTM A 193
Stainless Steel	Type 410	ASTM A 276	High tensile Alloy Steel	Gr. 2H	ASTM A 194