



ANSI, CLT & CLB

CHEMICAL PROCESS PUMPS



**RAPID
ALLWEILER**
Pumping our future



RAPID ALLWEILER PUMPS HEAD OFFICE

WE HAVE ALL THE TICKS

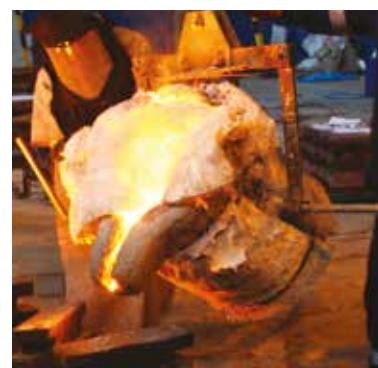
- DEEP APPLICATION KNOWLEDGE
- TAILOR MADE PUMPING SOLUTIONS
- STATE OF THE ART TRAINING CENTRE
- LEADING PROVIDER OF TOP QUALITY PRODUCTS
- LOCAL MANUFACTURE
- FOUNDED IN 1932
- OWN FOUNDRY
- ACCREDITED PUMP REPAIR/SERVICE WORKSHOP
- ISO 9001:2008
- BEE ACCREDITED
- AFTER MARKET SERVICE



FOUNDER A J HINDRY



OWN WORKSHOP



OWN FOUNDRY

Version 1 - Chemical Process Pumps: Rapid Allweiler Pumps

Whilst all care has been taken to ensure the accuracy of the information contained in this Brochure was correct at the time of printing, please be advised we cannot be held responsible for any errors contained within and or changes that may have taken place. Dimensions contained within are for reference purpose only and should not be used for construction; certified drawings are available upon request. For confirmation of any information contained herewith please contact a member of our technical sales team.

COLFAX
Fluid Handling

ALLWEILER®

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ANSI



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CLB



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APPLICATION

- Chemical
- Petrochemical
- Pulp & Paper
- Primary metals
- Pharmaceutical
- Textile
- Food

RA Pump Range	Minimum Flow (m³/h)	Maximum Flow (m³/h)	Minimum Head (m)	Maximum Head (m)	Maximum Temperature
ANSI	2	900	3	140	260 °C

DESIGN & CONSTRUCTION

- Single stage end suction centrifugal pump with fully open impeller allowing it to handle solids up to 25mm.
- Back pull out feature allows for the removal of the entire rotating assembly without disturbing the suction and discharge pipe work.
- The volute casing has horizontal suction and vertical discharge flanges.
- Available in a wide range of materials (including special alloys)

is inherent in full shroud designs. It is matched to casing for high efficiency and enables excellent passage for solids.

- The open vane design has large smoothly contoured flow passages, which minimize NPSH requirements.
- Wear adjustment within the bearing assembly design allows for hydraulic performance to be maintained by an external impeller adjustment, thus giving extended maintenance intervals on the pump.

Stuffing Box Cover

- The Cover can be supplied with a jacket for cooling the stuffing box chamber in high temperature services.
- The jacket can also be used for heating viscous or high freezing point liquids.
- It is equipped with a Quench Gland and the gland follower is split for easy removal. Tapped openings to lantern ring permit "in and out" sealing and external flush of lubrication as required.
- Stuffing box is completely machined for mechanical seal installation, either originally or as a field conversion.

This pump offers a wide variety of features:

Casing

- Axial suction and radial vertical discharge, foot supported for maximum resistance to pipe misalignment and distortion.
- 150lb flanges as standard and for heavy duty applications 300lb flanges are optional (ANSI B16.5).
- Gauge and drain plug openings are supplied when specified.

Impeller

- The impeller is fully open with partial shrouds for maximum vane support without the high thrust that

ANSI

HEAVY-DUTY PROCESS PUMPS

- Internal, external, double- or balanced seals, with any required gland, restricting bushing and flushing lines furnished to meet individual sealing needs.

Frame Adapter

- Contains non-sparking rotating deflectors, and in-board bearing oil seal.
- Adapter may be piped to drain. Model ANSI 343 adapter on 6" diameter sizes is cast integral with bearing frame.

Bearing Frame

- Heavy-duty cast-iron construction with large oil reservoir and water jacket.
- The Oil level is monitored by sight glass. Oil seals on each end and oil breather fully protect oil from contamination while allowing for expansion and contraction of air caused by ambient temperature change (bearing isolators – optional).

Shaft

- Designed for 0,05mm maximum deflection at stuffing box face. All bearing and packing surfaces are factory machined to high tolerances.

Shaft Sleeve

- Renewable shaft sleeve is fitted with one end free to expand with temperature variations while Teflon O-ring prevents leakage under the sleeve.

Bearings

- Inboard bearing single row, deep groove is pressed on shaft and is free to float axially in frame-carrier.
- Outboard bearing is double row, deep groove angular contact shouldered and locked onto shaft in the bearing housing enabling it to carry any radial and unbalanced thrust loads.

MATERIALS OF CONSTRUCTION

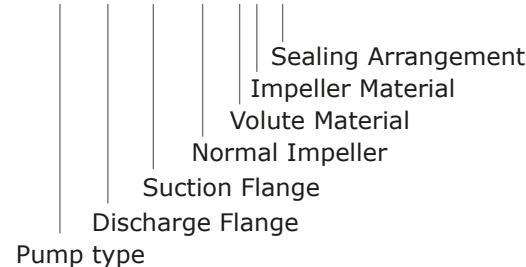
Shaft:	316 Stainless steel
Impeller:	316 Stainless steel
Volute:	316 Stainless steel
Bearing Bracket:	Cast iron
Frame Adaptor:	Cast iron
Stuffing Box:	316 Stainless steel
Shaft Sleeve:	316 Stainless steel

Other construction materials available for specialised applications:

CD4MCu:	Cast Chrome - Nickel Alloy - ASTM A 890 CD4MCU
GA-20:	Cast Alloy 20 ASTM A 743 CN7M
Monel:	Cast Monel ASTM A 494 M35-1
Nickel:	Cast Nickel ASTM A 494 CZ100
Hast-C:	Cast Hast-C ASTM A 494 CW12MW
Hast-B:	Cast Hast-B ASTM A 494 N12MV
WCB:	Cast Steel ASTM A216-03 WCB

MODEL DESCRIPTION

ANSI 3 x 4 - 13 SSM



ANSI
HEAVY-DUTY PROCESS PUMPS

INTERCHANGEABILITY GUIDE

Shaft and Bearing Frame Assembly	Shaft unit	Casing Cover		volute - nominal impeller		delivery branch	bearing bracket size
		Adapter	Stuffing box	Impeller	Casing		
						ANSI 343 22mm Shaft Max.kW - 30	1 x 1½ - 6
							1½ x 3 - 6
							2 x 3 - 6
						ANSI 343 22mm Shaft Max.kW - 30	1 x 1½ - 8
							1½ x 3 - 8
						ANSI 495 45mm Shaft Max.kW - 91	2 x 3 - 8
							3 x 4 - 8
							3 x 4 - 8G
						ANSI 495 45mm Shaft Max.kW - 91	1 x 2 - 10
							1½ x 3 - 10
							2 x 3 - 10
							3 x 4 - 10
							4 x 6 - 10
						ANSI 495 45mm Shaft Max.kW - 91	1½ x 3 - 13
							2 x 3 - 13
							3 x 4 - 13
							4 x 6 - 13
						ANSI 708 60mm Shaft Max.kW - 110	6 x 8 - 13
							8 x 10 - 13
							6 x 8 - 15
							8 x 10 - 15
							8 x 10 - 15G

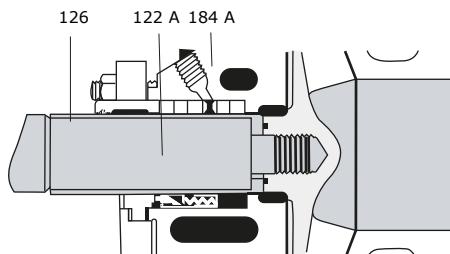
ANSI

HEAVY-DUTY PROCESS PUMPS

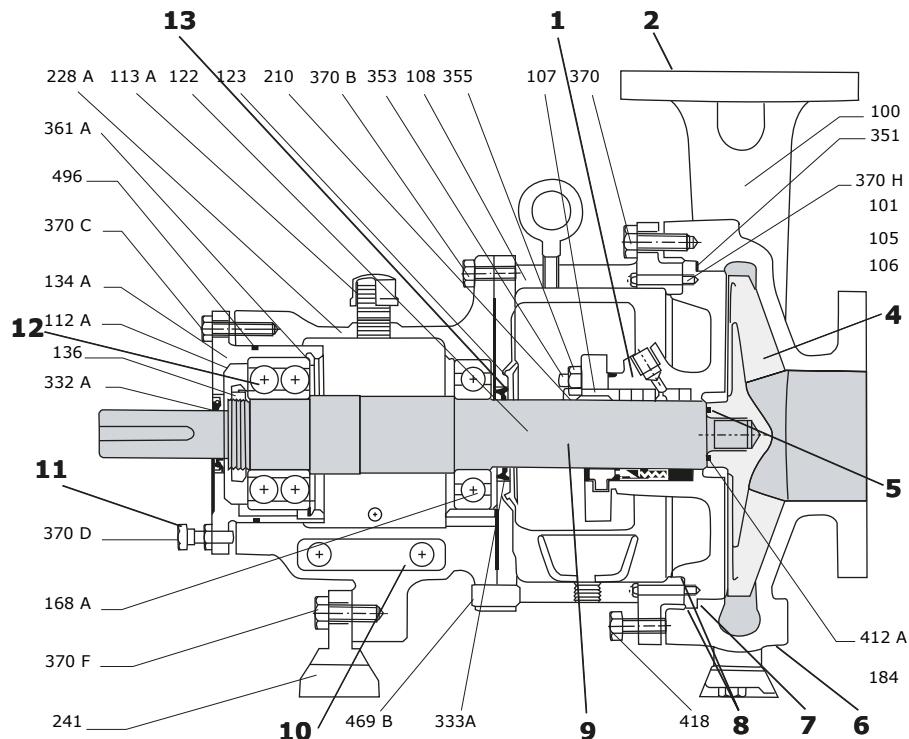
SECTIONAL DRAWING

HEAVY-DUTY DESIGN FEATURES FOR TOTAL RANGE OF PROCESS SERVICE

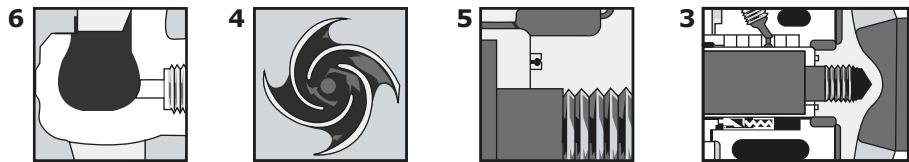
MODEL ANSI 708/495



Optional Jacketed Stuffing Box.
Shaft Sleeve is Standard.



Available on all Model ANSI Pumps



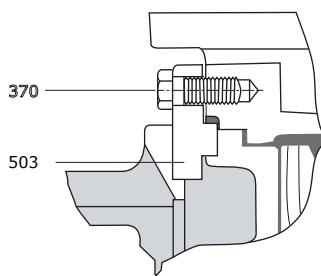
	DESCRIPTION
1	MAXIMUM SEALING FLEXIBILITY <ul style="list-style-type: none"> • Choice of packed gland or mechanical seal. • Any make - inside or outside - single, double and balanced.
2	HEAVY WALLED CASING <ul style="list-style-type: none"> • To resist pipe loads and corrosion • 150 pound flanges standard • 300 pound flanges optional
3	RENEWABLE SHAFT SLEEVE STANDARD <ul style="list-style-type: none"> • Simplifies maintenance - Renew sealing surface without shaft and bearing disassembly • Teflon "O" Ring protects shaft against liquid contact JACKET STUFFED BOX OPTIONAL <ul style="list-style-type: none"> • For cooling packing or seal in temp. to 260°C.
4	SEMI OPEN IMPELLER <ul style="list-style-type: none"> • With expeller vanes, smoothly contoured for slurry handling and to meet low NPSH requirements. • Original clearance maintained by external adjustment.
5	POSITIVE LIQUID SEALING AT IMPELLER <ul style="list-style-type: none"> • Teflon "O" Ring in controlled compression protects threaded area against corrosion. • Metal contact between shaft and impeller transmits torque and assures perfect alignment.
6	CASING DRAIN OPTIONAL
7	POSITIVE SEALING AT CASING JOINT <ul style="list-style-type: none"> • With fully confined gasket. • Alignment fit protected from liquid.
8	ACCURATE MACHINED FITS MEAN POSITIVE ALIGNMENT <ul style="list-style-type: none"> • Accurate alignment of impeller to casing provides maximum hydraulic efficiency. • Concentricity of shaft to stuffing box bore assures low sealing maintenance.
9	HEAVY-DUTY SHAFT <ul style="list-style-type: none"> • Designed for tough services. Maximum: 0.05mm deflection at stuffing box face at maximum load. • Renewable shaft sleeve standard.
10	OIL LUBRICATION STANDARD <ul style="list-style-type: none"> • Rugged bearing housing vent . Grease lubrication optional. • Large cooling jacket assures lower bearing temperature on high temperature services. • Oil return drains under bearings assure uniform oil circulation through bearings.
11	CONTINUOUS HIGH PERFORMANCE Maintained by external impeller adjustment – simple and fast with open end wrench . no shimming required
12	HIGH THRUST CAPABILITY With double row thrust bearing and shaft lock nut. Minimum shaft end play for effective stuffing box sealing. Bearings sized for 2 year minimum life.
13	BEARING HOUSING Sealed to prevent contamination from corrosive atmosphere, leakage and wash – down. Double-lip seals are provided as standard for extended service life. Bearing isolators may be provided as an option.

ANSI

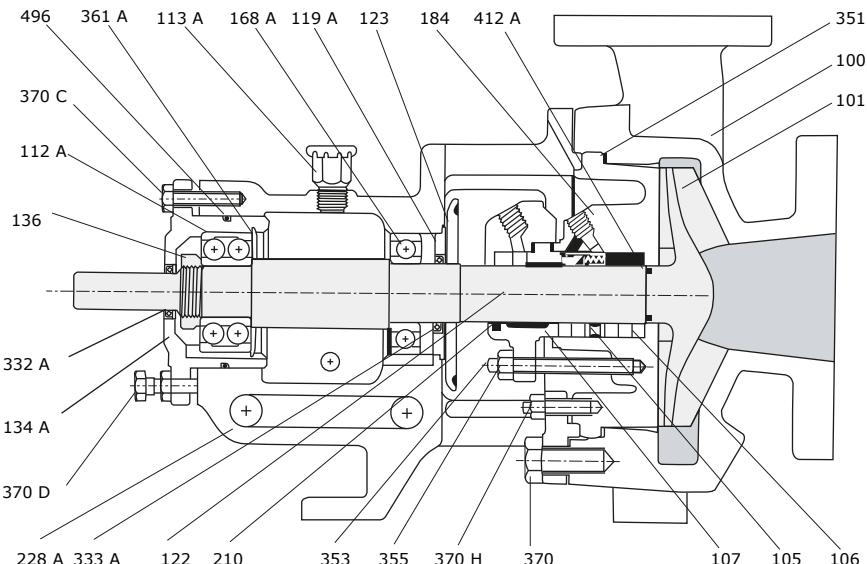
HEAVY-DUTY PROCESS PUMPS

SECTIONAL DRAWING

MODEL ANSI 343



Assembly View of 1x1½-8 & 1½x3-8



PARTS LIST

Item Number	No. Read. Per Pump	Part Description	Materials
105	1	Lantern Ring	316SS
106	1 Set	Stuffing Box Packing	P.T.F.E
107	1	Gland Follower	316SS
108	1	Frame Adaptor	Cast Iron
109A	1	Bearing End Cover - Coupling End	Cast Iron
112A	1	Ball Bearing - Outboard End	Steel
113A	1	Bearing Frame Breather	Non Metallic
119A	1	Bearing End Cover - Inboard	Steel
122	1	Pump Shaft (Less Sleeve)	316SS
122A	1	Pump Shaft (With Sleeve)	316SS
123	1	Deflector	Glass Reinforced Nylon
126*	1	Shaft Sleeve	316SS
134A	1	Bearing Housing	Cast Iron
136	1	Bearing Locknut	Steel
168A	1	Ball Bearing - Inboard	Steel
184	1	Stuffing Box Cover - Standard	316SS
184A	1	Stuffing Box Cover - Water Jacketed	316SS
210	1	Gland Packing	Valumoid
228A	1	Bearing Frame	Cast Iron
241	1	Bearing Frame Foot	Cast Iron
		Slight Glass (Not Shown)	Polycarbonate

Item Number	No. Read. Per Pump	Part Description	Materials
261	1	Gasket - Adapter to Stuffing Box	Valumoid
332A	1	Oil Seal - Coupling End	Buna Rubber
333A	1	Oil Seal - Inboard End	Buna Rubber
351	1	Gasket - Casing	Valumoid
353	2	Gland Stud	316SS
355	2	Gland Stud Nut	304SS
360C	1	Gasket - Brg. End Cover to Brg. Housing	Valumoid
260D	1	Gasket - Bearing Frame to Adapter	Valumoid
361A	1	Circlip	Steel
370	4-24	Cap Screw - Frame/Adaptor to Casing	304SS
370B	4	Cap Screw - Adapt./Adapt. Ring to Frame	Steel
370C	3-4	Tap Bolt - Bearing Housing	Steel
370D	3-4	Tap Bolt w/Lock Nut - Impeller Adjust.	Steel
370F	1-2	Cap Screw - Frame Foot	Steel
370H	2	Stud Nut - Cover to Adapter	304SS
371D	8	Cap Screw	Steel
412A	1	"O" Ring - Impeller	Teflon
418	2-3	Tap Bolt - Jacking	Steel
469	2	Dowel Pin - Frame to Adapter	Steel
496	1	"O" Ring - Bearing Housing	Buna Rubber
503	1	Adapter Ring	Cast Iron

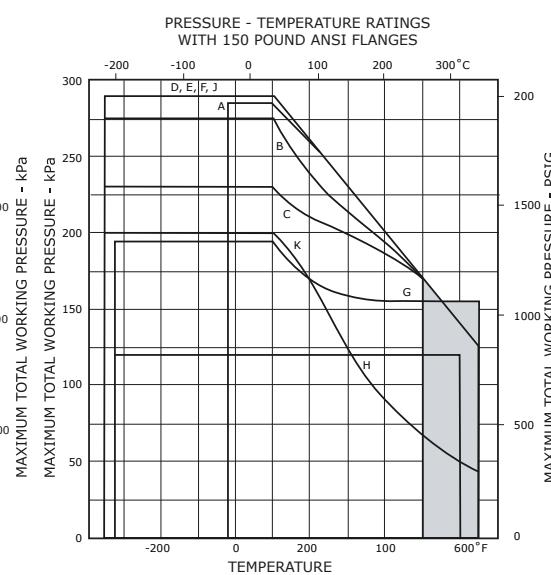
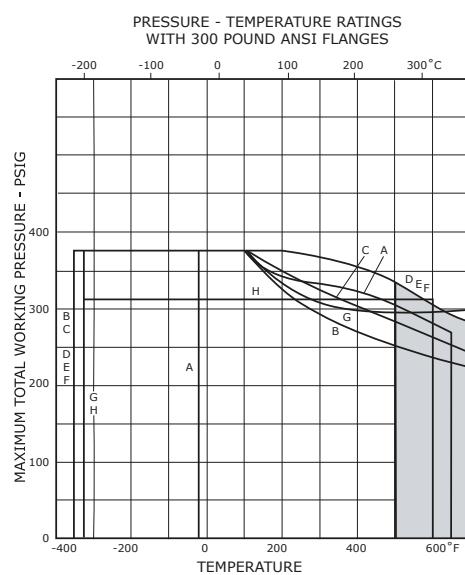
CONSTRUCTION DETAILS

POWER END		ANSI 343	ANSI 495	ANSI 708
SHAFT DIAMETERS	AT IMPELLER	19 mm	25 mm	38 mm
	IN STUFFING BOX (WITH SLEEVE)	1.375"	1.75"	2"
	SLEEVE OUTSIDE DIAMETER	1.375"	1.75"	2.5"
	BETWEEN BEARINGS	38 mm	54 mm	79 mm
BEARINGS	AT COUPLING	24 mm	32 mm	60 mm
	RADIAL	TYPE 207-S	TYPE 309-S	TYPE 313-S
	COUPLING END (DOUBLE ROW)	5306 mm	5309 mm	5313 mm
STUFFING BOX	BEARING SPAN	105 mm	171 mm	235 mm
	SHAFT OVERHANG	156 mm	213 mm	253 mm
	BORE	50.8 mm	63.5 mm	86 mm
	DEPTH	54 mm	67 mm	76 mm
	PACKING SIZE	8 X 8 mm	10 X 10 mm	11 X 11 mm
	NO OF RINGS	5	5	5
	WITDH OF LANTERN RING	11 mm	16 mm	16 mm
	DISTANCE - END OF BOX TO NEAREST OBSTRUCTION	55 mm	76 mm	74 mm

PUMP END	ANSI 343				ANSI 495				ANSI 708														
	1 x 1½-6	1½ x 3-6	2 x 3-6	1 x 1½-8	1 x 1½-8	2 x 3-8	3 x 4-8	3 x 4-8G	1 x 2-10	1½ x 3-10	2 x 3-10	3 x 4-10	4 x 6-10	1½ x 3-13	2 x 3-13	3 x 4-13	4 x 6-13	6 x 3-13	8 x 10-13	6 x 8-15	8 x 10-15	8 x 10-15G	
MAIMUM DIAMETER SOLIDS	8	11	9	8	11	12	28	17	11	5	9	15	25	5	9	15	25	17	25	20	28	20	
SHAFT DEFLECTION LOAD FACTOR (M)	3500 R/MIN	3	6,2	7	6	7,8	8,6	-	15	7,2	8,6	9,8	15	-	10	16	35	-	-	-	-	-	-
	1750 R/MIN	0,8	1,6	1,8	1,5	2	2,2	7	4,1	1,9	2,2	2,5	4,1	17	2,6	4,6	12	17	8	15	10	-	30
	1150 R/MIN	0,3	0,7	0,8	0,7	0,9	1	3	1,8	0,8	1	1,1	1,7	6,8	1,2	1,9	5	6,8	3,6	6,7	4,5	12	14
MAXIMUM CASING THICKNESS																							
CASING CORROSION ALLOWANCE																							
WORKING PRESSURE																							
TEST PRESSURE																							
MAXIMUM LIQUID TEMPERATURE*																							
MAXIMUM LIQUID TEMPERATURE**																							
UNIT MASS																							

*WITHOUT COOLING

**WITH COOLING

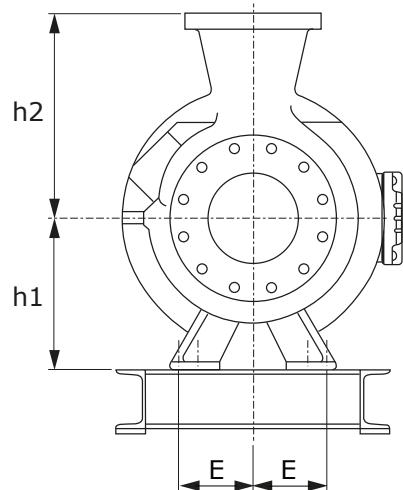
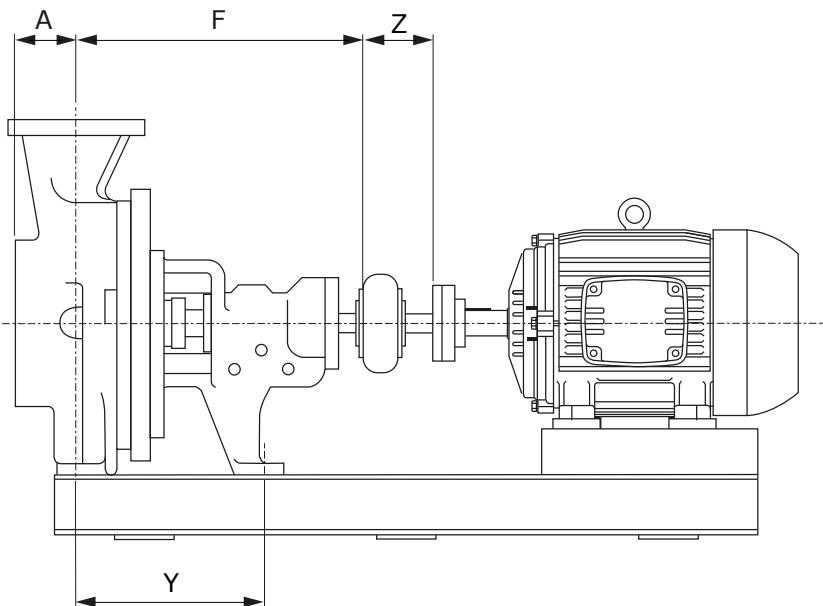


Curve	Material	ASTM Designation
A	Ductile Iron	A395
B	316SS	A744-CF-8M
C	GA-20	A744-CN-7M
D	Hast-B	A494-N-12M-2
E	Hast-C	A494-CW-12M-2
F	CD4MCu	A744-CD-4MCu
G	Monel	A744-M-35
H	Nickel	A744-CZ-100

ANSI

HEAVY-DUTY PROCESS PUMPS

DIMENSIONS



DIMENSIONS DETERMINED BY PUMP													
MODEL	PUMP SIZE	Nominal Discharge Size in "	Nominal Suction Size in "	h2	F	A	h1	Y	E	Z	Shaft Dia. at Cplg.	KEY-WAY	Pump Mass kg
ANSI 343	1 X 11 $\frac{1}{2}$ -6	1	1 $\frac{1}{2}$	165	343	102	133	184	76	100	24	8X7	39
	1 $\frac{1}{2}$ X 3-6	1 $\frac{1}{2}$	3	165	343	102	133	184	76	100	24	8X7	42
	2 X 3-6	2	3	165	343	102	133	184	76	100	24	8X7	44
	1 X 11 $\frac{1}{2}$ -8	1	1 $\frac{1}{2}$	165	343	102	133	184	76	85	24	8X7	46
	1 $\frac{1}{2}$ X 3-8	1 $\frac{1}{2}$	3	165	343	102	133	184	76	85	24	8X7	49
ANSI 495	2 X 3-8	2	3	241	495	102	210	318	124	85	32	10X8	91
	3 X 4-8	3	4	279	495	102	210	318	124	85	32	10X8	100
	3 X 4-8G	3	4	279	495	102	210	318	124	85	32	10X8	100
	1 X 2-10	1	2	216	495	102	210	318	124	110	32	10X8	91
	1 $\frac{1}{2}$ X 3-10	1 $\frac{1}{2}$	3	216	495	102	210	318	124	110	32	10X8	100
	2 X 3-10	2	3	241	495	102	210	318	124	110	32	10X8	105
	3 X 4-10	3	4	279	495	102	254	318	124	110	32	10X8	120
	4 X 6-10	4	6	343	495	102	254	318	124	110	32	10X8	139
	1 $\frac{1}{2}$ X 3-13	1 $\frac{1}{2}$	3	267	495	102	254	318	124	95	32	10X8	112
	2 X 3-13	2	3	292	495	102	254	318	124	95	32	10X8	125
ANSI 708	3 X 4-13	3	4	318	495	102	254	318	124	95	32	10X8	150
	4 X 6-13	4	6	343	495	102	254	318	124	95	32	10X8	185
	6 X 8-13	6	8	406	708	152	368	476	203	133	79	23X8	254
	8 X 10-13	8	10	457	708	152	368	476	203	133	79	23X8	304
	6 X 8-15	4	8	457	708	152	368	476	203	133	79	23X8	277
	8 X 10-15	4	10	483	708	152	368	476	203	133	79	23X8	336
	8 X 10-15G	4	10	483	708	152	368	476	203	133	79	23X8	322

Flanges are drilled to ANSI B16.5 flange dimensions.

TAPPED OPENING INDICATES ITEMS FURNISHED STANDARD				
PURPOSE	NO OF TAPS	TAP SIZE		
		ANSI 343	ANSI 495	ANSI 708
LANTERN RING CONNECTOR	2	1/4 "	3/8 "	3/8 "
FRAME ADAPTER DRAIN	1	SLOT	1 "	1 "
CASING DRAIN (WITH ASBESTOS GASKET)	1	13/8 "	13/8 "	13/8 "
ALTERNATE CASING DRAIN	1	1/2 "	1/2 "	1/2 "
BEARING FRAME CONTROL	4 •	1/2 "	1/2 "	1/2 "
DISCHARGE GAUGE CONNECTION	1	1/4 "	3/8 "	3/8 "
SUCTION GAUGE CONNECTION	1	1/4 "	3/8 "	3/8 "
STUFFING BOX CIRCULATING LINE	1	1/4 "	3/8 "	3/8 "
QUENCH GLAND CONNECTION	2	1/4 "	1/4 "	1/4 "

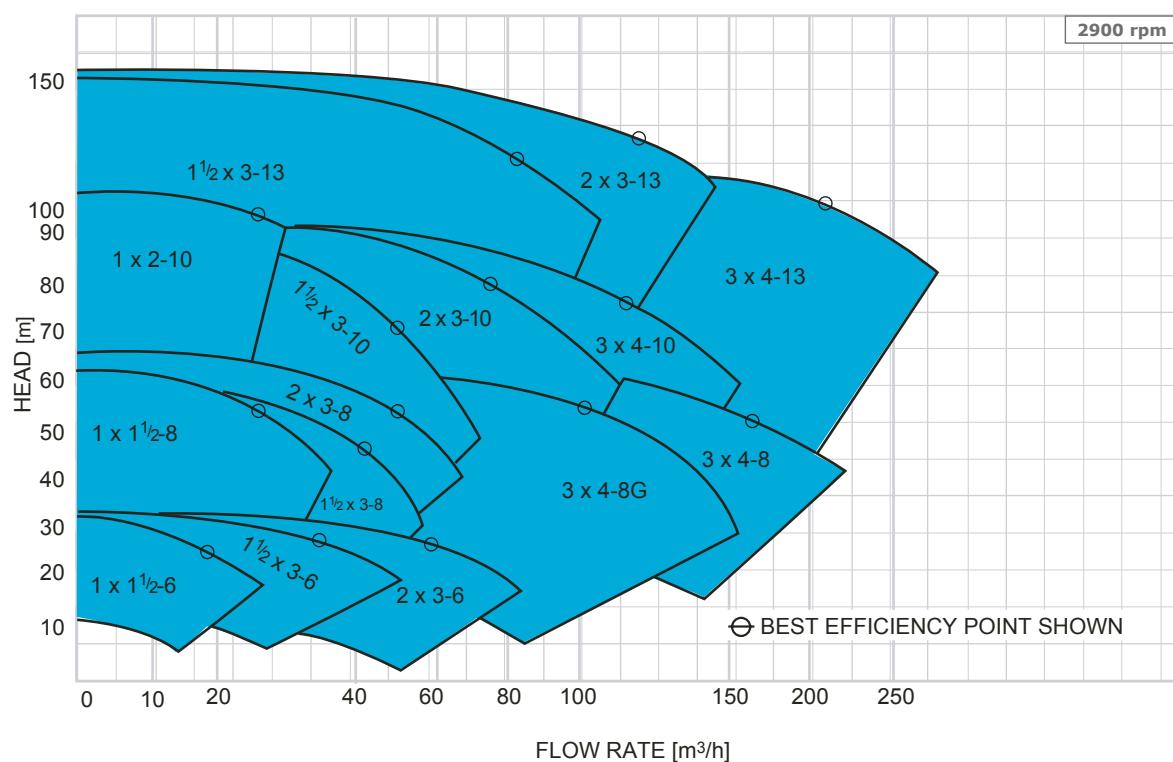
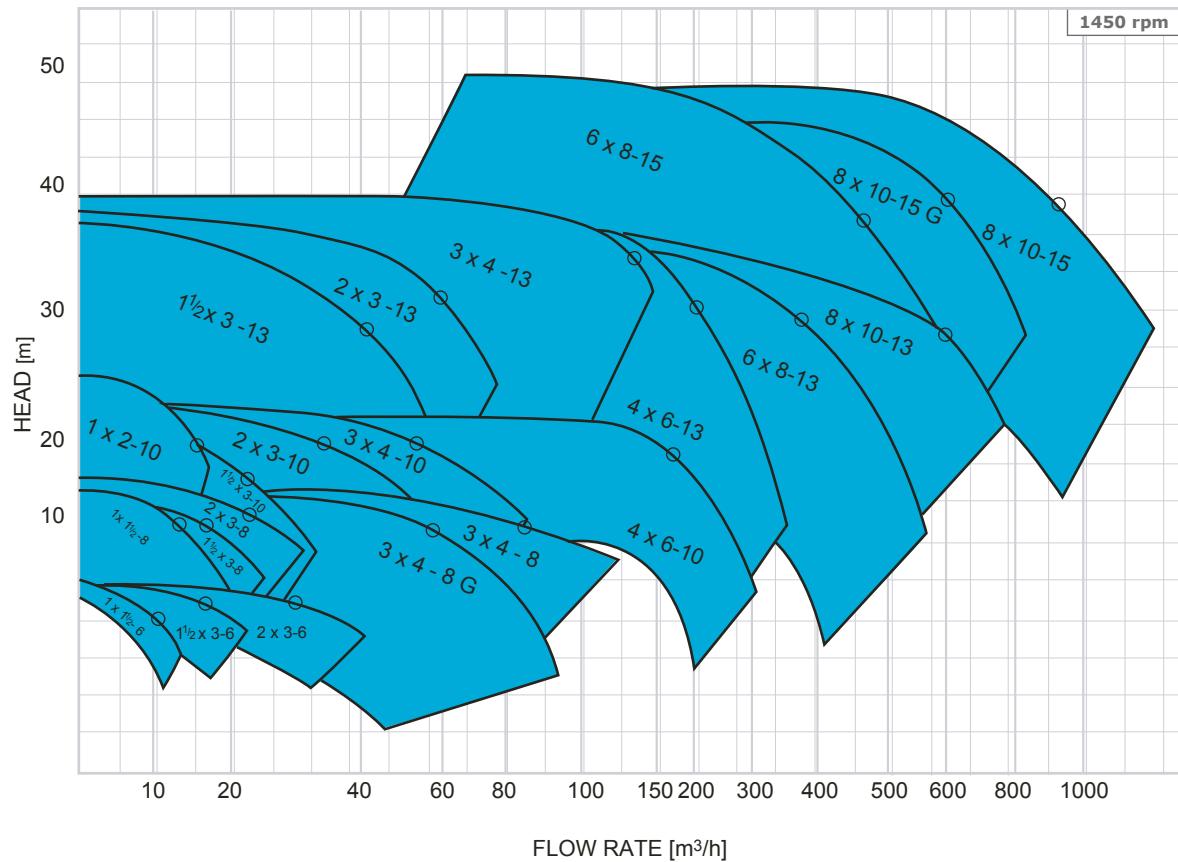
• 4 x 6 - 10 & 4 x 6 - 13 have no tap, 3 x 4 - 13 have 1/4" tap.

MODEL	R/MIN				
	3560	2900	1780	1450	1180
ANSI 343	30,0	24,4	14,9	12,1	9,9
ANSI 495	91,0	74,0	45,5	37,1	30,2
ANSI 708	-	-	186,4	152,1	123,8
					92,5

ANSI

HEAVY-DUTY PROCESS PUMPS

TOMBSTONE CURVES



* FOR INDIVIDUAL PUMP PERFORMANCE CURVES, REFER TO OUR ANSI CURVES BOOK.



APPLICATION

- Pharmaceutical
- Food and Beverage
- Air Conditioning
- Paints and Inks
- Steel Manufacturing
- Chemical Industry

RA Pump Range	Minimum Flow (m³/h)	Maximum Flow (m³/h)	Minimum Head (m)	Maximum Head (m)	Maximum Temperature
CLT	2	1050	3	140	180 °C

DESIGN & CONSTRUCTION

- Single stage, end-suction and of modular design with a high interchangeability of parts.
- Suitable for pumping clean liquids and highly aggressive chemicals.
- Excellent hydraulic performance with low N.P.S.H required values.
- The suction flange is horizontal and the discharge is vertical.
- Standard flanges conform to DIN 2543 PN16.
- The wet end components of the pump (Volute, Impeller and Seal or Gland Plate) are supplied standard in high grade Cast Stainless Steel for long life.
- They have overhung impellers, hydraulic balance is effected by balance holes in the impeller. Standard construction is with soft packed stuffing box or single, unbalanced mechanical seal.
- The entire range offers a high interchangeability, thus reducing spares stock holding.
- Back pull out feature for ease of maintenance, allowing the volute casing to remain connected to the pipework when removing the rotating assembly.
- Shaft is supported by sealed for life deep groove ball bearings, allowing for a maintenance free life cycle.
- Bearing assemblies from our EN 733, NT-Range are utilized allowing a high interchangeability of spares.

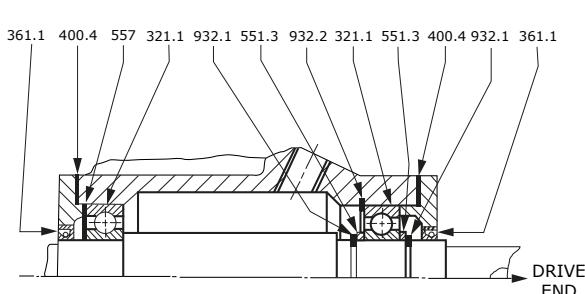
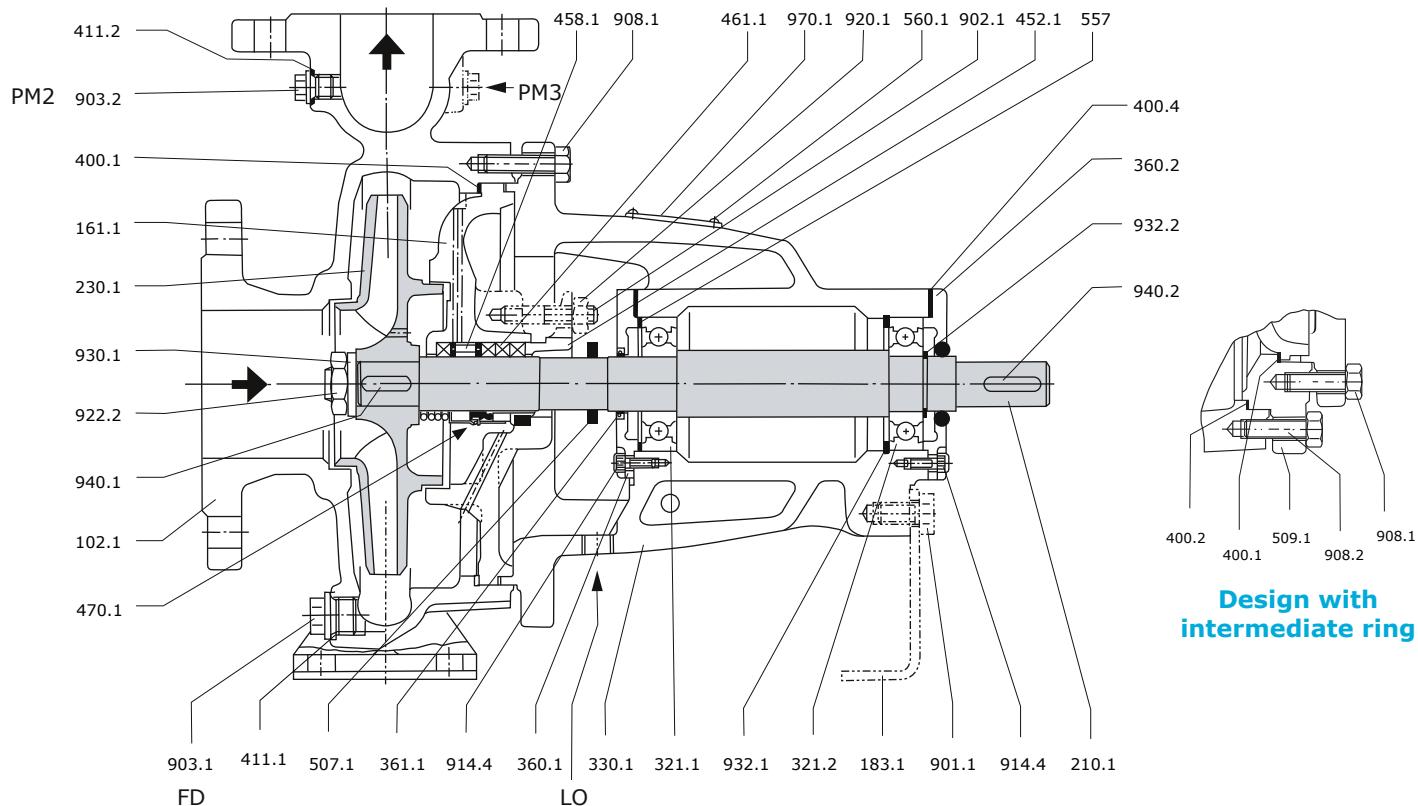
MATERIALS OF CONSTRUCTION

Pump shaft: Grade 316 Stainless steel
 Volute casing: Grade 316 Stainless steel
 Impeller: Grade 316 Stainless steel
 Gland plate/seal plate: Grade 316 Stainless steel
 Bearing assembly: Cast Iron

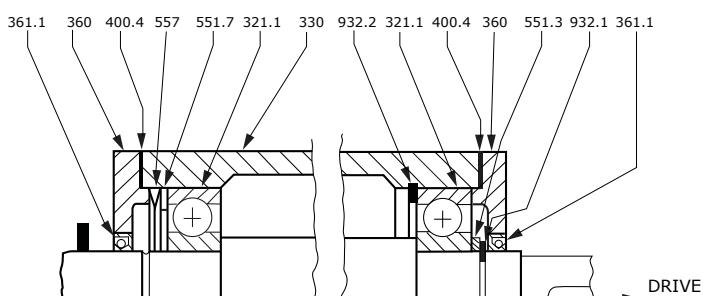
MODEL DESCRIPTION

CLT 32-200 S S M
 Sealing Arrangement
 Impeller Material
 Volute Material
 Nominal Impeller Diameter in mm
 Discharge Size in mm
 Pump type

SECTIONAL DRAWING



NT 530



NT 585

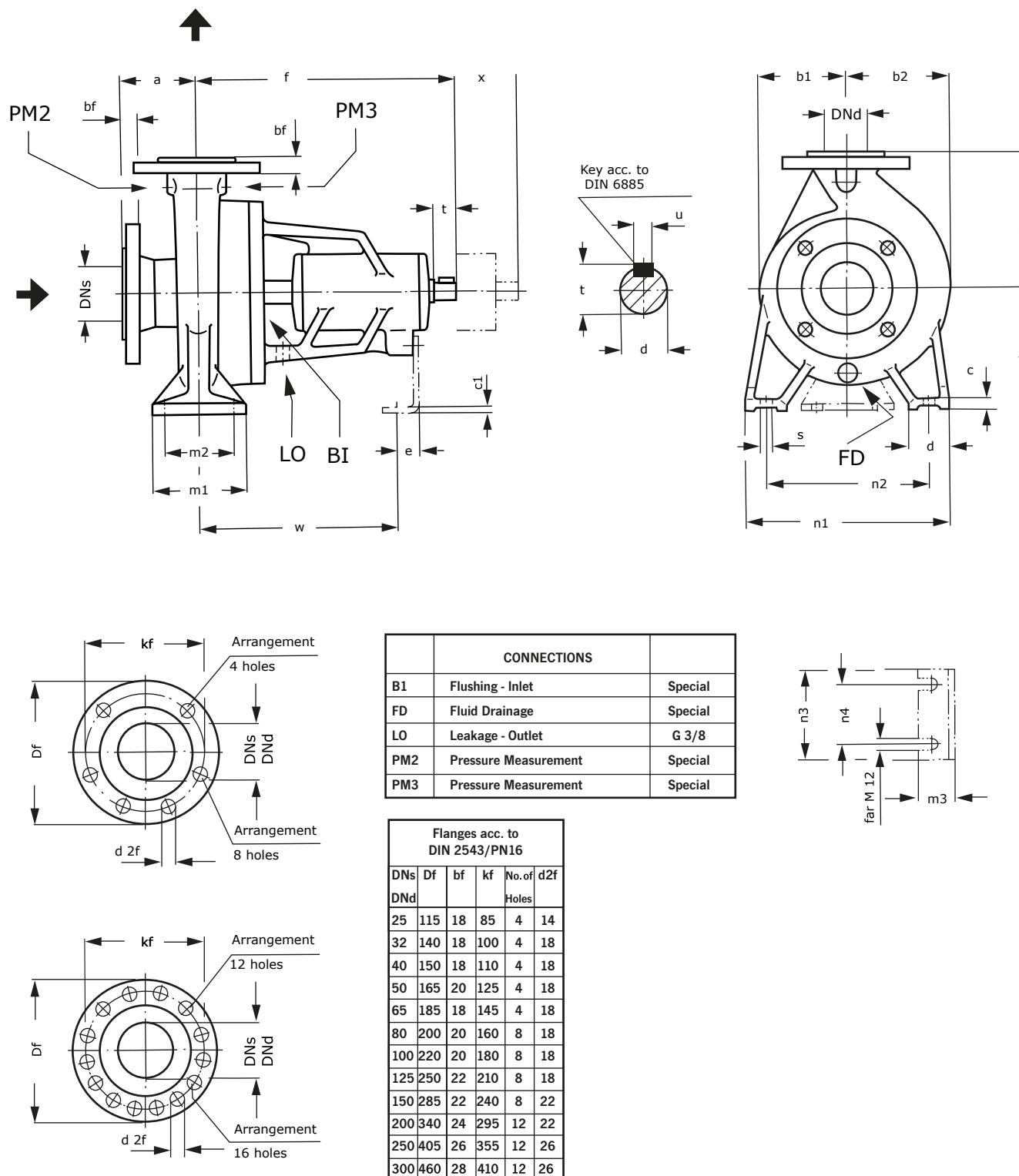
PARTS LIST

DESCRIPTION	PART NO.
VOLUTE CASING	102.1
GLAND/SEALPLATE	161.1
SUPPORT FOOT	183.1
SHAFT	210.1
IMPELLER	230.1
GROOVE BALL BEARING	321.1
GROOVE BALL BEARING	321.2
BEARING BRACKET	330.1
BEARING COVER	360.1
BEARING COVER	360.2
OIL SEAL	361.1
GASKET	400.1
GASKET	400.2
GASKET	400.4

DESCRIPTION	PART NO.
DISTANCE WASHER	551.1
DISTANCE WASHER	551.2
WAVE WASHER	557.0
HEXAGON SCREW	901.1
STUD BOLT	902.1
SCREW PLUG	903.1
SCREW PLUG	903.2
SET SCREW	908.1
SET SCREW	908.2
SOCKET HEAD CAP SCREW	914.4
HEX. NUT.	920.1
IMPELLER NUT	922.2
SPRING RING	930.1

DESCRIPTION	PART NO.
GLAND	452.1
LANTERN RING	458.1
PACKING RING	461.1
MECHANICAL SEAL	470.1
FLINGER RING	507.1
MATCHING RING	509.1
SPRING WASHER	930.2
CIRCLIP	932.1
CIRCLIP	932.2
KEY	940.1
KEY	940.2
CUP SPRING	950.2
NAME PLATE	970.1

DIMENSIONS

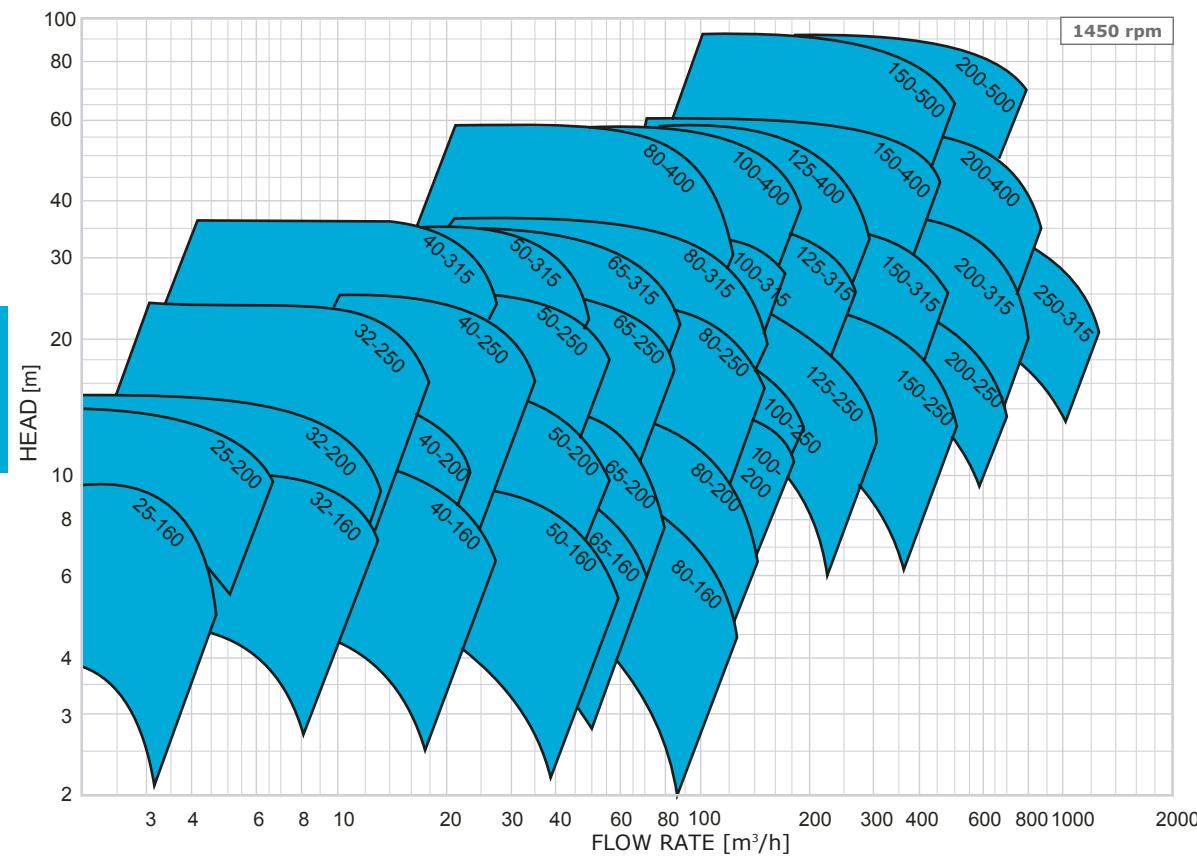


DIMENSIONS

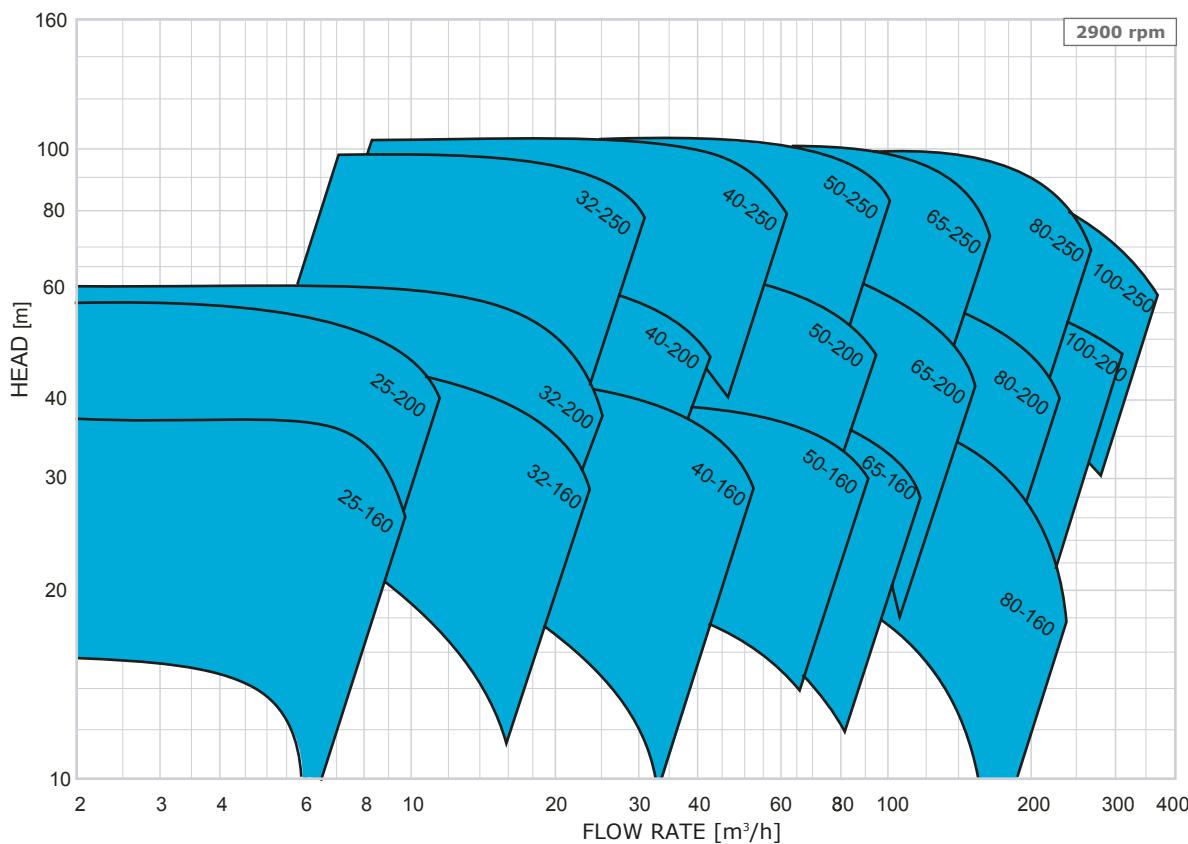
Size	Suction Flange DNs	Pressure Flange DNd	Pump Dimensions						Foot Dimensions												Bolts	Extension Dimension	Shaft End				Corresponds to DIN 24255
			a	f	b1	b2	h1	h2	b	c	c1	e	m1	m2	m3	n1	n2	n3	n4	w			x	d	I	t	
25-160	40	25	80	360	128	128	132	160	50	15	4	28	100	70	45	240	10	160	110	260	M12	100	24	50	27	8	
25-200	40	25	80	360	132	132	160	180	50	15	4	28	100	70	45	240	190	160	110	260	M12	100	24	50	27	8	
32-160	50	32	80	360	130	130	132	160	50	15	4	28	100	70	45	240	190	160	110	260	M12	100	24	50	27	8	•
32-200	50	32	80	360	130	135	160	180	50	15	4	28	100	70	45	240	190	160	110	260	M12	100	24	50	27	8	•
32-250	50	32	100	470	170	170	180	225	65	15	4	28	125	95	45	320	250	160	110	340	M12	100	32	80	35	10	
40-160	65	40	80	360	130	130	132	160	50	15	4	28	100	70	45	240	190	160	110	260	M12	100	24	50	27	8	•
40-200	65	40	100	360	130	140	160	180	50	15	4	28	100	70	45	265	212	160	110	260	M12	100	24	50	27	8	•
40-250	65	40	100	470	170	170	180	225	65	15	4	28	125	95	45	320	250	160	110	340	M12	100	32	80	35	10	
40-315	65	40	125	470	200	200	200	250	65	20	4	28	125	95	45	345	280	160	110	340	M12	100	32	80	35	10	
50-160	80	50	100	360	130	130	160	180	50	15	4	28	100	70	45	265	212	160	110	260	M12	100	24	50	27	8	
50-200	80	50	100	360	135	150	160	200	50	15	4	28	100	70	45	265	212	160	110	260	M12	100	24	50	27	8	
50-250	80	50	125	470	170	170	180	225	65	15	4	28	125	95	45	320	250	160	110	340	M12	100	32	80	35	10	
50-315	80	50	125	470	200	200	225	280	65	20	6	30	125	95	47	345	280	160	110	340	M12	100	32	80	35	10	
65-160	100	65	100	360	130	155	160	200	65	15	4	28	125	95	45	280	212	160	110	260	M12	100	24	50	27	8	
65-200	100	65	100	470	170	170	180	225	65	15	4	28	125	95	45	320	250	160	110	340	M12	140	32	80	35	10	
65-250	100	65	125	470	170	190	200	250	80	18	4	28	160	120	45	360	280	160	110	340	M16	140	32	80	35	10	
65-315	100	65	125	530	200	230	225	280	80	20	6	31	160	120	47	460	315	160	110	370	M16	140	42	110	45	12	
80-160	125	80	125	360	145	180	180	225	65	15	4	28	125	95	45	320	250	160	110	260	M12	140	24	50	27	8	
80-200	125	80	125	470	170	190	180	250	65	18	4	28	125	95	45	345	280	160	110	340	M12	140	32	80	35	10	
80-250	125	80	125	470	185	210	225	280	80	18	6	30	160	120	47	400	315	160	110	340	M16	140	32	80	35	10	
80-315	125	80	125	530	210	255	250	315	80	20	6	31	160	120	47	400	315	160	110	370	M16	140	42	110	45	12	
80-400	125	80	125	530	245	260	280	355	80	20	6	31	160	120	47	435	355	160	110	370	M16	140	42	110	45	12	
100-200	125	100	125	470	170	205	200	280	80	18	4	28	160	120	45	360	280	160	110	340	M16	140	32	80	35	10	•
100-250	125	100	140	530	200	230	225	280	80	20	6	31	160	120	47	400	315	160	110	370	M16	140	42	110	45	12	
100-315	125	100	140	530	210	260	250	315	80	20	6	31	160	120	47	400	315	160	110	370	M16	140	42	110	45	12	
100-400	125	100	140	530	250	295	280	355	100	20	6	31	200	150	47	500	400	160	110	370	M20	140	42	110	45	12	•
125-250	150	125	140	530	210	260	250	355	80	20	6	31	160	120	47	400	315	160	110	370	M16	140	42	110	45	12	
125-315	150	125	140	530	215	255	280	355	100	20	6	31	200	150	47	500	400	160	110	370	M20	140	42	110	45	12	•
125-400	150	125	140	530	265	320	315	400	100	20	6	31	200	150	47	500	400	160	110	370	M20	140	42	110	45	12	•
150-250	200	150	160	530	225	285	280	375	100	20	6	31	200	150	47	500	400	160	110	370	M20	180	42	110	45	12	
150-315	200	150	160	585	265	280	315	400	100	22	10	42	200	150	65	550	450	250	200	410	M20	180	60	105	64	18	
150-400	200	150	160	585	300	330	315	450	100	22	10	42	200	150	65	550	450	250	200	410	M20	180	60	105	64	18	
150-500	200	150	180	585	320	380	375	500	100	25	10	42	200	150	65	550	450	250	200	410	M20	180	60	105	64	18	
200-250	200	200	180	530	265	340	355	425	100	27	6	31	200	150	47	550	450	160	110	370	M20	180	42	110	45	12	
200-315	250	200	200	585	275	350	355	450	100	27	10	42	200	150	65	550	450	250	200	410	M20	180	60	105	64	18	
200-400	250	200	180	585	315	370	355	500	100	30	10	42	200	150	65	550	450	250	200	410	M20	180	60	105	64	18	
200-500	250	200	200	585	360	440	425	560	100	25	10	42	200	150	65	660	560	250	200	410	M20	180	60	105	64	18	
250-315	300	250	250	585	315	445	400	560	130	30	10	42	260	190	65	690	560	250	200	410	M24	180	60	105	64	18	

Dimensions in mm.

TOMBSTONE CURVES



Size*	Pg. no.	
	1450	2900
25-160	3	42
25-200	4	43
32-160	5	44
32-200	6	45
32-250	7	46
40-160	8	47
40-200	9	48
40-250	10	49
40-315	11	50
50-160	12	51
50-200	13	52
50-250	14	53
50-315	15	54
65-160	16	55
65-200	17	56
65-250	18	57
65-315	19	58
80-160	20	59
80-200	21	60
80-250	22	61
80-315	23	62
80-400	24	
100-200	25	63
100-250	26	64
100-315	27	65
100-400	28	
125-250	29	
125-315	30	
125-400	31	
150-250	32	
150-315	33	
150-400	34	
150-500	35	
200-250	36	
200-315	37	
200-400	38	
200-500	39	
250-315	40	
250-400	41	



* FOR INDIVIDUAL PUMP PERFORMANCE CURVES, REFER TO OUR CLT & CLB CURVES BOOK.



APPLICATION

- Pharmaceutical
- Food and Beverage
- Air Conditioning
- Paints and Inks
- Steel Manufacturing
- Chemical Industry

RA Pump Range	Minimum Flow (m³/h)	Maximum Flow (m³/h)	Minimum Head (m)	Maximum Head (m)	Maximum Temperature
CLB	2	450	3	140	180 °C

DESIGN & CONSTRUCTION

- Closed couple single stage, end-suction and of modular design with a high interchangeability of parts.
- They are suitable for pumping clean liquids and highly aggressive chemicals.
- Excellent hydraulic performance with low N.P.S.H required values.
- The suction flange is horizontal and the discharge is vertical as standard however the volute may be rotated on certain sizes.
- Flanges conform to DIN 2543 PN16.
- The wet end components of the pump (Volute, Impeller and Seal or Gland Plate) are supplied standard in high grade Cast Stainless Steel for long life.
- They have overhung impellers, hydraulic balance is effected by balance holes in the impeller. Standard construction is with soft packed stuffing box or single, unbalanced mechanical seal.
- The entire range offers a high interchangeability, thus reducing spares stock holding.
- Stub shaft design which is attached onto the motor

shaft, therefore the pump runs off the motor bearings and does not utilize its own bearing assembly.

- The volute casing is attached to the motor by means of a pump to motor bracket.
- Offers a space saving option.
- More economical, cost saving.

MATERIALS OF CONSTRUCTION

Pump Shaft:	Stainless Steel (316)
Volute Casing:	316 Stainless Steel*
Impeller:	Stainless Steel*
Shaft Sealing:	Gland Packed or Mechanical Seal* to suit application
Motor Bearings:	Grease lubricated ball bearings

* Special alloys available to meet specific application.

Motor

Standard I.E.C flange mounted or foot and flange mounted three phase, 380 or 525 volt totally enclosed fan cooled motors are used, with either cast iron or aluminum bodies. Non standard motors can be supplied upon request.

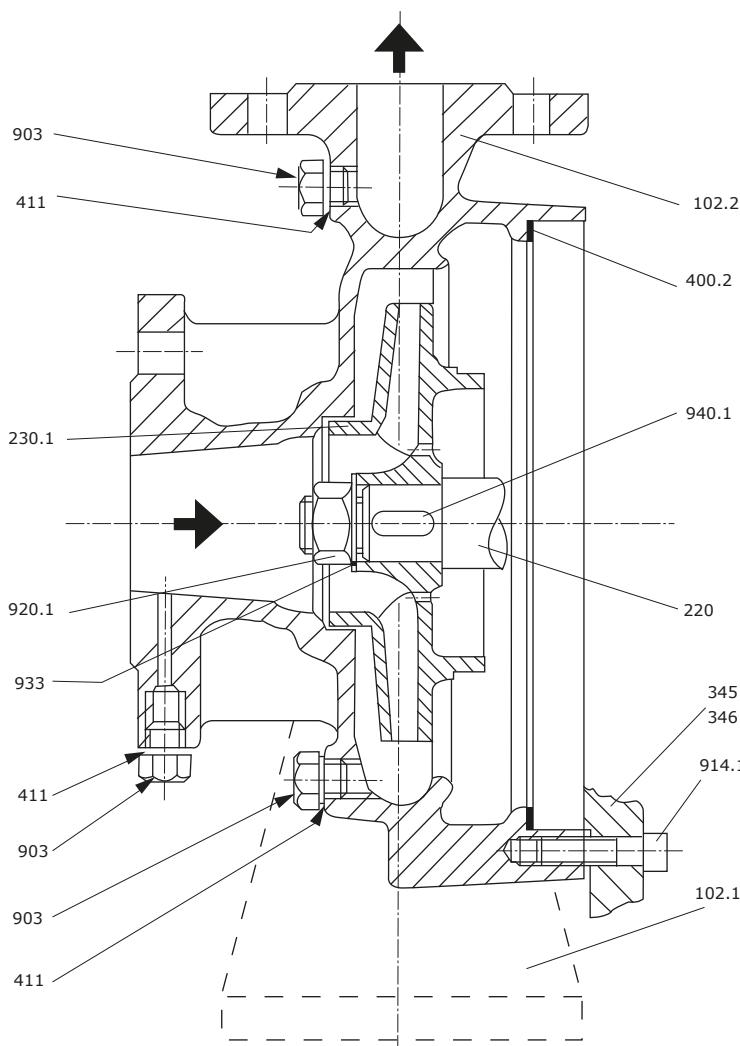
MODEL DESCRIPTION

CLB 50-160/5,5/2 SSM

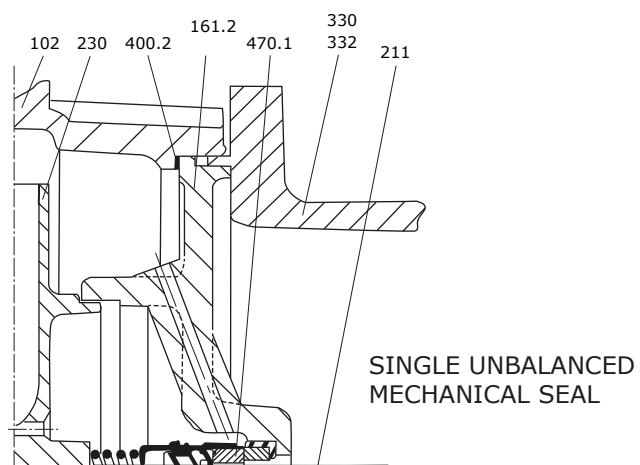
- Sealing Arrangement
- Impeller Material
- Volute Material
- Motor speed 2 pole or 4 pole
- Motor kW
- Nominal Impeller diameter in mm
- Discharge diameter in mm
- Monoblock Design

SECTIONAL DRAWING

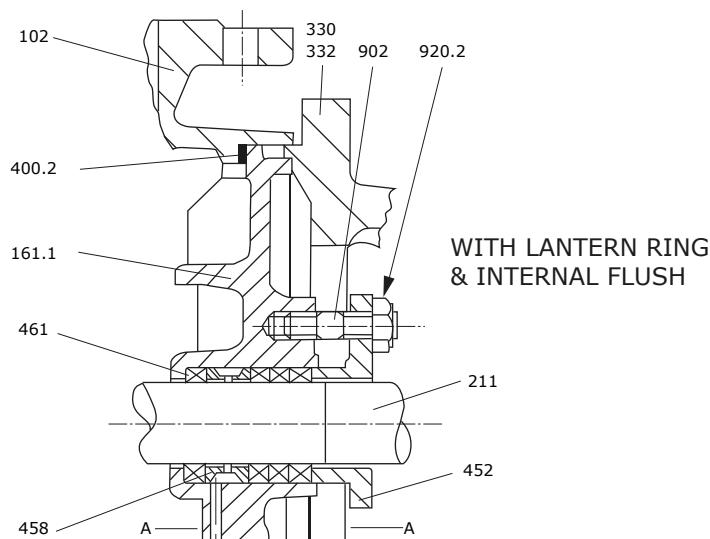
SINGLE-STAGE PUMP



MECHANICAL SEAL



GLAND PACKED



SECTIONAL DRAWINGS & PARTS LIST

PARTS LIST

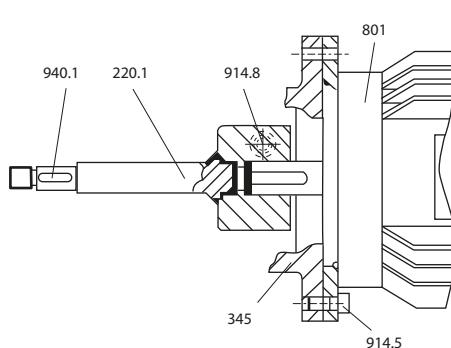
DESCRIPTION	PART NO.
VOLUTE CASING CLB (WITH FEET)	102.1
VOLUTE CASING CLB (WITHOUT FEET)	102.2
GLAND PLATE	161.1
SEAL PLATE	161.2
STUB SHAFT 25-160	220.1
STUB SHAFT 360 & 470	220.2
DRIVE COUPLING	223
IMPELLER	230.1
BRACKET - PUMP/MOTOR (WITHOUT FOOT)	345
BRACKET - PUMP/MOTOR (WITH FOOT)	346

DESCRIPTION	PART NO.
ADAPTOR PLATE	348.1
ADAPTOR PLATE	348.2
GASKET	400.2
WASHER	411
GLAND	452
LANTERN RING	458
GLAND PACKING RING	461
MECHANICAL SEAL	470.1
MOTOR	801
STUD	902

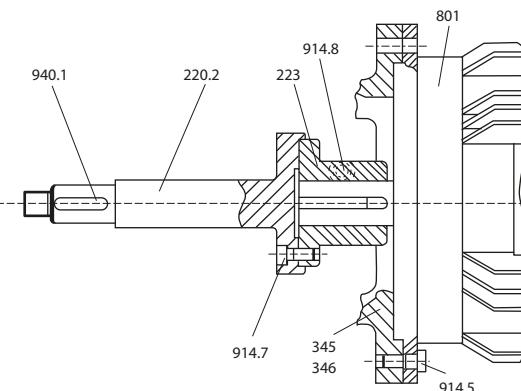
DESCRIPTION	PART NO.
PLUG	903
SET SCREW	914.1
SET SCREW	914.5
COUNTERSUNK CAP SCREW	914.6
CAP SCREW	914.8
CAP SCREW	917.7
IMPELLER NUT - HEX	920.1
NUT - HEX	920.2
SPRING WASHER	933
KEY - IMPELLER	940.1

POWER/MOTOR END

SHAFT SIZE 25-160

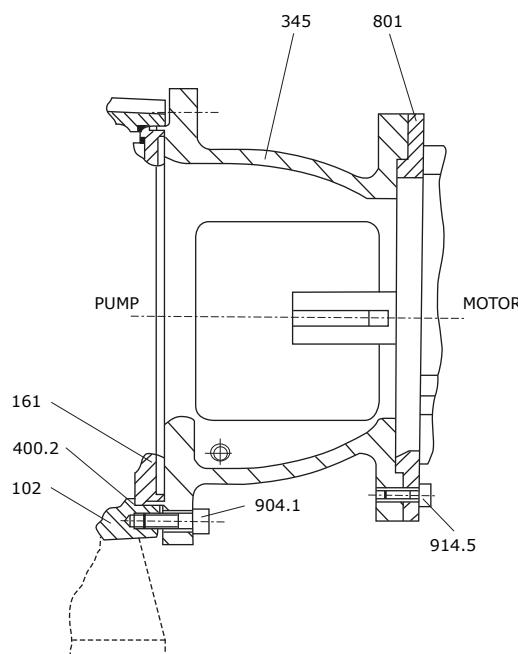


SHAFT SIZE 360 & 470



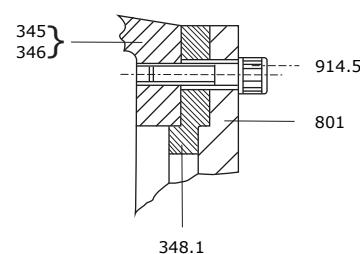
PUMP/MOTOR BRACKET

SIZE 25-160, 360/4, 360/11 & 470/22

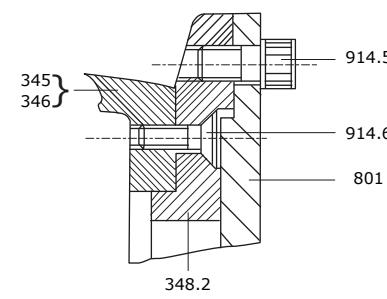


MOTOR ADAPTOR PLATES

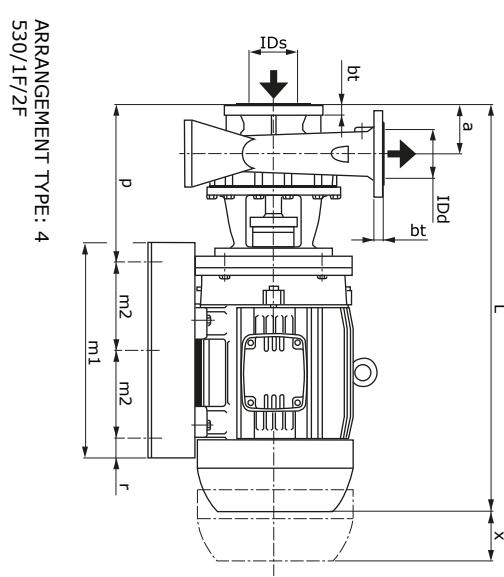
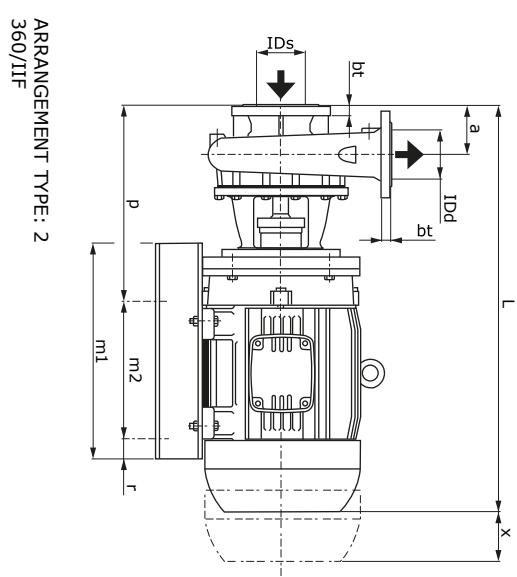
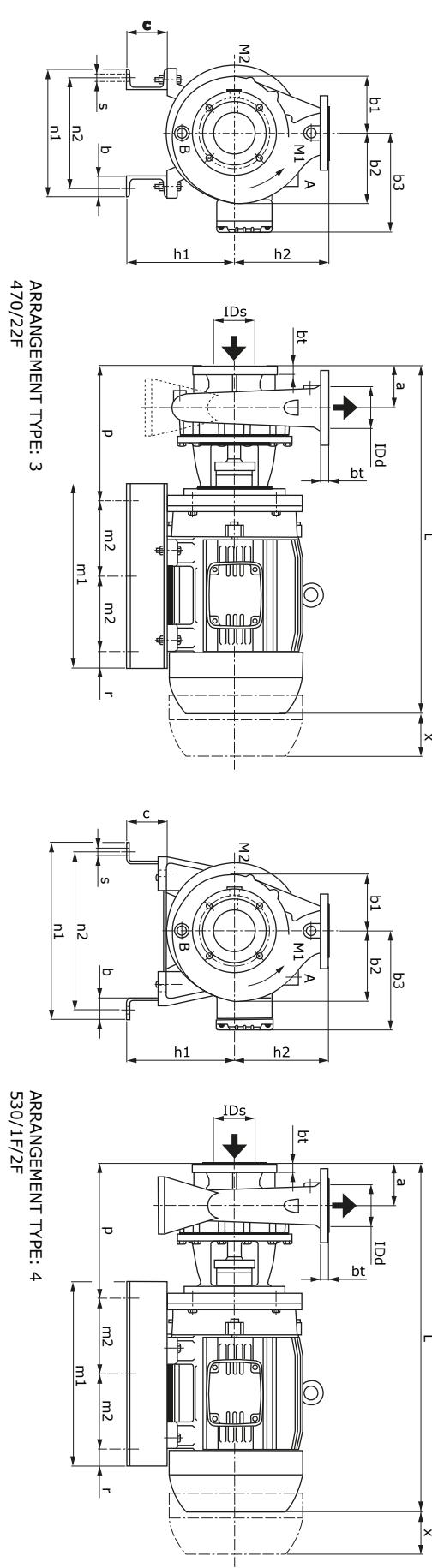
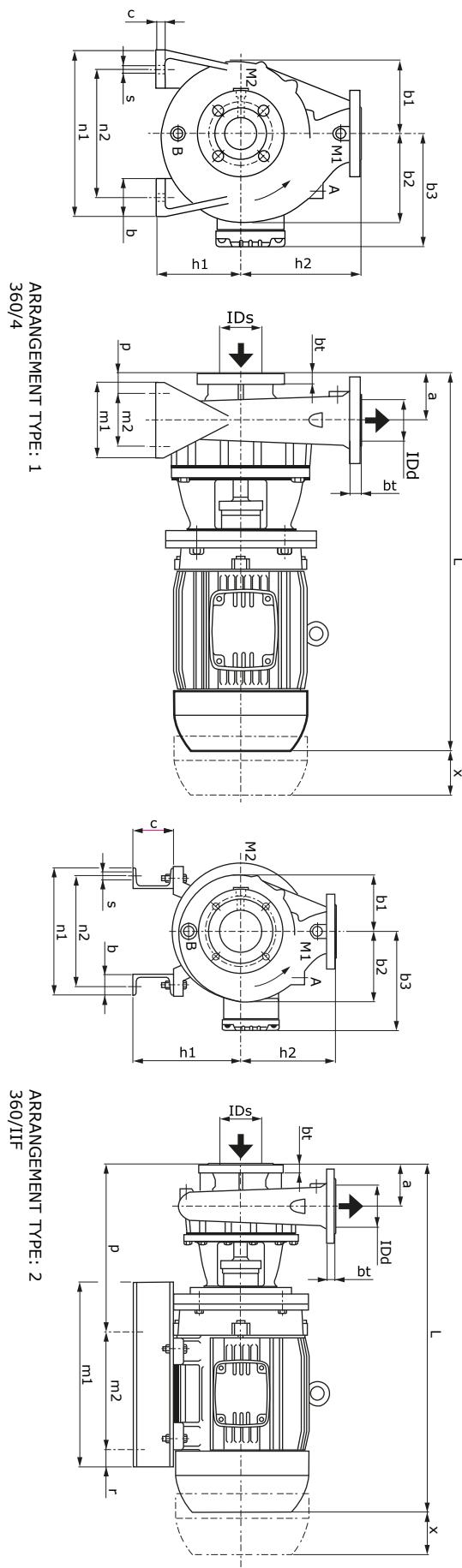
FRAME D90S & D90L MOTORS



FRAME D100L, D112M, D160M,
D160L, D180M - D180L MOTORS



DIMENSIONS



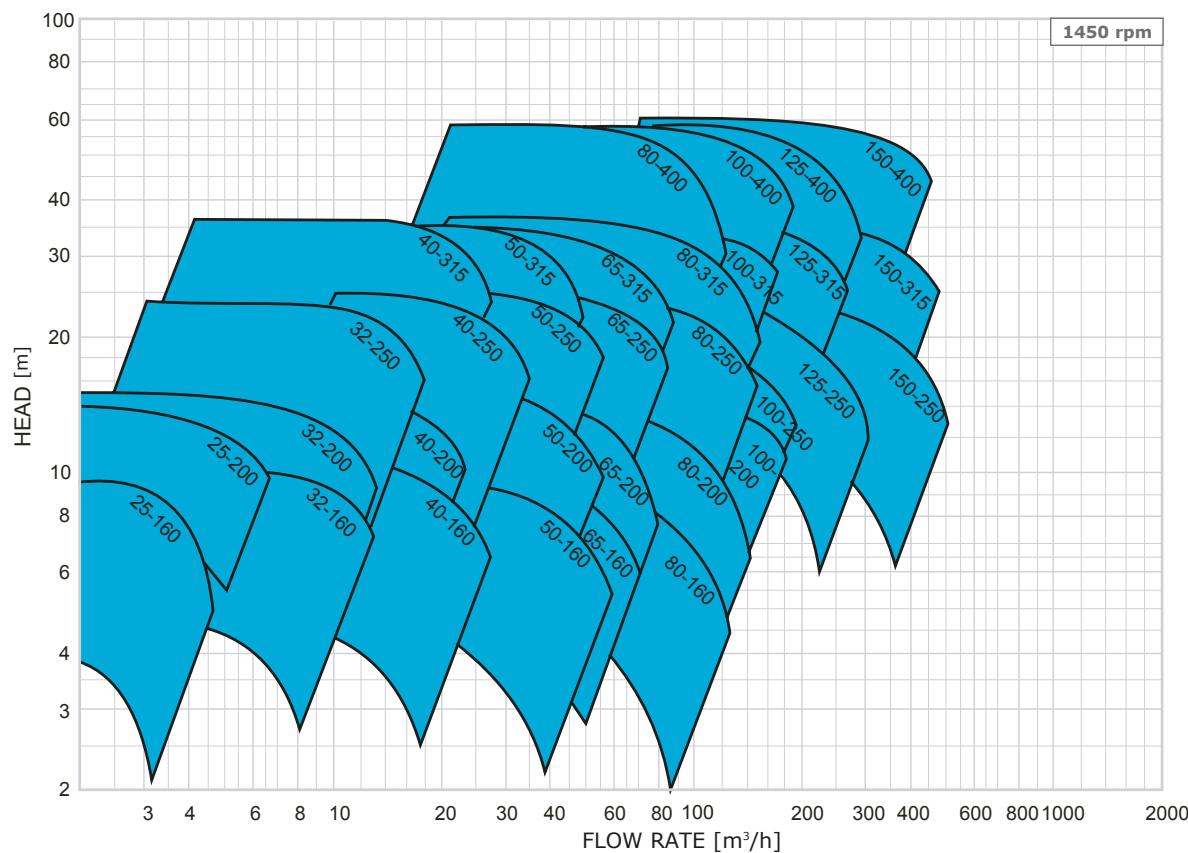
DIMENSIONS

Pump	Bracket	Arrangement	Motor	Motor frame size	Pole	IDs	IDd	Pump Dimensions								Foot Dimensions								Bolts	Dismantling Space	Drilling Hole	Drainage Hole	Gauge Connection	Mass kg Approx.
								Suction Flange	Discharge Flange	a	b1	b2	±b3	h1	h2	±L	b	c	m1	m2	r	n1	n2	p					
CLB			kW																										
25-160	25-160	1	0.55 0.22	D80 D90L	4 2	40	25	80	100	108	155	112	160	437	50	15	100	70	-	220	190	45	15	60	R1/4"	R1/4"	R1/4"	29	
25-200	360/4	1	0.55 0.75 1.1	D80	4	40	25	80	132	132	145	160	180	509	50	15	100	70	-	240	190	45	15	80	R1/4"	R1/4"	R1/4"	33 35 38	
			2.2 3	D90L D100L	2																							47 54	
32-160	360/4	1	0.55 0.75	D80	4	50	32	80	123	123	145	132	160	592	50	15	100	70	-	240	190	45	15	80	R1/4"	R1/4"	R1/4"	34 35	
			3 4	D100L D112M D132S	2																							49 56	
			5.5 7.5	360/11	2																							65 75	
32-200	360/4	1	0.75 1.1	D80	4	50	32	80	124	130	145	155	160	180	494	50	15	100	70	-	240	190	45	15	80	R1/4"	R1/4"	R1/4"	40 44
			3 4	360/4	1																							70 80	
			5.5 7.5	360/11	2																							70 80	
32-250	470/22	3	7.5 11 15 18.5	D132S D160M	2	65	40	80	123	123	145	132	160	777	50	100	330	145	-	248	220	45	15	80	R1/4"	R1/4"	R1/4"	40	
40-160	360/4	1	18.5 0.55 0.75 1.1	D160L D80 D90S D90L	4	65	40	80	123	123	145	132	160	671	50	15	100	70	-	240	190	45	15	80	R1/4"	R1/4"	R1/4"	40 42	
			3 4	360/4	2																							4	
40-200	360/4	1	0.55 0.75 1.1 1.5	D80S	4	65	40	100	125	135	155	160	180	542	50	15	100	70	-	265	212	65	15	80	R1/4"	R1/4"	R1/4"	49 52	
			4 5.5	360/4	1																							59	
40-200	360/11	2	5.5 11 15	D112M D132S D160M	2						218			691	50	100	330	145	40	248	220	424	12				80 90		
			5.5 11 15	40-315	2																						110 125		
40-250	470/22	3	5.5 11 15 18.5	D132S D160M	4 2	65	40	100	150	156	155	160	225	837	50	15	125	95	-	320	250	53	12	80	R1/4"	R1/4"	R1/4"	56 65	
40-315	470/22	3	5.5 11 15 18.5	D160L D180M D200L D132S	4 2	65	40	100	125	130	145	160	180	883	65	100	400	300	50	308	250	342	16				388		
			5.5 11 15 18.5	40-315	3																						145		
			5.5 11 15 18.5	40-315	3																						41		
50-160	360/4	1	0.55 0.75 1.1 1.5	D80	4	80	50	100	125	130	145	145	160	180	560	50	15	100	70	-	265	212	45	14	80	R1/4"	R1/4"	R1/4"	41 45
			4 5.5	360/4	1																							48	
			5.5 11 15	360/11	2																							105	
50-200	360/4	1	1.1 1.5 2.2 3	D90S D90L D100L	4	65	50	100	133	145	155	160	200	567	50	15	100	70	-	265	212	65	15	80	R1/4"	R1/4"	R1/4"	59 49	
			7.5 11 15 18.5	360/4	1																							95 115 130 145	
50-250	470/22	3	5.5 15 18.5	D132S D160L D180M D200L	4 2	65	50	100	156	169	165	180	225	839	65	15	125	95	-	320	250	53	12	80	R1/4"	R1/4"	R1/4"	69 130	
			22 37 30 37	470/22	3																							150 215 285 305	
50-315	470/22	3	5.5 7.5 3	D132S D132M	4 2	65	50	100	156	169	165	180	225	1008	65	15	125	95	-	320	250	53	12	80	R1/4"	R1/4"	R1/4"	69 130	
			30 37 45 55	470/22	3																								

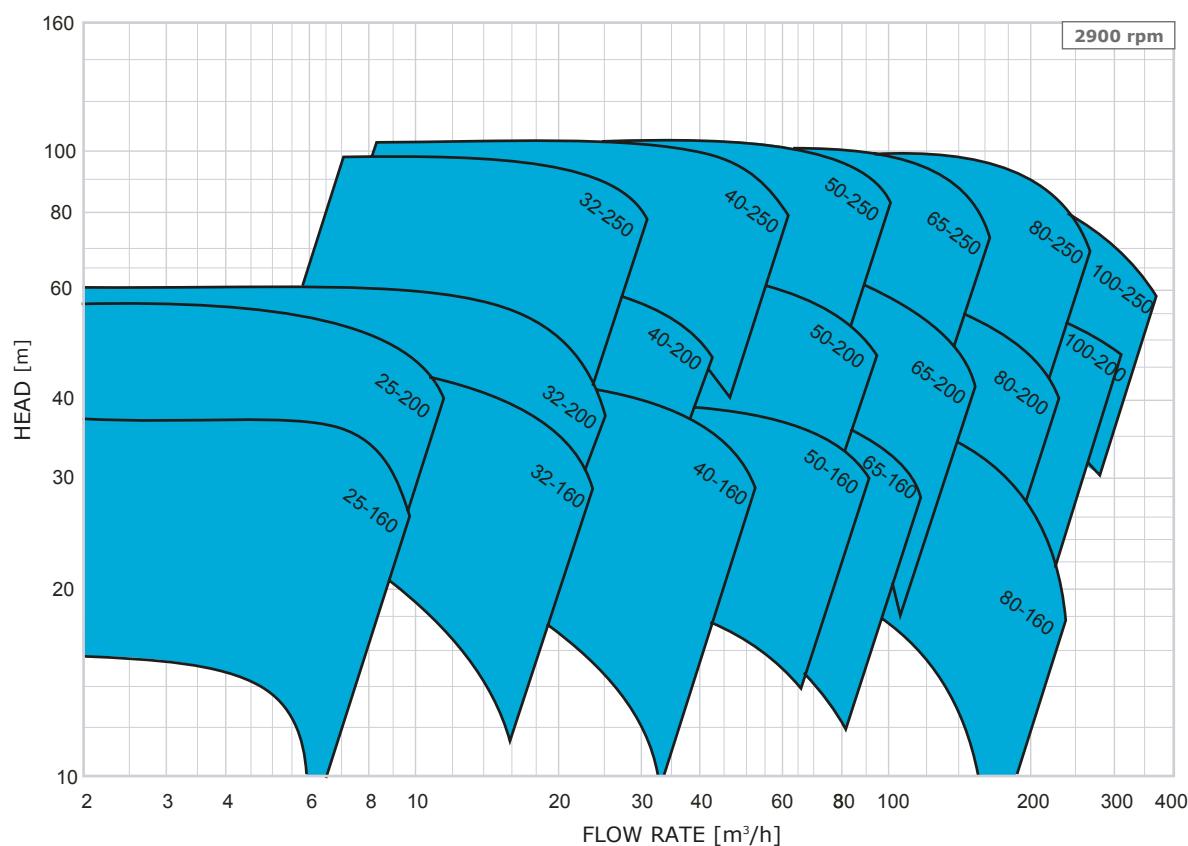
DIMENSIONS

Pump	Bracket	Arrangement	Motor	Motor frame Size	Pole	Suction Flange		Pump Dimensions							Foot Dimensions							Dismantling Space	Priming Hole	Drainage Hole	Gauge Connection	Mass kg Approx.		
						IDs	IDd	a	b1	b2	±b3	h1	h2	±L	b	c	m1	m2	r	n1	n2	p	s	x	A	B	M1/M2	
NB																												
65-200	470/22	3	11 15 18.5 22 30	D60M D160L D180M D200L	2	80	65	100	148	170	155 165 256	180 260	225	567	65	15	155	95	-	320	250	53	12	80	R1/4"	R1/4"	58 65 115 130 145	
65-250	470/22	3	5.5 7.5 11 22 30 37 45	D132S D132M D160M D180M D200L D225SM	4	80	65	100	164	184	218	232	250	730 768	50	100	330	145	40	248	220	463	12	100	R3/8"	R3/8"	125 135	
65-315	360/4	4	7.5 11 15	D132S D160M D160L	4	100	80	125	136	170	155	180	225	450	65	15	125	95	-	320	250	78	12	80	R1/4"	R1/4"	54	
80-160	360/4	1	0.75 1.1 1.5 2.2 3	D80 D90S D100L	4	100	80	125	136	170	155	180	225	450	65	15	125	95	-	320	250	78	12	80	R1/4"	R1/4"	54 57 64 67	
	360/11	1	7.5 11 15 18.5 22	D132M D160M D160M D160L D180M	2						218 256	232 260			716 862	50 65	100	330	145	40	248	220	449	12				90 115 125 145 210
80-200	470/22	3	5.5 18.5	D132S D160L D180M D200L	4	100	80	125	163	188	218	232	250	755 945 256	50	100	330	145	40	248	220	488	12	100	R3/8"	R3/8"	125 210 245 315	
	470/22	3	22 30	D160L D180M D200L	2						947 276	967 292	1070	1000	400	65	300	50	50	308	250	450						
80-250	470/22F	2	5.5 7.5 11	D132S D132M D160M	4	100	80	125	182	208	218	232	280	755 793 901	50	100	330	145	40	248	220	488	12	100	R3/8"	R3/8"	135 145 165	
		30 45 55 75	D200L D225SM D250SM		2						945 1264 1300														180 200			
80-315	470/22F	2	7.5 11 15 18.5	D132M D160M D160L	4	100	80	125	210	231	256	260	315	887 931 953	80	80	400	300	50	308	250	392	16	100	R3/8"	R3/8"	180 190 270	
80-400	530/1F	4	11 15 18.5 22 30	D160M D160L D180M D180L D200L	4	125	100	140	256	272	256	360		919 985 1023 1110	78	200	520	210	50	490	420	373	16					185 205 225 257 325
100-200	470/22F	2	5.5 18.5	D132S D132M D160L	4	125	100	125	165	203	218	201	280	755 793 945	50	100	330	145	50	248	220	488	12	120	R3/8"	R3/8"	140 150 220 250 320 340 475	
		22 30 37 45	D160L D180M D200L	2						967 292	1070	1120	1000	80	80	450	350	50	349	279	450							
100/250	530/1F	2	11 18.5	D132M D160L D200L D225SM D250SM	4	125	100	140	189	224	218 256	232 260	280	808 946 366 349	50	100	330	145	50	248	220	503	12	120	R3/8"	R3/8"	145 175 475 640 735	
		18.5 37 45 55 75	D200L D225SM D250SM		2					305 350	1135 1242 1300 1450	18	80	550	490	30	436	360	420	591	24							
100/315	530/1F	2	11 15 18.5	D160M D160L	4	125	100	140	220	250	256 276	260	315	946 968 1006	65	100	400	300	50	308	250	451	16	120	R3/8"	R3/8"	205 280 295	
100-400	530/1F	4	18.5 22 30 37	D160L D180M D200L	4	125	100	140	256	272	276 366	360	355	1049 1136 1224	78	180 160	570	235	50	520	450	387	16	120	R3/8"	R3/8"	290 350 355 480	
125-250	530/1F	4	11 15 18.5	D160M D160L	4	150	125	140	212	255	256 276	260	355	916 960 982	65	100	400	300	50	386	320	421	16	120	R3/8"	R3/8"	190 205 280	
125-315	530/1F	4	15 18.5 22 30	D160M D160L D180M D200L	4	50	125	140	226	252	276 366	360	355	1011 1049 1136 1224	78	180 135	570	235	50	520	450	387	16	120	R3/8"	R3/8"	290 300 375 362	
150-250	530/1F	4	11 15 18.5 22 30 37	D160M D160L D180M D200L	4	200	150	160	231	283	256 276	360	375	1009 1069 1156	78	200 180	520	210	50	490	420	419	16	120	R3/8"	R3/8"	220 295 320 385	
150-315	530/1F	4	22 30 37 45 55	D180M D200L D225SM D250SM	4	200	150	160	239	271	276 292	360	400	1069 1156 1244	78	180 135	570	235	50	520	450	407	16	120	R3/8"	R3/8"	320 373 375 592	
150-400	530/2F	4	37 45 55 75 90	D225M D250M	4	200	150	160	277	305	366 488	360	1244 1435	78	135 80	470	185	50	690	620	604	24	120			395 600 694 865 1200		
200-250	530/1F	4	22 30 37	D180L D200L D225M	4	200	200	180	262	330	276 292	360	425	1089 1176 1264	78	180 135	570	235	50	520	450	427	16	120	R3/8"	R3/8"	340 392 384	
	530/2F	4																										

TOMBSTONE CURVES



Size*	Pg. no.	
	1450	2900
25-160	3	42
25-200	4	43
32-160	5	44
32-200	6	45
32-250	7	46
40-160	8	47
40-200	9	48
40-250	10	49
40-315	11	50
50-160	12	51
50-200	13	52
50-250	14	53
50-315	15	54
65-160	16	55
65-200	17	56
65-250	18	57
65-315	19	58
80-160	20	59
80-200	21	60
80-250	22	61
80-315	23	62
80-400	24	
100-200	25	63
100-250	26	64
100-315	27	65
100-400	28	
125-250	29	
125-315	30	
125-400	31	
150-250	32	
150-315	33	
150-400	34	
150-500	35	
200-250	36	
200-315	37	
200-400	38	
200-500	39	
250-315	40	
250-400	41	



* FOR INDIVIDUAL PUMP PERFORMANCE CURVES, REFER TO OUR CLT & CLB CURVES BOOK.

Notes

ANSI, CLT & CLB

CHEMICAL PROCESS PUMPS

Notes

RAW

Rapid Allweiler Way

COMMUNICATION

- Define Requirement
- Provide Solution
- Order Confirmation/Weekly Feedback
- Utilize MRP and KANBAN processes to ensure alignment between all departments

QUALITY

- ISO 9001:2008
- Continuous QC Inspection in Manufacturing Process
- External suppliers vetted and quality checked

COMMITMENT

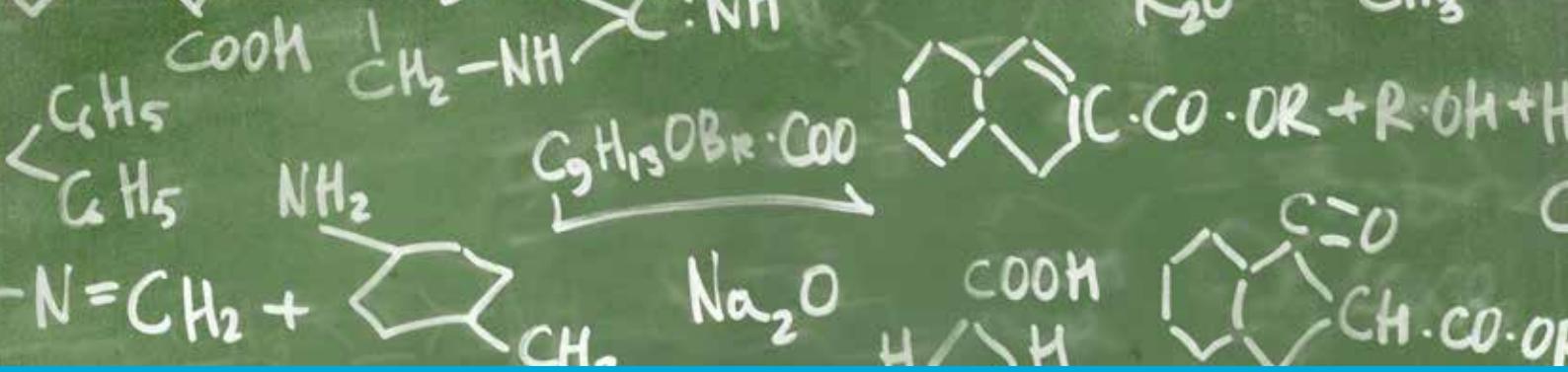
Our Core Value System:

-  Can Do
-  Growth Orientated
-  Passion
-  Respect
-  Ethical
-  Trust

SATISFACTION

- Delivered as Promised, Quality and on Time
- Engage in ongoing feedback
 - Once Product is Delivered
 - When Product is Commissioned

" Delivered as Promised"



BASIC FORMULAS

H = Head(m)

Q = Flow(m³/h)

Eff = Pump Eff%

Density = SG

Capacity

$$\text{l/sec} \times 3.6 = \text{m}^3/\text{h}$$

$$\text{m}^3/\text{h} \div 3.6 = \text{l/sec}$$

$$\text{Imp gpm} \times 0.2271 = \text{m}^3/\text{h} \quad \text{m}^3/\text{h} \times 4.403 = \text{Imp gpm}$$

$$\text{US gpm} \div 0.246 = \text{l/min} \quad \text{l/min} \times 0.246 = \text{US gpm}$$

$$10000 \text{ kg/hr} =$$

$$\frac{10\text{m}^3\text{h}}{\text{Density(SG)}}$$

Head/Pressure

$$\text{Ft} \div 3.28 = \text{m}$$

$$\text{m} \times 3.28048 = \text{Ft}$$

$$\text{Bar} \times 100 = \text{kpa}$$

$$\text{m} \times 9.805 = \text{kpa}$$

$$\text{kpa} \times 0.102 = \text{m}$$

$$\text{m} \times 0.098 = \text{Bar}$$

$$\text{Bar} \times 10.19 = \text{m}$$

$$\text{m} \times 1.45 = \text{psi}$$

$$\text{psi} \times 6.895 = \text{kpa}$$

Power

$$\text{hp} \times 0.746 = \text{kw}$$

$$\text{kw} \times 1.340483 = \text{hp}$$

$$\text{kw abs} =$$

$$\frac{\text{Q} \times \text{H} \times \text{SG}}{367 \times \text{Eff}(\%)}$$

$$\text{kw} =$$

$$\frac{\text{Amps} \times \text{Volts} \times \text{Power Factor} \times 1.732}{1000}$$

$$\text{RPM} =$$

$$\frac{\text{Hz} \times 120}{\text{No of Poles}}$$

$$\text{Hz} =$$

$$\frac{\text{RPM} \times \text{No Of Poles}}{120}$$

$$\text{Velocity m/sec} =$$

$$\frac{\text{Q} \times 353.63}{(\text{Pipe Dia})^2}$$

Efficiency

$$\text{EFF}(\%) =$$

$$\frac{\text{Q} \times \text{H} \times \text{SG}}{367 \times \text{kw(abs)}}$$

Temperature

$$\text{Deg.C} = (\text{deg.F}-32) \times 0.556$$

$$\text{Deg.F} = (1.8 \times \text{deg.C}) + 32$$

Peripheral Speed

$$\text{Peripheral Speed(Impeller)} = \frac{\text{imp.dia.(mm)} \times \pi \times \text{N(Rpm)}}{60 \times 1000}$$

Viscosity

vis Viscous Liquid

w Water

Given: Qvis in m³/h kinematic viscosity v in mm²/s

$$\text{Hvis in m} \quad \text{pvvis in kg/dm}^3$$

$$\text{Qw} =$$

$$\frac{\text{Qvis}}{\text{CQ}}$$

$$\text{Hw} =$$

$$\frac{\text{Hvis}}{\text{CH}}$$

$$\text{Qw} =$$

$$\text{C\%} \times \% \text{w}$$

$$\text{Pvis} =$$

$$\frac{\text{Qvis} \times \text{Hvis} \times \text{Pvis}}{367 \times \text{Eff}(\%) \text{ vis}}$$

Centrifugal and Axial Flow Pump Affinity Laws:

Speed changes & impeller diameter remains the same:

$$\text{Q1/Q2} = \text{N1/N2}$$

$$\text{H1/H2} = (\text{N1}/\text{N2})^2$$

$$\text{P1/P2} = (\text{N1}/\text{N2})^3$$

Impeller diameter changes and speed remains the same:

$$\text{Q1/Q2} = \text{D1/D2}$$

$$\text{H1/H2} = (\text{D1}/\text{D2})^2$$

$$\text{P1/P2} = (\text{D1}/\text{D2})^3$$



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