Contents

1. Design

KWP pumps are horizontal, single stage, single entry, back pullout type, radially split volute casing process type centrifugal pumps with radial flow non-clogging overhung impeller. In their main dimensions, they largely comply with specifications of standardized chemical pumps in accordance with DIN 24256.

2. Application

KWP pumps are used to pump contaminated fluids, sludges, untreated effluents, sewage, storm water, pulp up to 4% consistency, thick fluids up to specific gravity 1.4 and drainage water. The application areas are industries like paper, food, chemical, mining, sugar, building and aluminium. Besides, they are used in effluent and sewage treatment and disposal plants.

3. Designation

KWP z GC m 100 - 315

Pump type

Impeller type
- z : Two vane non-clogging closed impeller
- d : Three vane non-clogging closed impeller
- f : Free flow impeller

Material of construction
- GC : Cast Iron pump with Stainless Steel impeller.
- C : Complete Stainless Steel pump

Additional description
- m : Pump with mechanical seal

Nominal size of discharge nozzle in mm

Nominal impeller diameter in mm

4. Operating parameters

4.1 Capacity and differential head

KWP pumps are available in the following range,

Discharge nozzle size	DN	65 mm to 200 mm
Capacity	Q	Up to 650 m^3/hr.
Head	H	Up to 100 m

For 200-315 f pump performance parameters are

Q BEP	83 m^3/hr.
H BEP	13.4 m
Best efficiency	48 %
NPSH BEP	2.1m

Limitations of end pressure should be taken care of.

4.2 NPSH

The NPSHr values given in the individual performance curves are minimum values which correspond to cavitation limits. As a safety reason increase the values shown on the curve by 0.5 m.

Over and above this safety margin, the NPSH available must at all times and under all conditions exceed NPSH required.

5. Selection of pump

Selection of the pump is based on,

Capacity	: m^3/hr
Head	: m
NPSHa	: m
Pumping liquid temp.	: ^{0}C
Density	: kg/dm^3
Kinematic viscosity	: cst
Speed	: rpm
Impeller peripheral speed	: m/sec
Max. discharge pressure	: kg/cm^2
Max. particle size	: mm

Preliminary pump selection for required capacity and head, is to be made by referring family curves.

5.1 Family curves

Figures 1, 2 and 3 show the family curves for nominal speed 2900 rpm, 1450 rpm and 960 rpm. Initial selection of the pump is to be done based on these curves. If the required operating speed is different than the nominal speed then the operating parameters shall be converted to nominal speed and then the selection is to be made.

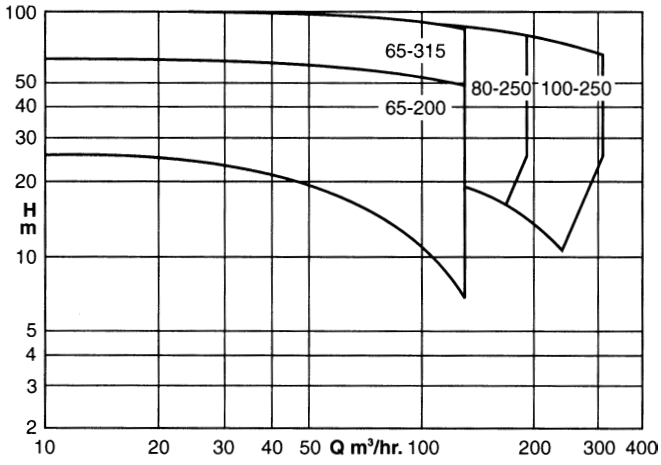


Fig. no. 1 : 2900 rpm

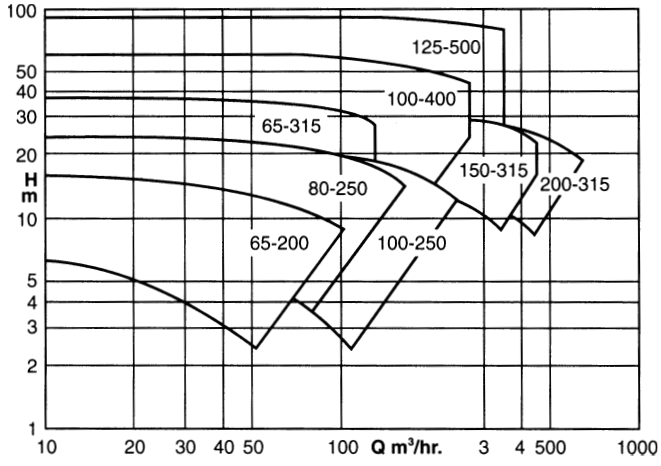


Fig. no. 2 : 1450 rpm

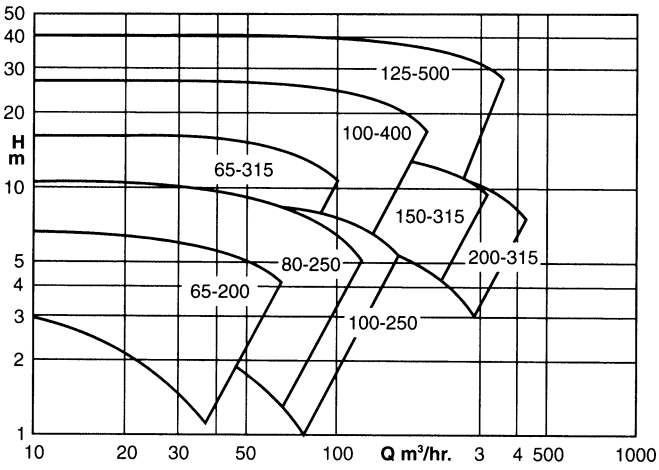


Fig. no. 3 : 960 rpm

5.2 Present programme available

Refer Table 1 which indicates present program available for developed pump sizes.

	Nominal impeller diameter in mm							Bearing Bracket type
	200	250	315			400	500	
Impeller type	z	z	z	d	f	z	d	
Nominal discharge nozzle size in mm								P 35 / 80
65	A		A					P 45 / 120
80		A						
100		A				A		P 55 / 140
125							A	P 65 / 160d
150			A					
200				A	A			

Table no. 1 : Bearing Bracket selection programme

5.3 Individual performance curves

The differential head and power curves are valid for the pumped medium of density = 1.0 kg/dm³ and kinematic viscosity up to 20 cst .

In case ρ not equal to 1.0 kg / dm³ , then the power must be multiplied by ρ. In case the kinamatic viscosity is greater than 20 cst, then viscosity correction factors are applicable. (Refer point 5.5)

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 shall be converted to effective speed of the prime mover using affinity laws.

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

5.4 Capacity

Qmin. = 0.15 Qopt., unless limited by the notation " Qmin." on the performance curve.
Qmax. = 1.2 Qopt. - 1450 rpm & 960 rpm
= 1.1 Qopt. - 2900 rpm
unless limited by the notation" Qmax." on the performance curve.

Pumps shall not be offered for capacities less than Qmin.or greater than Qmax.

5.5 Efficiency

For the efficiency values mentioned in the standard performance curves, viscosity correction factor is to be applied for viscous liquids, having kinematic viscocity greater than 20 cst.

Min. allowed viscosity correction factor $k\eta = 0.5$

5.6 Impeller diameter selection

The performance curves indicate the minimum and maximum impeller diameters. The impeller diameter obtained from the performance curve, for the selected operating point is to be increased by 1 mm for C.I. impeller and 2 mm for Stainless Steel impellers.

5.7 Rotational speed

The maximum permissible rotational speeds are listed in Table 2. For Sp. gravity = 1 and Capacity band 0.15 Qopt. ≤ Q ≤ 1.1 Qopt.

Pump size	Speed rpm	Sp.gravity 1		Sp.gravity 1.2		Sp.gravity 1.4	
		N	H	N	H	N	H
		Permissible impeller diameter in mm					
65-200	2900	209	209	190	209	-	200
	1450	209	209	209	209	209	209
	960	209	209	209	209	209	209
65-315	2900	260	260	260	260	260	260
	1450	320	320	320	320	320	320
	960	320	320	320	320	320	320
80-250	2900	-	230	-	-	-	-
	1450	260	260	260	260	260	260
	960	260	260	260	260	260	260
100-250	2900	230	260	-	230	-	230
	1450	260	260	260	260	260	260
	960	260	260	260	260	260	260
100-400	1450	404	404	404	404	404	404
	960	404	404	404	404	404	404
125-500	1450	504	504	504	504	504	504
	960	504	504	504	504	504	504
150-315	1450	320	320	320	320	320	320
	960	320	320	320	320	320	320
200-315	1450	320	320	320	320	320	320
	960	320	320	320	320	320	320

N = Normal bearing bracket,
H = Heavy duty and axially adjustable bearing bracket.

Table no. 2 : Maximum permissible rotational speed

Note : These speeds are determined by considering

1. Maximum permissible shaft deflection 0.4 mm at impeller center line.
3. Minimum bearing life of 10,000 hours evaluated by calucations.

5.8 Pressure and temperature limits

Refer Table 3, for maximum permissible pump operating pressure according to temperature, irrespective of the material of construction of the pump.

Pumping liquid temperature in ^{0}C	Permissible pump discharge pressure in kg/cm^2
- 30 to + 120	10
+120 to + 180	8
+180 to + 250	6

Table no. 3 : Pressure and Temperature limitations

5.9 Flanges

Standard flange rating is as per

- DIN 2533 / 16 for C.I. pumps.#
- DIN 2543 / 16 for St.Steel pumps.#

The suction flange on the casing is not a salient flange, but only a sealing face with bosses for tapped holes. The suction piping is connected to pump by means of studs. The suction flange is always as per DIN standard.

5.10 Maximum Permissible P/n values

	Bearing Bracket			
Standard	**P35/80**	**P45/120**	**P55/140**	**P65/160d**
Heavy duty & axially adjustable	**P45/120ax**	**P55/140ax**	**P65/160ax**	**P65/160x**
rpm	**Max. permissible kW rating**			
960	20	48	105	210
1450	30	72	160	320
2900	60	144	-	-
P/n value	0.021	0.05	0.11	0.22

Table no. 4 : Max. Permissible P/n values in kW / rpm

5.11 Power reserves for drives

Power absorbed at pump shaft in kW	Reserve power margin of driver
1.5 to 7.5 kW	Approx 30 % or 1 kW whichever is greater
7.5 to 20 kW	Approx. 25 %
20 to 50 kW	Approx. 15 %
Above 50 kW	Approx. 10 %

Table no. 5 : Reserve power margin for drivers
Driver rating below 1.5 kW is not allowed.

6. Design features

Direction of rotation of the pump is clockwise when seen from drive end.

A flange spacer piece, generally called as hand-hole pipe can be provided at an extra cost, for a large cleaning opening, for bolting on to the suction nozzle.

6.1 Casing

Radially split volute casing consists of cast integral suction and discharge nozzles. Casing is provided with wear plate on the suction side.

The axial suction nozzle is not a conventional flange (Refer pt. 5.9). Discharge nozzle is directed vertically upwards.

6.1.1 Casing constructions

A : Design - 2 construction

Applicable for all impeller shapes. Casing fitted with a wear plate at suction end. Discharge cover on the discharge side, with cast integral stuffing box housing and no provision for cooling of discharge cover. (Refer fig. no. 4)

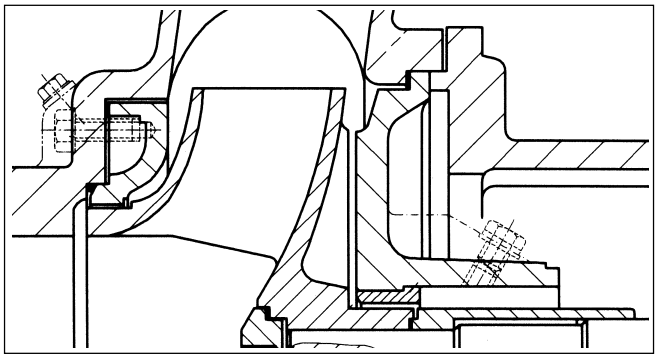


Fig. no. 4 : Design - 2 construction.

B : Design - 4 construction

For all impeller shapes. Casing fitted with a wear plate at suction end, discharge cover on the discharge side with bolted on stuffing box housing. Cooling provision is provided for stuffing box housing. (Refer fig. no. 5).

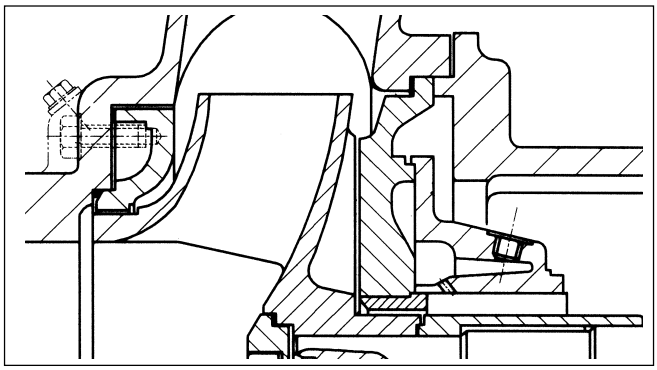
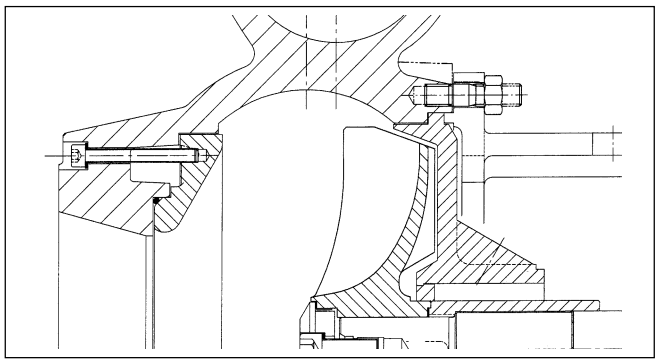


Fig. no. 5 : Design - 4 construction

C : Casing with Free flow impeller for size 200-315

Casing fitted with a wear plate at suction end. (similar to Design 2)Discharge cover on the discharge side, with cast integral stuffing box housing and no provision for cooling of discharge cover. (Refer fig. no. 4)



6.2 Impeller

Impeller is axial entry, radial flow and single suction type. Impellers are available in following types :

6.2.1 Type 'z' and 'd'

Type 'z' with 2 vanes and type 'd' with 3 vanes, impellers are suitable for contaminated fluids and fluids containing solid particles (max. particle size measured diagonally = 0.9 x narrowest impeller width, but at least 5 mm smaller than the width of the un-constricted passage), also for sludges which do not liberate gas, provided they can be pumped hydraulically. The fluid pumped shall be free from any long fibered solids, liable to bunch or twist. Also suitable for pumping stock suspensions, with a stock density up to 4% bone dry approx., depending on their character. For consistency > 1%, correction factors need to be calculated. (Refer ZO/BO).

For impeller outlet width & maximum / minimum impeller diameter refer individual performance curve.

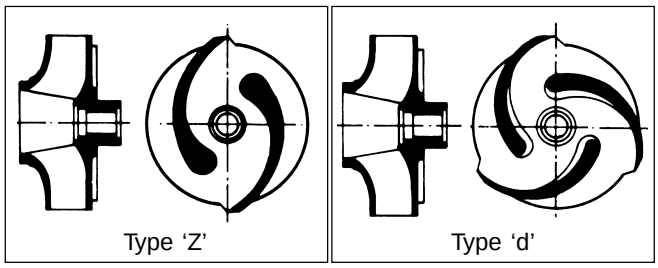


Fig. no. 6 : ' z ' and ' d ' type Impellers

6.2.2 Type 'f' (Only for size 200-315)

For pumping fluids containing large amount of trapped air or gas (stock suspensions, depending on their nature upto 4 % bone dry, sludge), which may also contain coarse solids and solids liable to twist or bunch.

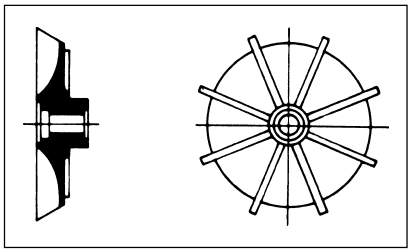


Fig. no. 6a : f Type impeller

6.2.3 Impeller types and maximum permissible particle size

Pump Size	Maximum permissible practicle size in mm	Impeller type
65 - 200	41	z
65 - 315	37	z
80 - 250	45	z
100 - 250	55	z
100 - 400	45	z
125 - 500	45	d
150 - 315	83	z
200 - 315	75	d
200 - 315	97	f

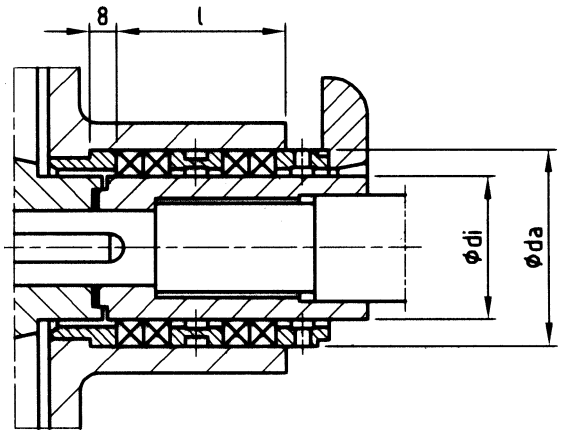
Table no. : 6 Maximum permissible particle size & Impeller type

6.3 Shaft seal

Shaft sealing is done either by gland packings or mechanical seal, depending on service conditions.
Change over from gland packing arrangement to single mechanical seal or vice-versa is possible by using corresponding set of interchangiable parts, also known as conversion kit. Refer Point no. 6.3.3 for further details.

6.3.1 Stuffing box packings

Generally gland packings are used for maximum suction pressure of 4 bar.



6.3.2 Mechanical seal

KWP pumps can be supplied with a mechanical seal, on request. The selection of correct seal type and arrangement should be based on seal manufacturer's data and recommendations. Mechanical seal can be supplied in a different material combinations, depending upon the nature of the liquid pumped.

As a standard feature, single, unbalanced mechnical seal is supplied in cartridge construction only.

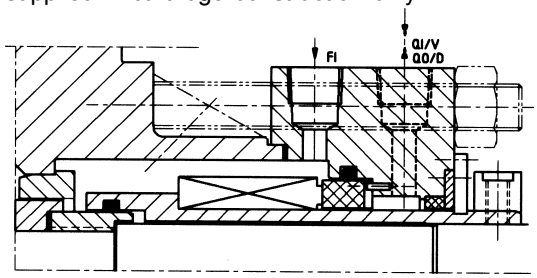


Fig. no. 7 : Single unbalanced cartridge seal

6.3.3 Conversion kit

A. Parts required to change-over from gland packing to single mechanical seal in cartridge construction :

1. Mechanical seal
2. Stuffing box housing or Discharge cover (if applicable)
3. Studs and nuts or Allen head screws for seal cover (4 nos.)
4. Set of gaskets and 'O' rings, as applicable

B. Parts required to change-over from single mechanical seal in cartridge construction to gland packing :

1. Shaft protection sleeve
2. Stuffing box housing or Discharge cover (if applicable)
3. Gland packing
4. Seal cage ring (if applicable)
5. Stuffing box pressure ring
6. Stuffing box gland
7. Studs and nuts for stuffing box gland (2 no.s)
8. Set of gaskets

C. Interchangeability of stuffing box

For single mechanical seals listed in Annexure 1, discharge cover (Design 2 construction) or stuffing box housing (Design 4 construction) remains common for mechanical seal and gland packing.

6.4 Flange spacer piece or hand-hole pipe

In case of applications involving pumping of liquids containing admixtures of coarse solids (sludges, effluents, sewage, etc.), a flange spacer piece usually called as hand-hole pipe can be provided for bolting onto the suction end of the casing. (Refer fig. no. 8)

After removing the hand-hole cover on the spacer piece, any built up of deposits or accumulations of solids in front of impeller which might clog the pump, can be easily and promptly removed, without having to disconnect the suction piping.

Refer Table 9 for dimensions of flange spacer piece with cleaning opening.

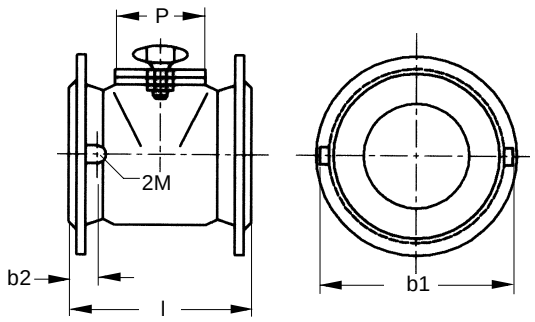


Fig. no. 8 : Flange spacer piece

Pump size	Nominal size DN mm	l mm	Vaccume gauge connection * 2M	b1 mm	b2 mm	Cleaning opening P mm
65-200 65-315	80	200		112		80
80-250	100	250		134		120
100-250 100-400	125	250	R1/2"	160	47	120
125-500 150-315	150	250		190		150
200-315	200	350		240	55	200

* Undrilled on standard construction

Table no. 7 : Dimensions of flange spacer piece with cleaning opening

7. Materials

KWP pumps are available in following material combinations.

Part no.	Description	Materil Execution GC	C
101	Volute casing	C. I.	CF 8 M
135.1	Wear plate	CF 8 M	CF 8 M
163	Discharge cover	C. I.	CF 8 M
183	Support foot	SG 400/12	SG 400/12
210	Shaft	45 C 8	45 C 8 or Type 410
230	Impeller	CF 8 M	CF 8 M
260	Impeller cap	Type 316	Type 316
330	Bearing bracket	C. I.	C. I.
344	Brg. bkt. lantern	C. I.	C. I.
451	St. box housing	C. I.	CF 8 M
452	St. box gland	C. I.	CF 8 M
454	St. box pr.ring	C. I.	CF 8 M
456	Neck ring	C. I.	Type 316
458	Lantern ring	C. I.	Type 316
461	St. box packing	TIWA	TIWA
524	Shaft prot.sleeve	45 C 8 / Ch. Pl.	Type 316

Table no. 8 :

Description	Material Grade	Ref.Standard
Cast iron	Gr. FG 260	IS 210
Cast alloy steel	CF 8 M	ASTM A 743
Stainless steel	Type 316	ASTM A 276
Stainless steel	Type 410	ASTM A 276
Spherodial Graphite Cast Iron	SG 400/12	IS 1865
Carbon Steel	45 C 8 / Ch.Pl.	IS 5517 with Chrome plating
Carbon Steel	45 C 8	IS 5517

Table no. 9 : Detailed material specifications

8. Technical data

8.1 Moment of gyration, dynamic moment of inertia and weights of the pumps

Pump size	Weight kg @	kg *	C liters	J kpms²	GD² kgm²
65-200	81.5	84	4.12	0.002442	0.095
65-315	134.5	143	6.23	0.010604	0.418
80-250	106	110	6.75	0.0055	0.215
100-250	117.5	120.5	9	0.00693	0.27
100-400	253	269.5	13.7	0.03135	1.23
125-500	394	402.5	23.1	0.0671	2.62
150-315	246.5	254.5	21.5	0.01837	0.72
200-315	296	304.5	30.5	0.022	0.867

@ For Design 2 construction.
* For Design 4 construction.

Table no. 10 : Weights and other technical data

W : Weight of pump with standard bearing arrangement and without flange spacer piece.
C : Capacity of water fill of pump excluding flange spacer piece.
J : Dynamic moment of interia with water.
GD² : Moment of gyration with water for CI construction, maximum impeller diameter and without coupling.

8.2 Stuffing box cooling

Design 4 construction with stuffing box cooling shall be provided for ...

- Temperature above 105 °C
  : for clean liquid with sealing / flushing provision
- For temperature above 90 °C
  : for contaminated liquids which leave abrasive reminder on evaporating in the stuffing box
  : without sealing / flushing liquid provision.

8.3 Sizing the suction line

The nominal size of the pump suction flange is not a guide to the correct sizing of suction line. It shall be sized for a flow of velocity not exceeding 2 m/sec. Conversely, if the liquid pumped contains admixtures of solids, sludges etc. the flow velocity in suction line shall not fall below 1 m/sec, in order to forestall the possibility of deposit accumulation in the suction line.

If nominal bore of the suction connection on the pump casing or on the flange spacer piece is smaller than the nominal bore of suction pipe line, an eccentric reducer fitted belly down, shall be incorporated. A conventional concentric reducer shall not be used, because it leads to formation of air pockets, affecting operating reliability of the pump.

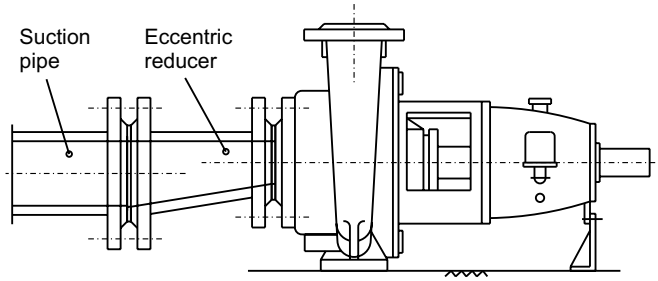


Fig. no. 9a : Standard arrangement of pump with eccentric reducer

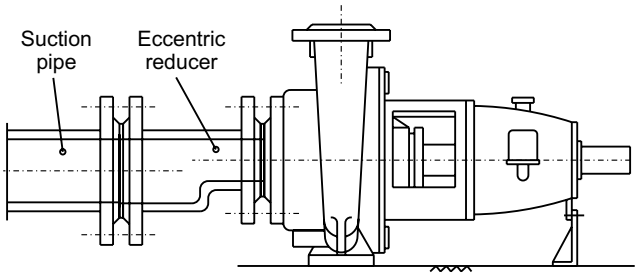


Fig. no. 9b :Arrangement of pump with eccentric reducer for paper pulp application

9. Accessories

9.1 Vacuum balance line

If the pump has to pump liquid out of vessel under vacuum, it is advisable to install a vacuum balance line. Refer fig. 22 for arrangement of vacuum balance line. This line shall have a nominal size of 25 mm at least. It shall be arranged to lead back into the suction vessel at a point above the maximum permissible liquid level. Its purpose is to return to the suction vessel any gas or air bubbles entrained with the liquid, or coming out of solution before they can penetrate into the eye of an impeller. An additional line starting at the pump discharge nozzle facilitates venting of the pump before start-up. The vacuum tight isolating valve E shall be closed after the venting procedure and shall remain closed while the pump is running. The main isolating valve A in the vacuum balance line must remain open at all times when the pump is running and shall only be closed when the pump is shut down. (Refer fig. no. 10 on page 7).

9.2 Auxiliary piping

It consists of pipe lines with necessary valves, flow indicators, pressure and temperature gauges. These pipe lines are installed for following purposes,

- stuffing box cooling (in case of pumping hot liquids),
- circulation of sealing liquid for gland packed pumps,
- circulation of flushing liquid for pumps with mechanical seal,
- draining the volute casing.

9.3 Coupling

The coupling connecting pump and prime mover can be either flexible or gear type. Preferably spacer type couplings are recommended for ease of maintainence and to take maximum advantage of back pull-out feature of KWP pumps, i.e. maintainence without disturbing the mounting of volute casing (bolted to suction and discharge piping) and prime mover. Spacer length shall be suitably selected. For minimum spacer length, refer dimension 'y' in Table 18 While selecting a coupling following care has to be taken,.

1. Maximum rated speed of the coupling shall be more than actual running speed of the coupling.
2. Maximum rated power transmitted by the coupling shall be more than the actual power tranmitted by the driver, for required duty point.
3. Permissible P/n value of the coupling shall be more than the actual ratio of power to be transmitted to the running speed of the coupling.
4. Permissible maximum bore of the coupling shall be more than the diameter of the pump shaft and prime mover shaft (in prescribed tolerances).

9.4 Coupling guard

The coupling shall be provided with coupling guard in accordance with accident prevention regulations.

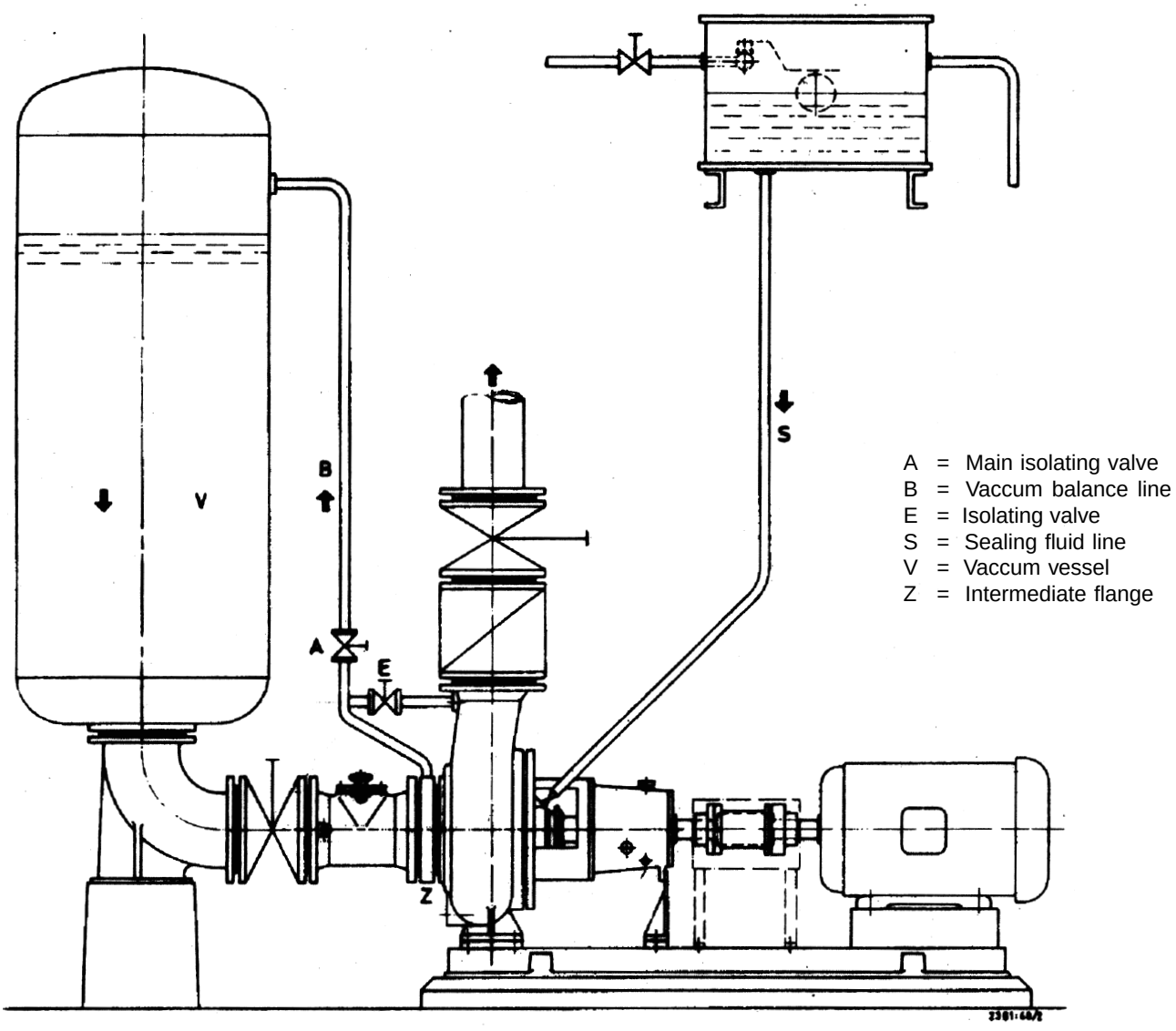
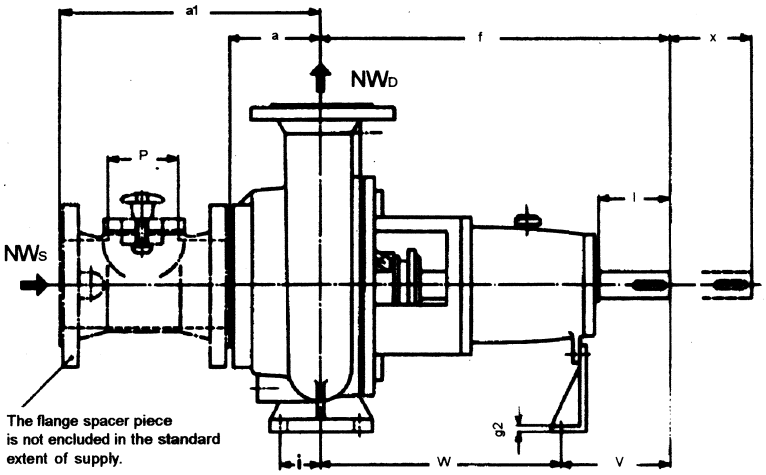
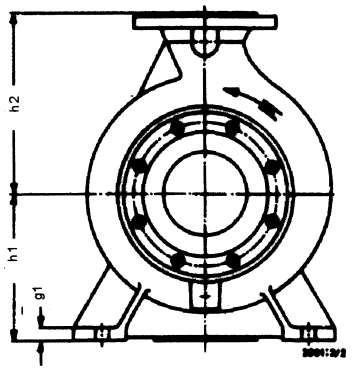


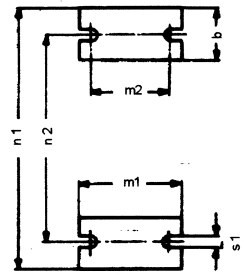
Fig. no. 10 : Installation diagram for operation in conjunction with vaccum vessel

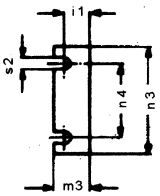
10. Pump dimensions



x = Dismantling dimension (for dismantling pump rotor without removing the motor).

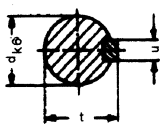






Stub shaft and key in accordance with DIN 6685

" n6 " fit on bearing bracket P 65 / 160



Pump casing will have either slots or holes for mounting

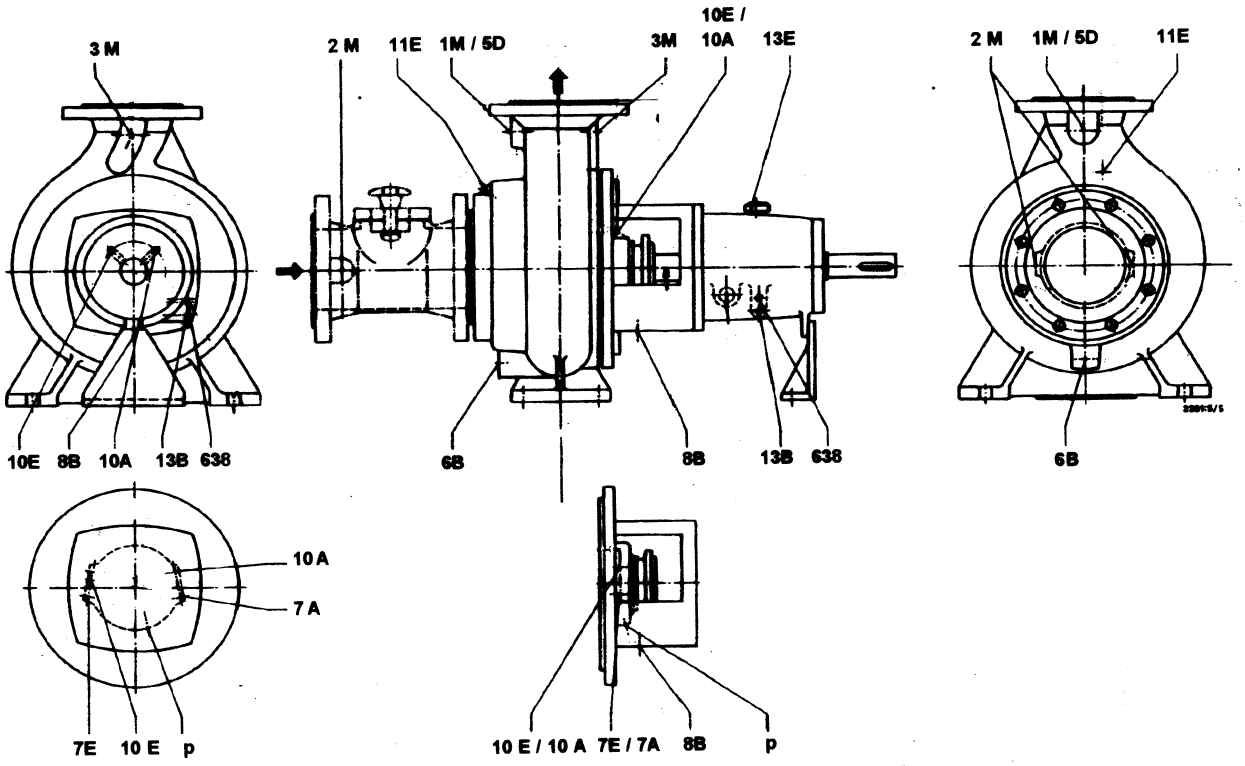
Pump size	Bearing bracket **	Pump dimensions															
		NW_D	NW_S	a	a1	b	f	g1	g2	h1	h2	m1	m3	n1	n3	P	x
65-200	P 35/80	65	80	125	327	65	500	16	8	180	225	125	47	320	160	80	120
65-315	P 45/120	65	80	140	342	80	530	18	12	225	280	160	52	400	160	80	120
80-250	P 35/80	80	100	125	377	80	500	18	8	225	280	160	47	400	160	120	120
100-250	P 45/120	100	125	140	392	80	530	18	12	225	280	160	52	400	160	120	140
100-400	P 55/140	100	125	140	392	100	670	20	12	280	355	200	60	500	200	120	160
125-500	P 65/160d	125	150	160	412	100	720	24	12	355	450	200	60	550	200	150	160
150-315	P 55/140	150	150	180	432	100	670	22	12	315	400	200	60	550	200	150	160
200-315	P 55/140	200	200	200	552	100	670	22	12	355	450	200	60	550	200	200	160

Pump size	Bearing bracket **	Shaft end dimensions				Feet dimensions								
		d_{k6}	l	t	u	i	i1	m2	n2	n4	s1	s2	v	w
65-200	P 35/80	32	80	35.3	10	47.5	30	95	250	110	14	14	130	370
65-315	P 45/120	42	110	45.1	12	60	33	120	315	110	18	14	160	370
80-250	P 35/80	32	80	35.3	10	60	30	120	315	110	18	14	130	370
100-250	P 45/120	42	110	45.1	12	60	33	120	315	110	18	14	160	370
100-400	P 55/140	48	110	51.5	14	75	39	150	400	140	23	18	170	500
125-500	P 65/160d	60	140	64.2	18	75	39	150	450	140	23	18	205	515
150-315	P 55/140	48	110	51.5	14	75	39	150	450	140	23	18	170	500
200-315	P 55/140	48	110	51.5	14	75	39	150	450	140	23	18	170	500

** The dimensions remain unaltered on pump constructions with a heavy duty bearing bracket with axially adjustable rotor.

Table no. 11

11. Auxillary connections on pump



Auxillary connections :	Pump type **							
	65-200	65-315	80-250	100-250	100-400	125-500	150-315	200-315
Pressure gauge / venting 1M / 5D	G 1/2"	G 1/2"	G 1"	G 1"	G 1"	G 1"	G 1"	G 1"
Pressure gauge 3M	G 1/2"	G 1/2"	G 1/2"	G 1/2"	G 1/2"	G 1/2"	G 1/2"	G 1/2"
Vaccume gauge. 2M *	G 1/2"	G 1/2"	G 1/2"	G 1/2"	G 1/2"	G 1/2"	G 1/2"	G 1/2"
Volute casing drain. 6B	G 3/4"	G 3/4"	G 3/4"	G 1"	G 1"	G 1"	G 1"	G 1"
Sealing / flushing liquid In / Out. 10E / 10A	G 1/4"	G 1/4"	G 1/4"	G 1/4"	G 3/8"	G 3/8"	G 3/8"	G 3/8"
Leakage liquid drain. 8B	G 1/2"	G 1/2"	G 1/2"	G 1/2"	G 1/2"	G 1/2"	G 1/2"	G 1/2"
Oil drain on bearing bracket. 13B	G 1/4"	G 1/4"	G 1/4"	G 1/4"	G 1/4"	G 1/4"	G 1/4"	G 1/4"
Constant level oiler. 638	G 1/4"	G 1/4"	G 1/4"	G 1/4"	G 1/4"	G 1/4"	G 1/4"	G 1/4"
Flushing of sealing clearance gap. 11E *	G 1/2"	G 1/2"	G 1/2"	G 1/2"	G 1/2"	G 1/2"	G 1/2"	G 1/2"
Cooling water In / Out. 7E / 7A	G 1/4"	G 1/4"	G 1/4"	G 1/4"	G 3/8"	G 3/8"	G 3/8"	G 3/8"
Cooling chamber drain. p	G 1/8"	G 1/8"	G 1/8"	G 1/8"	G 1/8"	G 1/8"	G 1/8"	G 1/8"
Vent plug. 13 E	G 5/8"	G 5/8"	G 5/8"	G 5/8"	G 5/8"	G 5/8"	G 5/8"	G 5/8"

* Normally undrilled.

** The dimensions remain unaltered on pump constructions with a heavy duty bearing bracket with axially adjustable rotor.

Table no. 12

12 Cross - sectional drawing

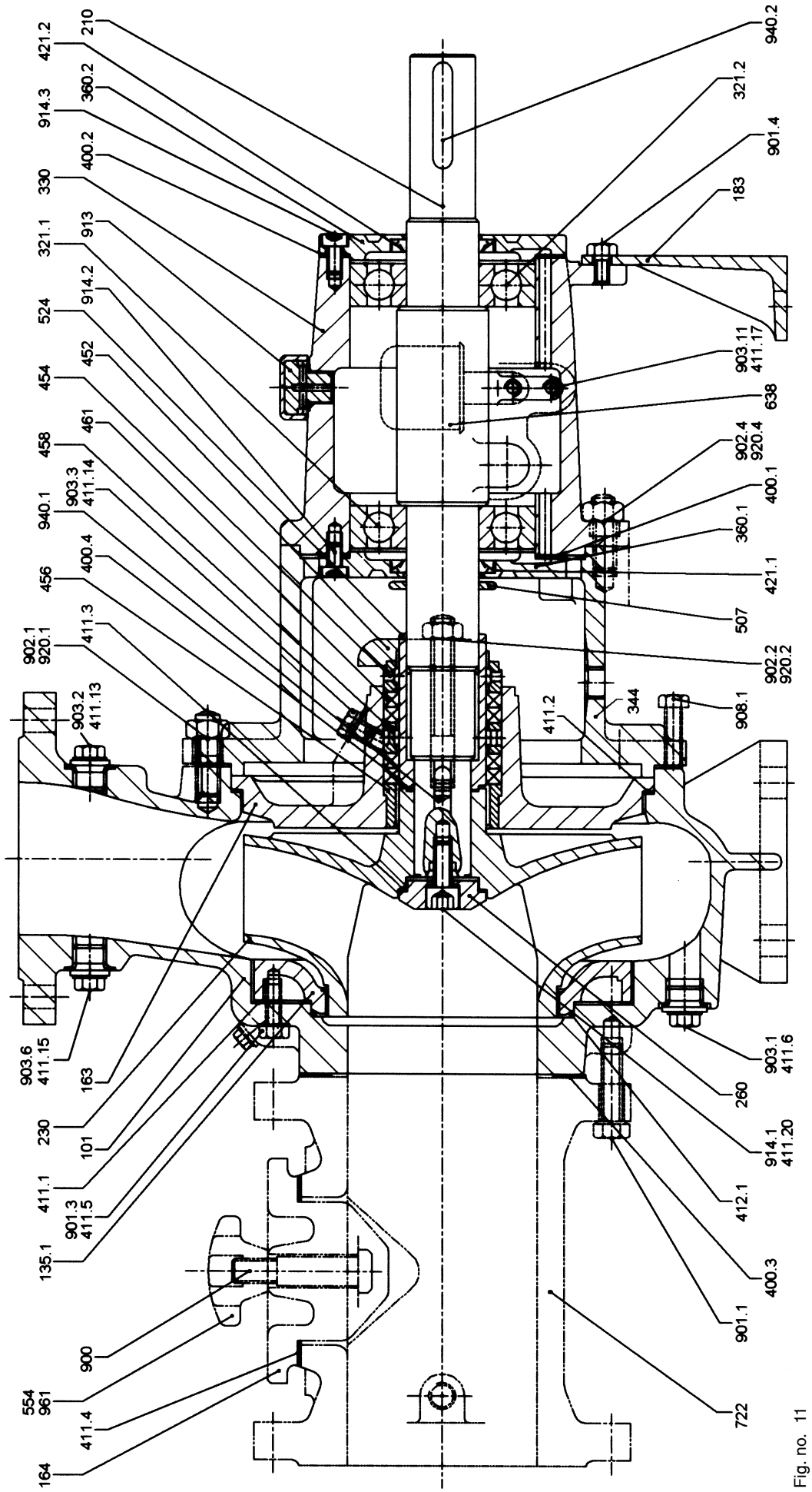
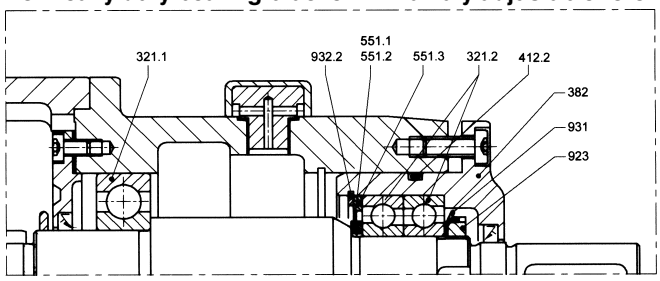


Fig. no. 11

12.1 List of components

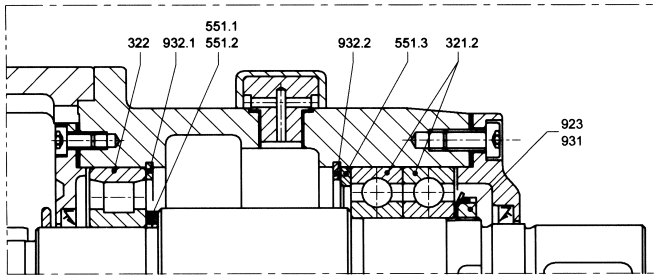
Part No.	Description
101	Volute casing
135.1	Wear plate
163	Discharge cover
164	Cleaning cover
183	Support foot
210	Shaft
230	Impeller
260	Impeller cap
321.1/2	Deep groove ball bearing
321.1	Deep groove ball bearing
321.2	Angular contact bearing
322	Cylindrical roller bearing
330	Bearing bracket
344	Bearing bracket lantern
360.1/2	Bearing cover
382	Bearing body
400.1/2	Gasket
400.3/4	Gasket
411.1/2/3/5/4/6	Gasket
411.13/14/15/17	Gasket
411.20	Gasket
412.1	O-ring
412.2	O-ring
421.1/2	Oil seal
452	Stuffing box gland
454	Stuffing box pressure ring
456	Neck ring
458	Lantern ring
461	Stuffing box packing
507	Splash ring
524	Shaft protection sleeve
554	Washer
576	Star knob
638	Constant level oiler
722	Flange spacer piece
900	Tee Hd. Bolt
901.1/3/4	Hex. Hd. Bolt
902.1/2/4	Stud
903.1/2/3/6	Hex. head plug
903.11	Hex. Hd. Plug
908.1	Hex. Hd. Bolt - Dismantling
913	Vent plug
914.2/3	Socket Hd. Cap Screw
914.1	Socket Hd. Cap Screw
920.01/02/04	Hex. nut
923	Withdrawl nut
931	Lock washer
932.2	Circlip
940.1/2	Key

For heavy duty bearing bracket with axialy adjustable rotor



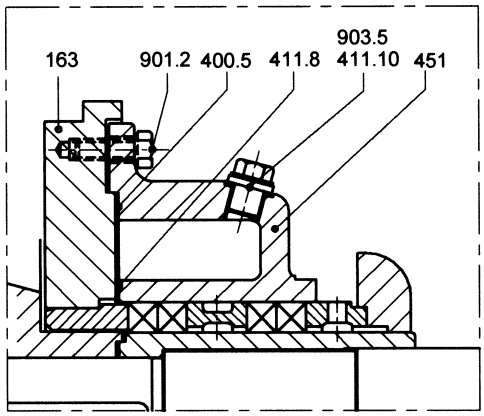
Part no.	Description
321.1	Deep groove ball bearing
321.2	Angular contact ball bearing
382	Bearing body
412.2	O-ring
551.1/2/3	Adjusting ring
923	Withdrawl nut
931	Lock washer
932.2	Circlip

For bearing bracket P 65 /160d :



Part no.	Description
321.2	Deep groove ball bearing
322	Cylindrical roller bearing
932.1/932.2	Circlip
551.1/2/3	Adjusting disc
923	Withdrawl nut
931	Lock washer
320.1/2	Angular contact bearing
923	Withdrawl nut
931	Lock washer

For cooled stuffing box housing :



Part no.	Description
363	Discharge cover
400.5	Gasket
411.8/10	Gasket
451	Stuffing box housing
901.2	Hex. head bolt
903.5	Hex head plug

Annexure 1 : Standardized mechanical seals

M/s EPIL

Seal construction	Seal type	Seal size according to bearing bracket P 35/80	P 45/120	P 55/140	P 65/160d	Material	API Plan	API Code
Single spring Unbalanced Cartridge	E01 Single seal	D 26	D 34	D 40	D 48	NFGB	02 / 11 + 61 / 62	USTFN
	E02 Single seal	D 26	D 34	D 40	D 48	NGGB EGGB	02 / 11 + 61 / 62	USTGN USTGX

M/s Flowserve

Seal construction	Seal type	Seal size according to bearing bracket P 35/80	P 45/120	P 55/140	P 65/160d	Material	API Plan	API code
Single spring Unbalanced Cartridge	ARO Single seal	1.5/8"	2.1/8"	2.1/2"	3"	E45EF/VVV	02 / 11 + 61 / 62	USTFN
	ARO-TT Single seal	1.5/8"	2.1/8"	2.1/2"	3"	E45EF/VTT EU4EF/VTT	02 / 11 + 61 / 62	USTGN USTGX

Description of material code :

Material code	Face combination	Secondary sealing
M/s EPIL		
NFGB	Carbon / SiC	Viton
NGGB	Carbon / SiC	Teflon
EGGB	TC-Ni / SiC	Teflon
M/s Flowserve		
E45EF/VVV	Sic / Carbon	Viton
E45EF/VTT	Sic / Carbon	Teflon
EU4EF/VTT	TC-Ni / SiC	Teflon