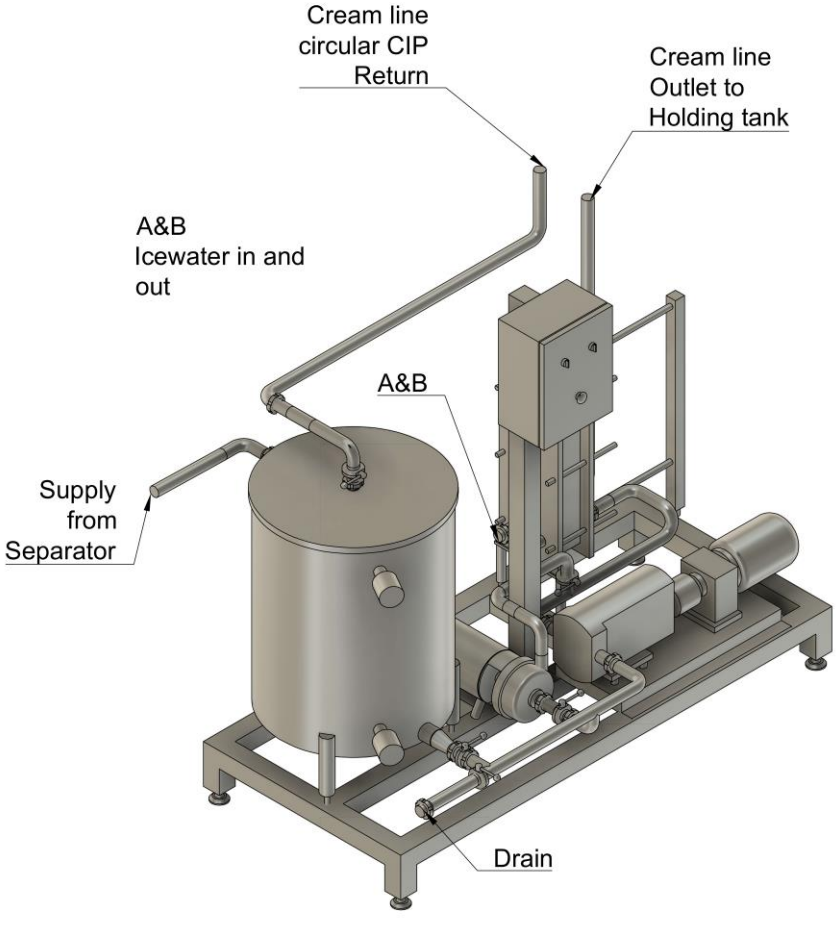
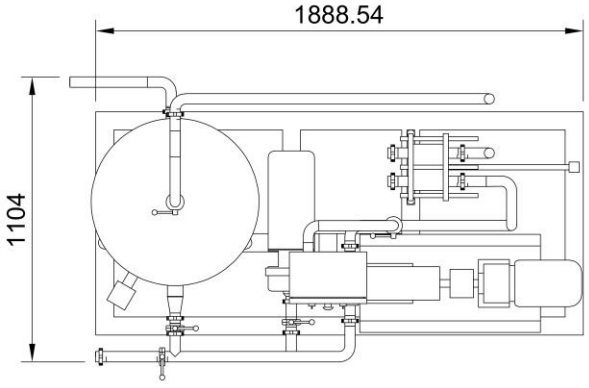
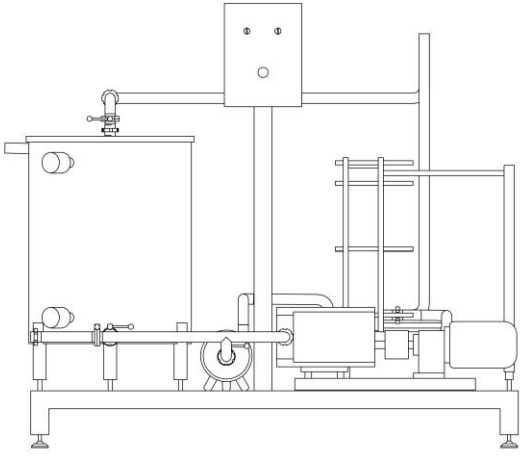
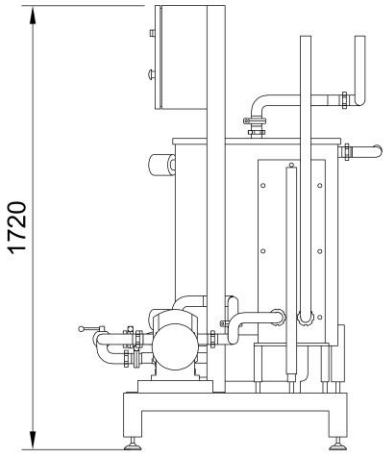




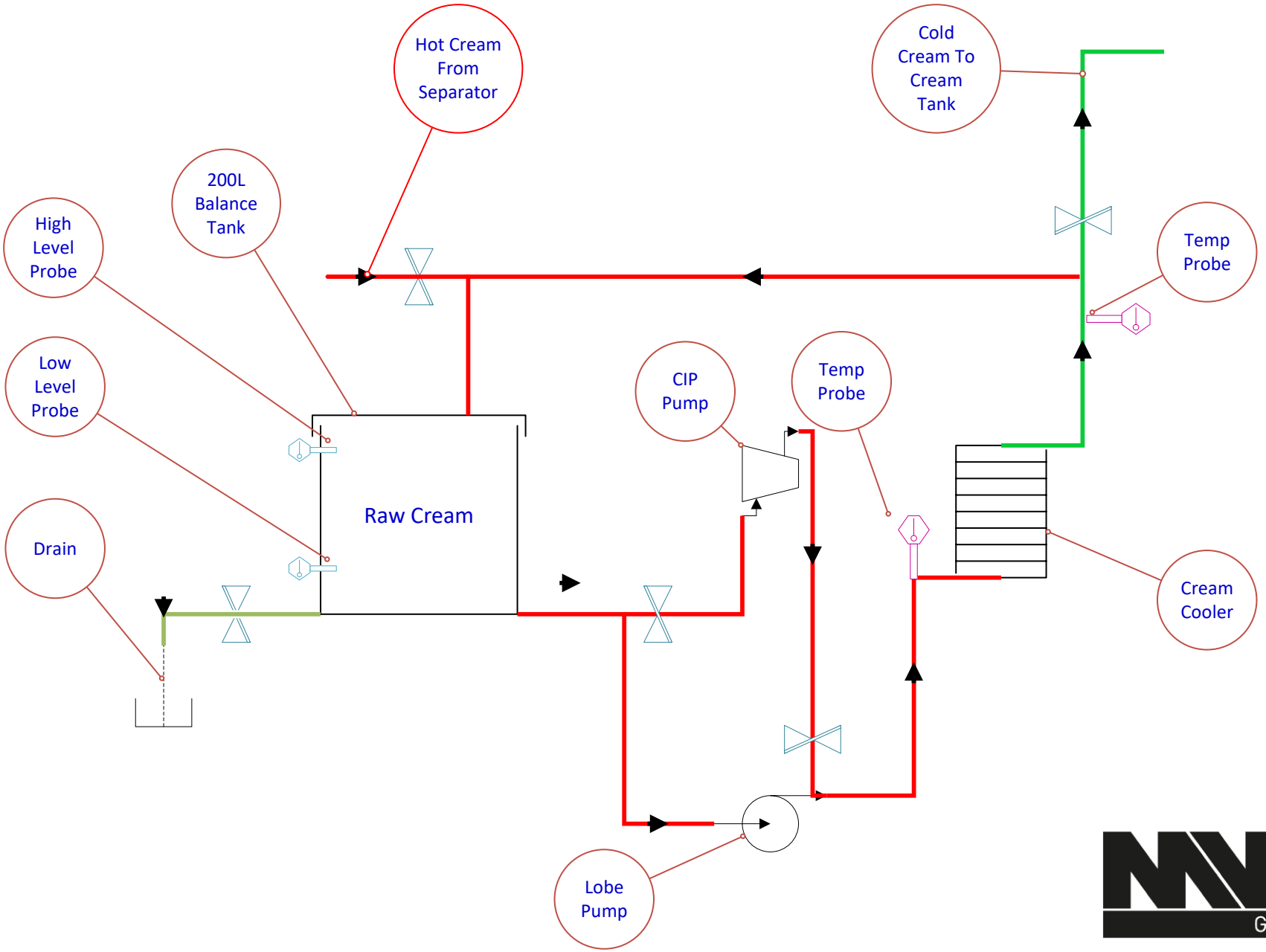




Dept.	Technical reference	Created by	Approved by
Engineering	Cream Cooler	Tertius Syfert 03/03/2024	
		Document type: Main Measurements	Document status: Final Design
		Title: Cream cooling Skid with CIP pump 500 Liters / Hour	DWG No.: Com Skid v11
			Rev. / Date of issue: 04/03/2024 / Sheet: 1/1

MACHINERY WORLD

Raw Cream Cooler Skid



1) Alfa Laval Cream Cooler Plate Heat Exchanger

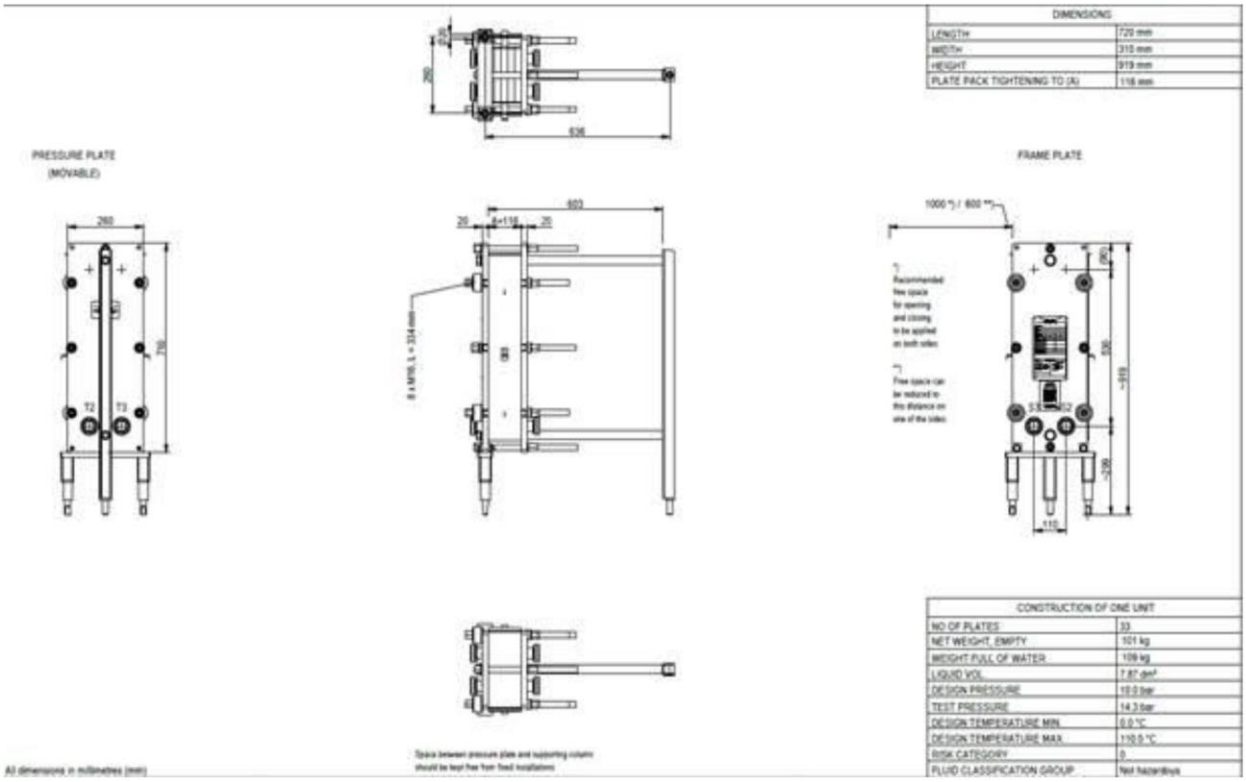
Section	Flow rate (kg/h)	Fluid	Temp. (°C)	Pressure drop (kPa)	Channel arrangement	Margin (%)
I	500	Cream 40 %	4.0 → 50.0	18.3	4*4 ML	7.0
	3000	Water	2.0 → 8.1	51.5	4*4 MH	

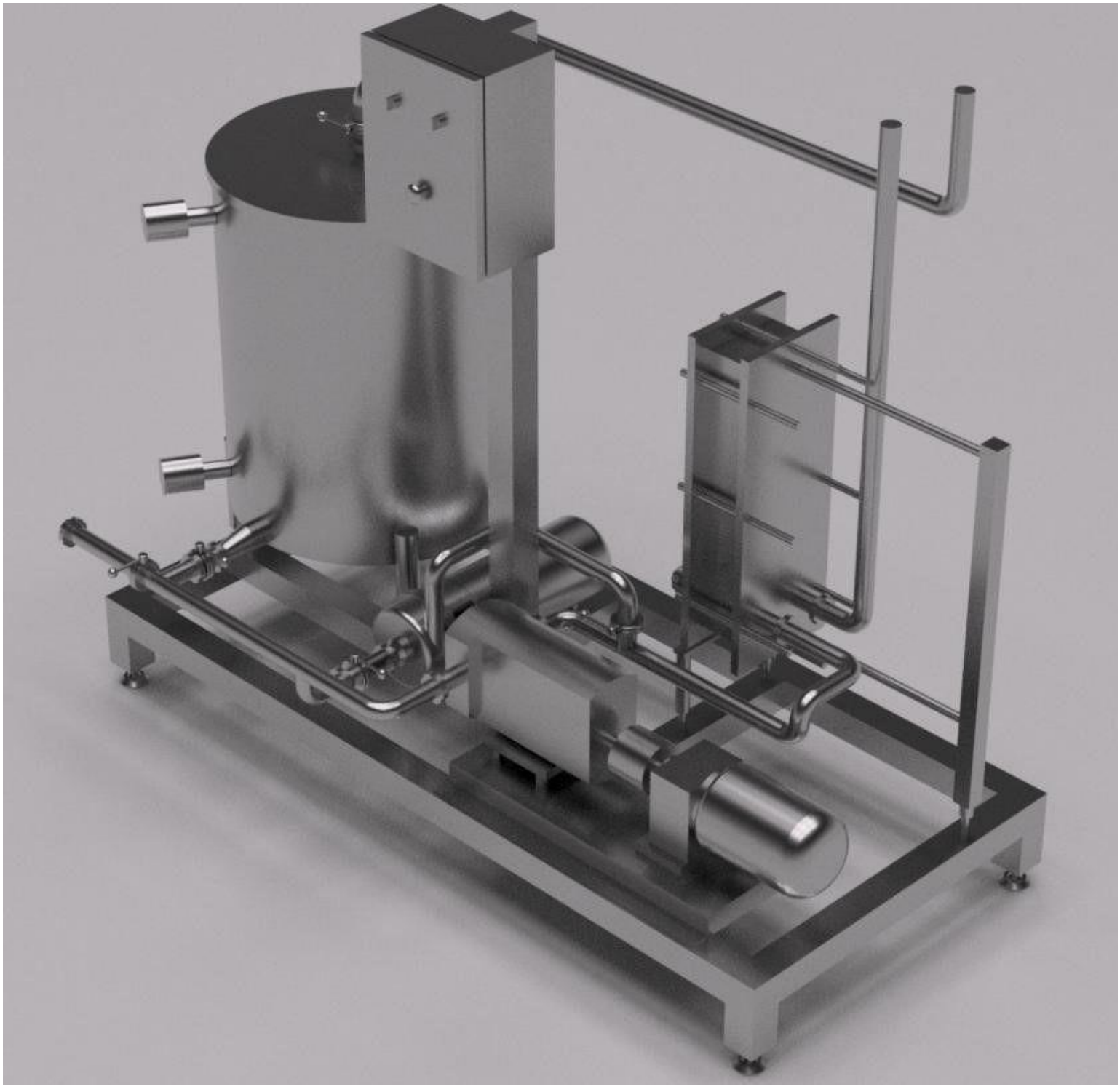
Plates and gaskets

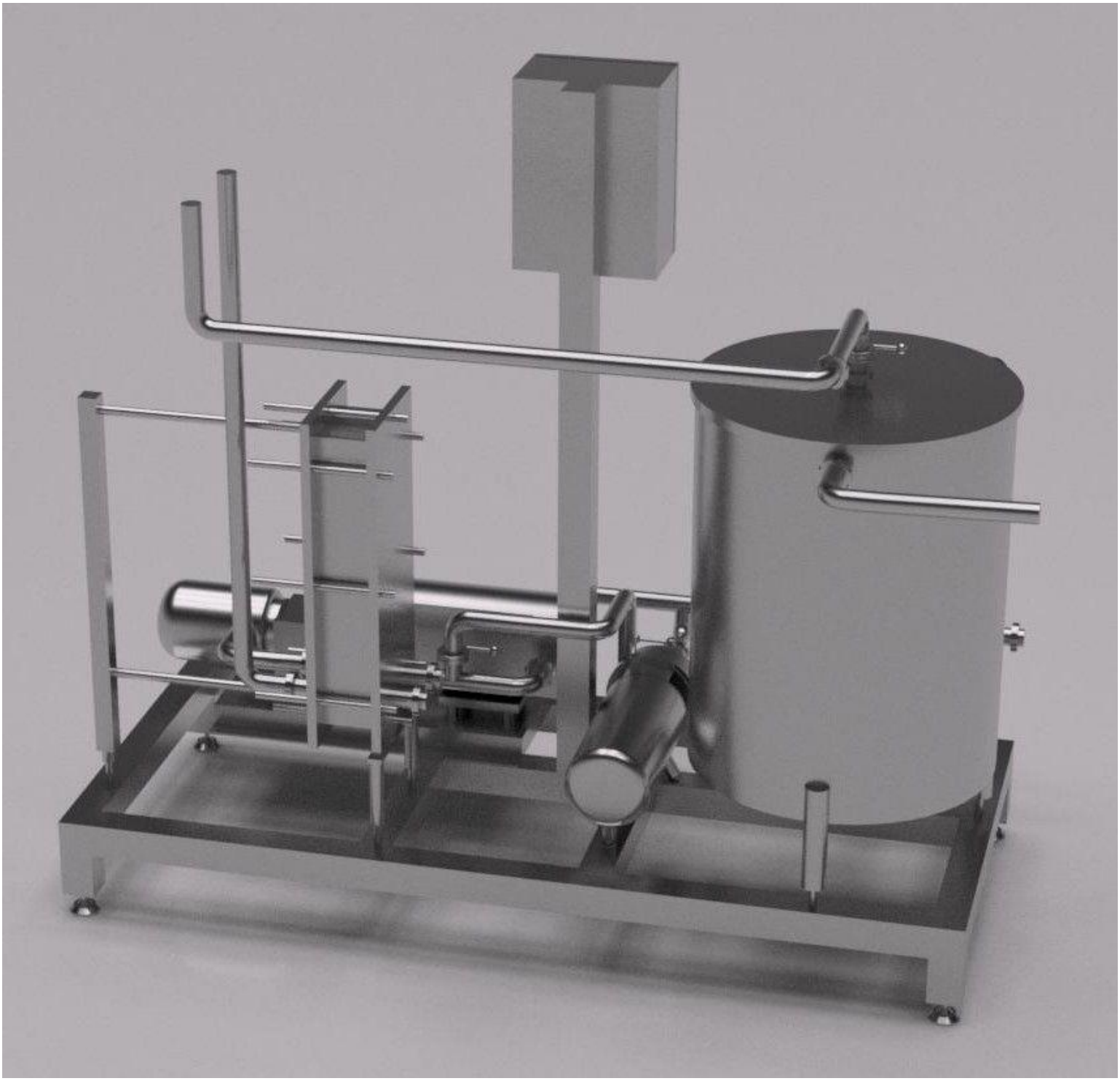
Section	Number of plates	Plate material/thickness	Gasket material/attachment:
All	33	ALLOY 316/0.5	NBRP/ClipGrip™

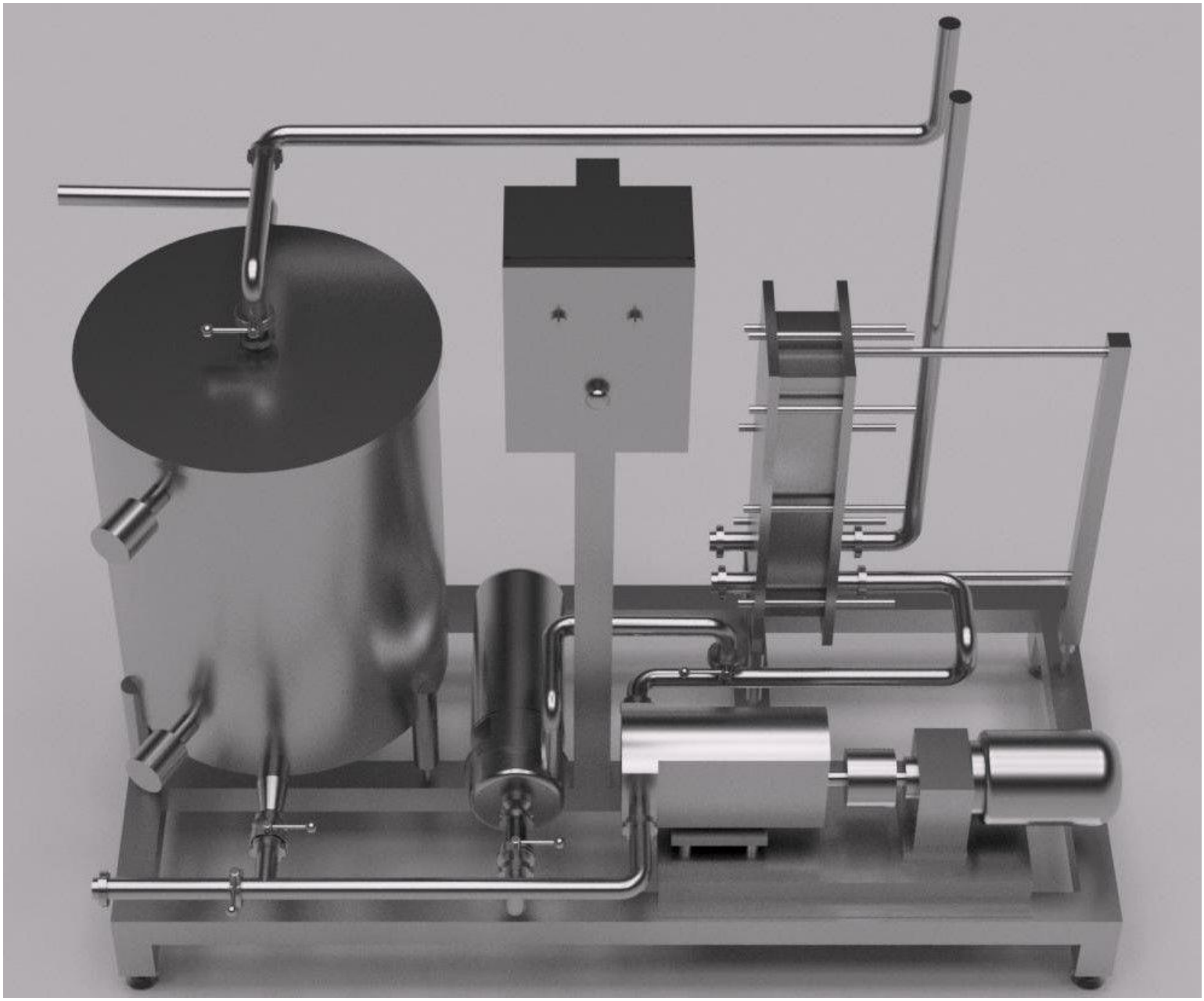
Extension capacity: 34% (11 plates)
The recommended minimum CIP flow rate is 1,840 kg/h.
Allow for approximately 100 kPa pressure drop during CIP.

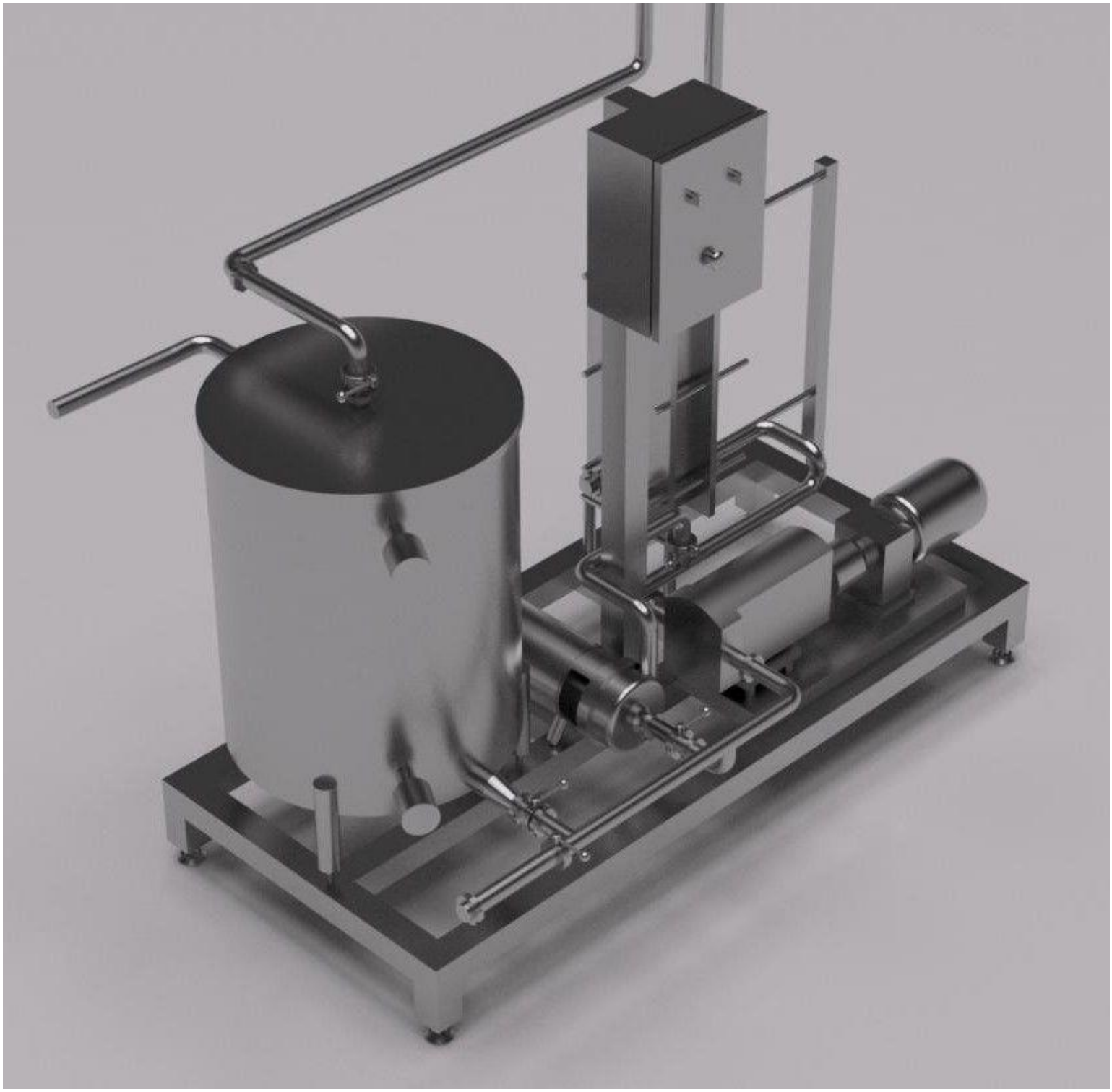
Pressure vessel approval		
Pressure vessel approval:		PED Article 4.3
Design pressure (MAWP):	bar	10.00
	bar	14.30
Design temperature max.:	°C	110.0
Design temperature min:	°C	0.0
Mechanical specification		
Carrying bar:		Stainless steel, 600 mm
Tightening bolt:		334 / 334 mm
Feet:		Low adjustable
Frame:		Solid
Approx. outer dimensions (L x W x H):	mm	750 x 320 x 940
Approx. weight, empty / operating:	kg	100 / 96
Type of package:		Ocean
Approx. packed weight:	kg	163





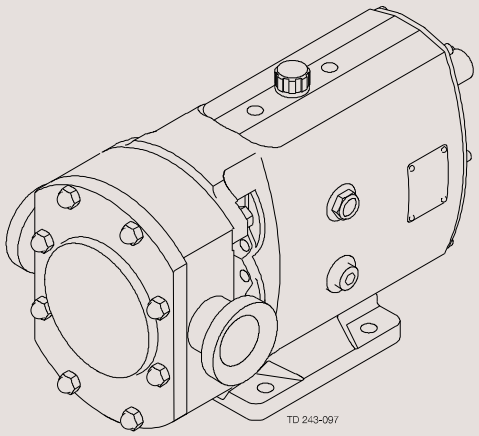


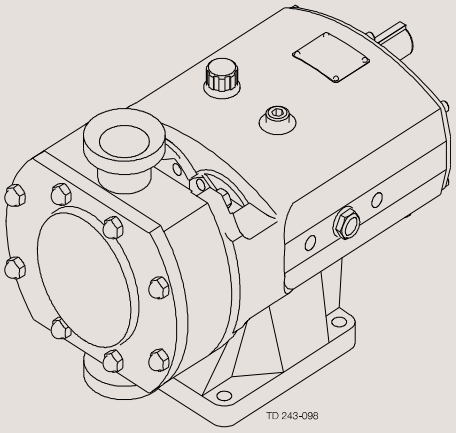




Instruction Manual

Rotary Lobe Pumps - SRU Range





ESE00693-EN15 2022-10

Original manual

6 Technical data

6.1 Technical data

6.1.1 Approximate oil capacities

Pump model	Port orientation		Port orientation	
	Vertical litres	Horizontal litres	Vertical US pints	Horizontal US pints
SRU1	0.3	0.4	0.6	0.8
SRU2	0.6	0.7	1.2	1.4
SRU3	1.0	1.5	2.2	3.1
SRU4	1.5	2.0	3.2	4.2
SRU5	3.0	4.0	6.3	8.4
SRU6	4.5	7.0	9.5	14.8

6.1.2 Weights

Pump model	Bare Shaft Pump kg (lb) Port Orientation		Typical pump with drive unit kg (lb) Port Orientation	
	Horizontal	Vertical	Horizontal	Vertical
SRU1/005	15 (33)	16 (35)	45 (99)	46 (101)
SRU1/008	17 (37)	18 (40)	55 (121)	56 (123)
SRU2/013	28 (62)	30 (66)	75 (165)	77 (170)
SRU2/018	29 (64)	31 (68)	80 (176)	82 (181)
SRU3/027	53 (117)	56 (123)	145 (320)	148 (326)
SRU3/038	56 (123)	59 (130)	150 (331)	153 (337)
SRU4/055	105 (231)	111 (245)	260 (573)	266 (586)
SRU4/079	110 (243)	116 (256)	265 (584)	271 (597)
SRU5/116	148 (326)	185 (408)	396 (873)	433 (955)
SRU5/168	156 (344)	193 (425)	411 (906)	448 (988)
SRU6/260	228 (503)	260 (573)	493 (1087)	525 (1157)
SRU6/353	233 (514)	265 (584)	513 (1131)	545 (1202)

The above weights are for guidance purposes only and will vary dependent upon specification of pump, baseplate and drive unit.

6.1.3 Tool requirements

Description	Tool required	Pump Model					
		SRU1	SRU2	SRU3	SRU4	SRU5	SRU6
Rotorcase cover nut (13)	Socket Size (mm)	13	17	17	17	17	19
	Torque Setting (Nm)	20	39	39	39	39	105
	Torque Setting (lbft)	14.8	28.8	28.8	28.8	28.8	77.4
Rotor retention nut (22)	Socket Size (mm)	17	24	24	36	36	36
	Torque Setting (Nm)	14	77	120	161	161	161
	Torque Setting (lbft)	10.3	56.8	88.5	118.8	118.8	118.8
Rotor TLA (19)	Key Size (mm)	-	-	-	-	-	5
	Torque Setting (Nm)	-	-	-	-	-	8
	Torque Setting (lbft)	-	-	-	-	-	5.9
Rotorcase retaining nut (4)	Spanner Size (mm)	13	17	17	19	19	24
	Torque Setting (Nm)	20	40	40	64	64	175
	Torque Setting (lbft)	14.8	29.5	29.5	47.2	47.2	129.1
Seal retainer screw (15)	Key Size (mm)	5	5	5	6	6	6
	Torque Setting (Nm)	10	10	10	25	25	25
	Torque Setting (lbft)	7.4	7.4	7.4	18.4	18.4	18.4
Gearcase cover screw (6)	Key Size (mm)	5	5	5	6	6	6
	Torque Setting (Nm)	10	10	10	25	25	25
	Torque Setting (lbft)	7.4	7.4	7.4	18.4	18.4	18.4
TLA/Clamp plate screw (40)	Key Size (mm)	5	5	5	5	6	6
	Torque Setting (Nm)	12	17	12	14	35	35
	Torque Setting (lbft)	8.9	12.5	8.9	10.3	25.8	25.8
Drain plug (45)	Key Size (in)	¼	¼	¼	¼	½	½
Foot bolt (58)	Key Size (mm)	5	6	6	8	10	10
	Torque Setting (Nm)	15	30	30	60	50	50
	Torque Setting (lbft)	11.1	22.1	22.1	44.3	37.0	37.0
Grub screw	Key size (mm)	2.5	2.5	2.5	2.5	4.0	4.0
Shaft seal, Single	Torque Setting (Nm)	3	3	3	3	8	13.5
	Torque Setting (lbft)	2.2	2.2	2.2	2.2	6	10
Shaft seal, Double	Torque Setting (Nm)	3	3	3	3	13.5	13.5
	Torque Setting (lbft)	2.2	2.2	2.2	2.2	10	10
Sight glass (46)	Socket Size (mm)	22	22	22	22	22	22
	Torque Setting (Nm)	2	2	2	2	2	2
	Torque Setting (lbft)	0.9	0.9	0.9	0.9	0.9	0.9

6.1.4 Pump Data Table

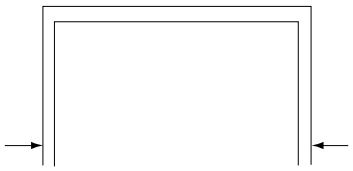
Model	Displacement			Suction & Discharge				Differential Pressure (Ex)		Max. Speed rev/min (Ex)	Max. Capacity at 1000 rpm m3/hr (Ex)
				Sanitary		Enlarged					
	litres/rev	Imp gal/ 100 rev	US gal/ 100 rev	mm	inch.	mm	inch.	bar	psi		
SRU1/005/LD or H	0.053	1.17	1.40	25	1.0	-	-	8	115	1000	3.18
SRU1/008/LD or H	0.085	1.87	2.25	25	1.0	40	1.5	5	75	1000	5.10
SRU2/013/LS or HS	0.128	2.82	3.38	25	1.0	40	1.5	10	145	1000	7.68
SRU2/013/LD or HD	0.128	2.82	3.38	25	1.0	40	1.5	15	215	1000	7.68
SRU2/018/LS or HS	0.181	3.98	4.78	40	1.5	50	2.0	7	100	1000	10.86
SRU2/018/LD or HD	0.181	3.98	4.78	40	1.5	50	2.0	10	145	1000	10.86
SRU3/027/LS or HS	0.266	5.85	7.03	40	1.5	50	2.0	10	145	1000	15.96
SRU3/027/LD or HD	0.266	5.85	7.03	40	1.5	50	2.0	15	215	1000	15.96
SRU3/038/LS or HS	0.384	8.45	10.14	50	2.0	65	2.5	7	100	1000	23.04
SRU3/038/LD or HD	0.384	8.45	10.14	50	2.0	65	2.5	10	145	1000	23.04
SRU4/055/LS or HS	0.554	12.19	14.64	50	2.0	65	2.5	10	145	1000	33.24
SRU4/055/LD or HD	0.554	12.19	14.64	50	2.0	65	2.5	20	290	1000	33.24
SRU4/079/LS or HS	0.790	17.38	20.87	65	2.5	80	3.0	7	100	1000	47.40
SRU4/079/LD or HD	0.790	17.38	20.87	65	2.5	80	3.0	15	215	1000	47.40
SRU5/116/LS or HS	1.160	25.52	30.64	65	2.5	80	3.0	10	145	600	41.76
SRU5/116/LD or HD	1.160	25.52	30.64	65	2.5	80	3.0	20	290	600	41.76
SRU5/168/LS or HS	1.680	36.95	44.38	80	3.0	100	4.0	7	100	600	60.48
SRU5/168/LD or HD	1.680	36.95	44.38	80	3.0	100	4.0	15	215	600	60.48
SRU6/260/LS or HS	2.600	57.19	68.68	100	4.0	100	4.0	10	145	500	78.00
SRU6/260/LD or HD	2.600	57.19	68.68	100	4.0	100	4.0	20	290	500	78.00
SRU6/353/LS or HS	3.530	77.65	93.25	100	4.0	150	6.0	7	10	500	105.90
SRU6/353/LD or HD	3.530	77.65	93.25	100	4.0	150	6.0	15	215	500	105.90

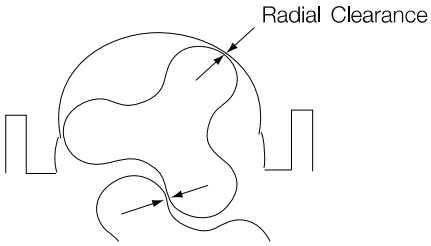
Please Note:
Maximum differential pressure capability of the pump does not apply to the pressure rating of the mechanical seals which is 20 bar, and the selected port connection as stated below:
SMS – 10 bar (all sizes)
RJT – 10 bar (all sizes)
DIN11851 – 40 bar (25-40mm), 25 bar (50-100mm), 16 bar (150mm)
IDF/ISS – 16 bar (25-50mm), 10 bar (65-150mm) providing provision for support ring is to be made.
Tri-clamp (BS4825) – Pressure rating is dictated by the clamp band used.
Refer to clamp band supplier.

For size 150mm on SRU6/0353 pumps, only DIN11851, SRJT or Tri-clamp connections are available.

Note:
(Ex)
ATEX applications: Differential pressure, Max. speed and Max. capacity are not applicable for ATEX applications.

6.2 Pumphead Clearance information





Front Clearance Rotor Length Back Clearance Mesh Clearance

Minimum mesh clearance at any mesh position. All dimensions in millimeters.

SRU1/005/LD (HD) TRILOBE and BILOBE ST.STL. ROTORS — 8 BAR

Temperature °C	Rotor Length	Front Clearance	Back Clearance	Rotor Diameter	Radial Clearance	Min. MESH* TRILOBE	Min. MESH* BILOBE 70°C
70°C	16.59 16.56	(min.) 0.12	0.15 0.10	64.66 64.62	(min.) 0.14	0.12	0.28
130°C	16.57 16.54	(min.) 0.14	0.15 0.10	64.64 64.60	(min.) 0.15	0.12	0.28
200°C	16.55 16.52	(min.) 0.16	0.15 0.10	64.62 64.58	(min.) 0.16	0.12	0.28

SRU1/008/LD (HD) TRILOBE and BILOBE ST.STL. ROTORS — 5 BAR

Temperature °C	Rotor Length	Front Clearance	Back Clearance	Rotor Diameter	Radial Clearance	Min. MESH* TRILOBE	Min. MESH* BILOBE 70°C
70°C	26.57 26.54	(min.) 0.14	0.15 0.10	64.62 64.58	(min.) 0.16	0.12	0.28
130°C	26.55 26.52	(min.) 0.16	0.15 0.10	64.60 64.56	(min.) 0.17	0.12	0.28
200°C	26.53 26.50	(min.) 0.18	0.15 0.10	64.58 64.54	(min.) 0.18	0.12	0.28

SRU2/013/LS (HS) TRILOBE and BILOBE ST.STL. ROTORS — 10 BAR

Temperature °C	Rotor Length	Front Clearance	Back Clearance	Rotor Diameter	Radial Clearance	Min. MESH* TRILOBE	Min. MESH* BILOBE 70°C
70°C	22.63 22.60	(min.) 0.14	0.12 0.07	86.28 86.24	(min.) 0.16	0.08	0.24
130°C	22.52 22.49	(min.) 0.22	0.15 0.10	86.22 86.18	(min.) 0.19	0.08	0.24
200°C	22.35 22.32	(min.) 0.32	0.22 0.17	86.18 86.14	(min.) 0.21	0.08	0.24

SRU2/013/LD (HD) TRILOBE and BILOBE ST.STL. ROTORS — 15 BAR

Temperature °C	Rotor Length	Front Clearance	Back Clearance	Rotor Diameter	Radial Clearance	Min. MESH* TRILOBE	Min. MESH* BILOBE 70°C
70°C	22.48 22.45	(min.) 0.23	0.18 0.13	86.20 86.16	(min.) 0.20	0.20	0.24
130°C	22.42 22.39	(min.) 0.25	0.21 0.16	86.14 86.19	(min.) 0.23	0.20	0.24
200°C	22.30 22.27	(min.) 0.33	0.28 0.23	86.10 86.06	(min.) 0.25	0.20	0.24

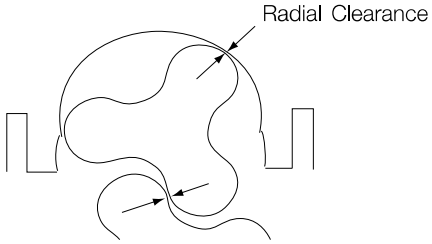
SRU2/018/LS (HS) TRILOBE and BILOBE ST.STL. ROTORS — 7 BAR

Temperature °C	Rotor Length	Front Clearance	Back Clearance	Rotor Diameter	Radial Clearance	Min. MESH* TRILOBE	Min. MESH* BILOBE 70°C
70°C	32.02 31.99	(min.) 0.15	0.12 0.07	86.26 86.22	(min.) 0.17	0.08	0.34
130°C	31.90 31.87	(min.) 0.24	0.15 0.10	86.18 86.14	(min.) 0.21	0.08	0.34
200°C	31.72 31.69	(min.) 0.35	0.22 0.17	86.12 86.08	(min.) 0.24	0.08	0.34

SRU2/018/LD (HD) TRILOBE and BILOBE ST.STL. ROTORS — 10 BAR

Temperature °C	Rotor Length	Front Clearance	Back Clearance	Rotor Diameter	Radial Clearance	Min. MESH* TRILOBE	Min. MESH* BILOBE 70°C
70°C	31.96 31.93	(min.) 0.18	0.15 0.10	86.20 86.16	(min.) 0.20	0.11	0.34
130°C	31.91 31.88	(min.) 0.20	0.18 0.13	86.12 86.08	(min.) 0.24	0.11	0.34
200°C	31.82 31.79	(min.) 0.22	0.25 0.20	86.06 86.02	(min.) 0.27	0.11	0.34

Front Clearance Rotor Length Back Clearance



Minimum mesh clearance at any mesh position. All dimensions in millimeters

SRU3/027/LS (HS) TRILOBE and BILOBE ST.STL. ROTORS — 10 BAR

Temperature °C	Rotor Length	Front Clearance	Back Clearance	Rotor Diameter	Radial Clearance	Min. MESH* TRILOBE	BILOBE 70°C
70°C	30.13 30.10	(min.) 0.16	0.15 0.10	107.88 107.83	(min.) 0.20	0.13	0.32
130°C	29.99 29.96	(min.) 0.27	0.18 0.13	107.80 107.75	(min.) 0.24	0.13	0.32
200°C	29.80 29.77	(min.) 0.39	0.25 0.20	107.72 107.67	(min.) 0.28	0.13	0.32

SRU3/027/LD (HD) TRILOBE and BILOBE ST.STL. ROTORS — 15 BAR

Temperature °C	Rotor Length	Front Clearance	Back Clearance	Rotor Diameter	Radial Clearance	Min. MESH* TRILOBE	BILOBE 70°C
70°C	30.08 30.05	(min.) 0.19	0.17 0.12	107.60 107.55	(min.) 0.34	0.17	0.40
130°C	30.02 29.99	(min.) 0.22	0.20 0.15	107.56 107.51	(min.) 0.36	0.17	0.40
200°C	29.92 29.89	(min.) 0.25	0.27 0.22	107.52 107.47	(min.) 0.38	0.17	0.40

SRU3/038/LS (HS) TRILOBE and BILOBE ST.STL. ROTORS — 7 BAR

Temperature °C	Rotor Length	Front Clearance	Back Clearance	Rotor Diameter	Radial Clearance	Min. MESH* TRILOBE	BILOBE 70°C
70°C	43.14 43.11	(min.) 0.17	0.15 0.10	107.76 107.71	(min.) 0.26	0.13	0.40
130°C	43.00 42.97	(min.) 0.28	0.18 0.13	107.64 107.59	(min.) 0.32	0.13	0.40
200°C	42.79 42.76	(min.) 0.42	0.25 0.20	107.52 107.47	(min.) 0.38	0.13	0.40

SRU3/038/LD (HD) TRILOBE and BILOBE ST.STL. ROTORS — 10 BAR

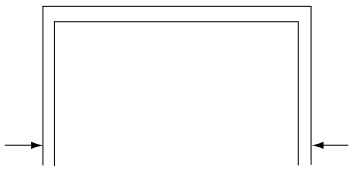
Temperature °C	Rotor Length	Front Clearance	Back Clearance	Rotor Diameter	Radial Clearance	Min. MESH* TRILOBE	BILOBE 70°C
70°C	42.99 42.96	(min.) 0.25	0.26 0.21	107.48 107.43	(min.) 0.40	0.17	0.40
130°C	43.02 42.99	(min.) 0.24	0.20 0.15	107.50 107.45	(min.) 0.39	0.17	0.40
200°C	42.92 42.89	(min.) 0.27	0.27 0.22	107.46 107.41	(min.) 0.41	0.17	0.40

SRU4/055/LS (HS) TRILOBE and BILOBE ST.STL. ROTORS — 10 BAR

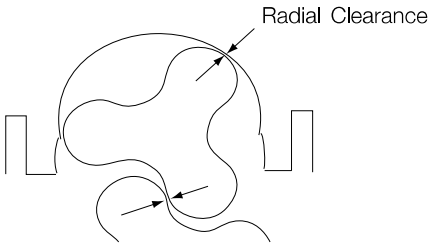
Temperature °C	Rotor Length	Front Clearance	Back Clearance	Rotor Diameter	Radial Clearance	Min. MESH* TRILOBE	BILOBE 70°C
70°C	38.20 38.17	(min.) 0.17	0.15 0.10	138.20 138.15	(min.) 0.18	0.15	0.32
130°C	38.07 38.04	(min.) 0.20	0.20 0.15	138.10 138.05	(min.) 0.23	0.15	0.32
200°C	38.03 38.00	(min.) 0.25	0.24 0.19	138.00 137.95	(min.) 0.28	0.15	0.32

SRU4/055/LD (HD) TRILOBE and BILOBE ST.STL. ROTORS — 20 BAR

Temperature °C	Rotor Length	Front Clearance	Back Clearance	Rotor Diameter	Radial Clearance	Min. MESH* TRILOBE	BILOBE 70°C
70°C	38.11 38.08	(min.) 0.21	0.20 0.15	137.90 137.85	(min.) 0.33	0.20	0.32
130°C	38.07 38.04	(min.) 0.25	0.20 0.15	137.80 137.75	(min.) 0.38	0.20	0.32
200°C	38.03 38.00	(min.) 0.29	0.20 0.15	137.70 137.65	(min.) 0.43	0.20	0.32



Front Clearance Rotor Length Back Clearance



Minimum mesh clearance at any mesh position. All dimensions in millimeters

SRU4/079/LS (HS) TRILOBE and BILOBE ST.STL. ROTORS — 7 BAR

Temperature °C	Rotor Length	Front Clearance	Back Clearance	Rotor Diameter	Radial Clearance	Min. MESH* TRILOBE	BILOBE 70°C
70°C	54.99 54.96	(min.) 0.20	0.17 0.12	137.96 137.91	(min.) 0.30	0.15	0.32
130°C	54.88 54.85	(min.) 0.25	0.22 0.17	137.82 137.77	(min.) 0.37	0.15	0.32
200°C	54.75 54.72	(min.) 0.30	0.27 0.22	137.66 137.61	(min.) 0.45	0.15	0.32

SRU4/079/LD (HD) TRILOBE and BILOBE ST.STL. ROTORS — 15 BAR

Temperature °C	Rotor Length	Front Clearance	Back Clearance	Rotor Diameter	Radial Clearance	Min. MESH* TRILOBE	BILOBE 70°C
70°C	54.81 54.78	(min.) 0.32	0.23 0.18	137.64 137.59	(min.) 0.46	0.20	0.32
130°C	54.77 54.74	(min.) 0.36	0.23 0.18	137.50 137.45	(min.) 0.53	0.20	0.32
200°C	54.73 54.70	(min.) 0.40	0.23 0.18	137.34 137.29	(min.) 0.61	0.20	0.32

SRU5/116/LS (HS) TRILOBE and BILOBE ST.STL. ROTORS — 10 BAR

Temperature °C	Rotor Length	Front Clearance	Back Clearance	Rotor Diameter	Radial Clearance	Min. MESH* TRILOBE	BILOBE 70°C
70°C	51.07 51.04	(min.) 0.25	0.18 0.13	172.58 172.53	(min.) 0.28	0.20	0.31
130°C	50.99 50.96	(min.) 0.33	0.18 0.13	172.46 172.41	(min.) 0.34	0.20	0.31
200°C	50.94 50.91	(min.) 0.38	0.18 0.13	172.32 172.27	(min.) 0.41	0.20	0.31

SRU5/116/LD (HD) TRILOBE and BILOBE ST.STL. ROTORS — 20 BAR

Temperature °C	Rotor Length	Front Clearance	Back Clearance	Rotor Diameter	Radial Clearance	Min. MESH* TRILOBE	BILOBE 70°C
70°C	50.98 51.04	(min.) 0.29	0.20 0.15	172.22 172.17	(min.) 0.46	0.20	0.31
130°C	50.93 50.90	(min.) 0.37	0.20 0.15	172.10 172.05	(min.) 0.52	0.20	0.31
200°C	50.79 50.76	(min.) 0.51	0.20 0.15	171.96 171.91	(min.) 0.59	0.20	0.31

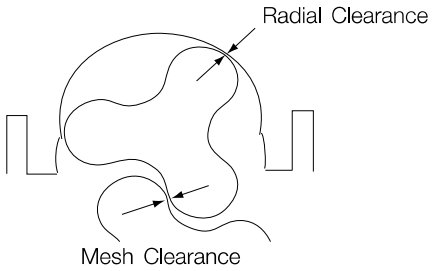
SRU5/168/LS (HS) TRILOBE and BILOBE ST.STL. ROTORS — 7 BAR

Temperature °C	Rotor Length	Front Clearance	Back Clearance	Rotor Diameter	Radial Clearance	Min. MESH* TRILOBE	BILOBE 70°C
70°C	74.06 74.03	(min.) 0.30	0.20 0.15	172.27 172.22	(min.) 0.44	0.20	0.31
130°C	73.93 73.90	(min.) 0.43	0.20 0.15	172.09 172.04	(min.) 0.53	0.20	0.31
200°C	73.79 73.76	(min.) 0.57	0.20 0.15	171.89 171.84	(min.) 0.63	0.20	0.31

SRU5/168/LD (HD) TRILOBE and BILOBE ST.STL. ROTORS — 20 BAR

Temperature °C	Rotor Length	Front Clearance	Back Clearance	Rotor Diameter	Radial Clearance	Min. MESH* TRILOBE	BILOBE 70°C
70°C	73.91 73.88	(min.) 0.38	0.27 0.22	171.97 171.92	(min.) 0.59	0.20	0.71
130°C	73.87 73.84	(min.) 0.42	0.27 0.22	171.79 171.74	(min.) 0.68	0.20	0.71
200°C	73.82 73.79	(min.) 0.47	0.27 0.22	171.59 171.54	(min.) 0.78	0.20	0.71

Front Clearance Rotor Length Back Clearance



Minimum mesh clearance at any mesh position. All dimensions in millimeters

SRU6/260/LS (HS) TRILOBE and BILOBE ST.STL. ROTORS — **10 BAR**

Temperature °C	Rotor Length	Front Clearance	Back Clearance	Rotor Diameter	Radial Clearance	Min. MESH* TRILOBE	BILOBE 70°C
70°C	84.34 84.31	(min.) 0.24	0.25 0.20	201.27 201.22	(min.) 0.40	0.30	0.39
130°C	84.19 84.16	(min.) 0.39	0.25 0.20	201.13 201.08	(min.) 0.47	0.30	0.39
200°C	84.01 83.98	(min.) 0.57	0.25 0.20	200.97 200.92	(min.) 0.55	0.30	0.39

SRU6/260/LD (HD) TRILOBE and BILOBE ST.STL. ROTORS — **20 BAR**

Temperature °C	Rotor Length	Front Clearance	Back Clearance	Rotor Diameter	Radial Clearance	Min. MESH* TRILOBE	BILOBE 70°C
70°C	84.08 84.05	(min.) 0.40	0.35 0.30	200.67 200.62	(min.) 0.70	0.35	0.80
130°C	84.03 84.00	(min.) 0.45	0.35 0.30	200.53 200.48	(min.) 0.77	0.35	0.80
200°C	83.97 83.94	(min.) 0.51	0.35 0.30	200.37 200.32	(min.) 0.85	0.35	0.80

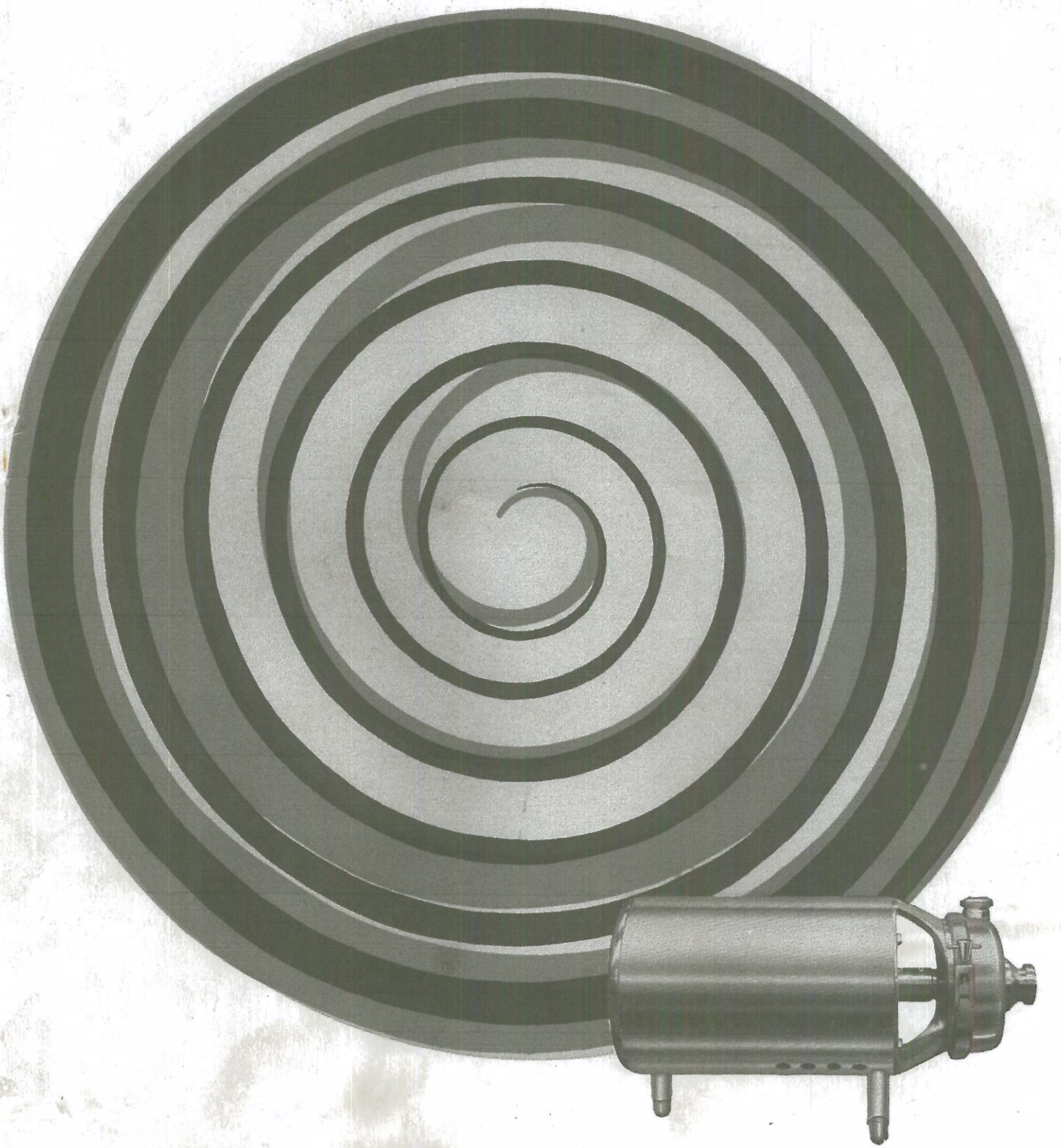
SRU6/353/LS (HS) TRILOBE and BILOBE ST.STL. ROTORS — **7 BAR**

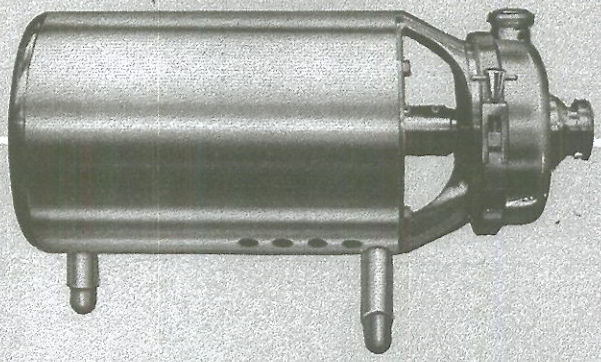
Temperature °C	Rotor Length	Front Clearance	Back Clearance	Rotor Diameter	Radial Clearance	Min. MESH* TRILOBE	BILOBE 70°C
70°C	113.68 113.65	(min.) 0.40	0.25 0.20	201.11 201.06	(min.) 0.48	0.35	0.40
130°C	113.50 113.47	(min.) 0.58	0.25 0.20	200.91 200.86	(min.) 0.58	0.35	0.40
200°C	113.30 113.27	(min.) 0.78	0.25 0.20	200.67 200.62	(min.) 0.70	0.35	0.40

SRU6/353/LD (HD) TRILOBE and BILOBE ST.STL. ROTORS — **15 BAR**

Temperature °C	Rotor Length	Front Clearance	Back Clearance	Rotor Diameter	Radial Clearance	Min. MESH* TRILOBE	BILOBE 70°C
70°C	113.23 113.20	(min.) 0.65	0.45 0.40	200.47 200.42	(min.) 0.80	0.40	0.55
130°C	113.17 113.14	(min.) 0.71	0.45 0.40	200.27 200.22	(min.) 0.90	0.40	0.55
200°C	113.11 113.08	(min.) 0.77	0.45 0.40	200.03 199.98	(min.) 1.02	0.40	0.55

Selecting APV Puma Pumps for hygienic and industrial duties





APV PUMA stainless steel centrifugal pumps

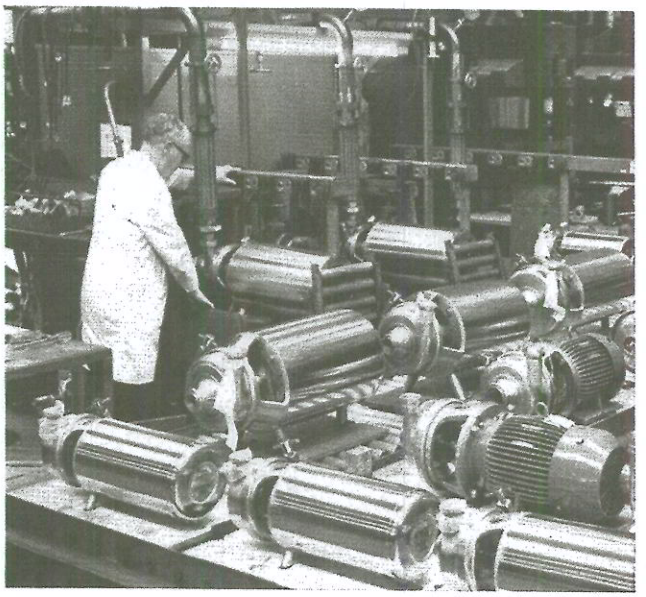
- **Efficient, robust and reliable**
- **Suitable for vacuum duties**
- **Hygienic or industrial**
- **Long seal life**
- **Variety of standard motors**
- **Easily cleaned and dismantled**
- **Choice of end connections**
- **Dry running capability**

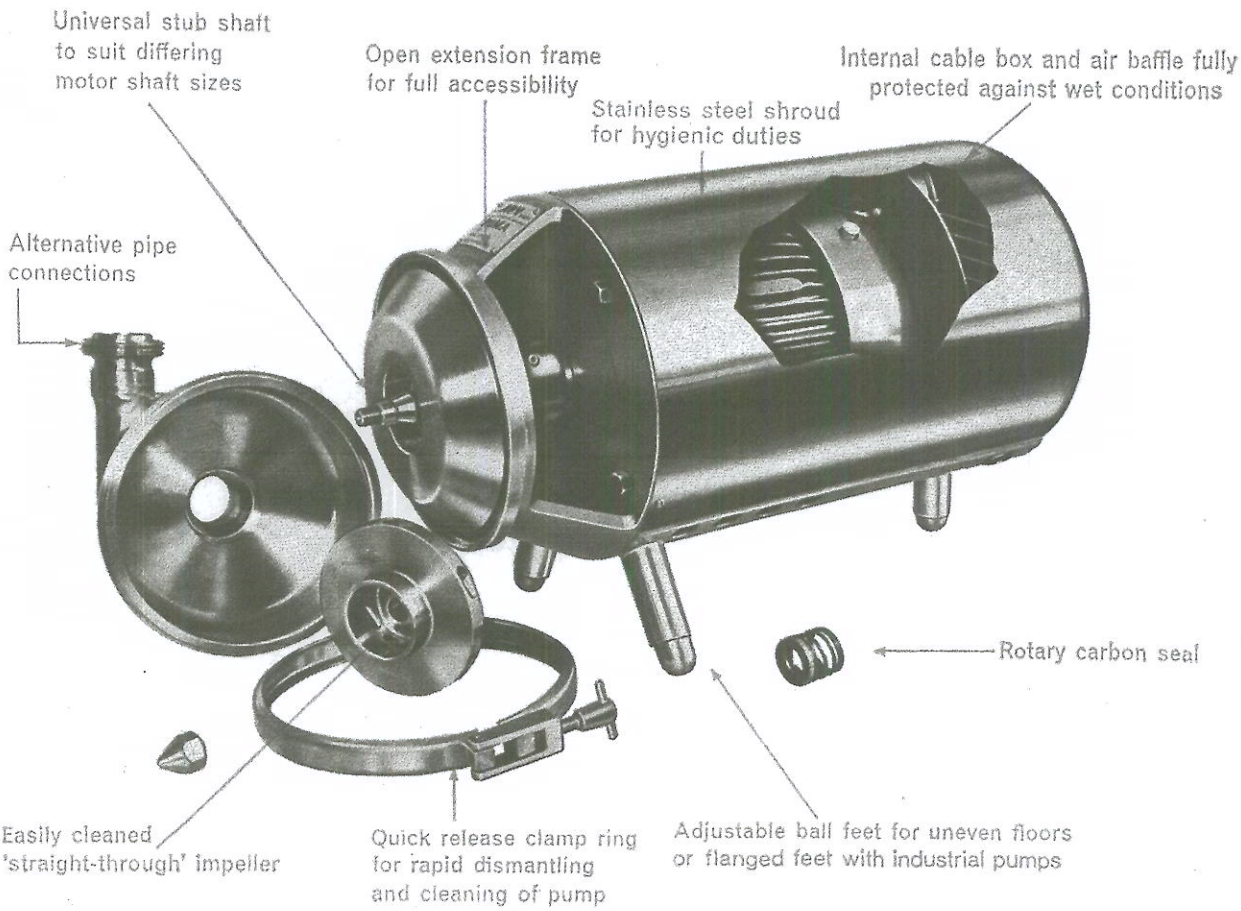
APV PUMA stainless steel centrifugal pumps

The PUMA range of stainless steel pumps incorporates over 30 years of APV experience as the largest European manufacturer of this special type of unit. It provides the Brewery, Dairy, Food and other potable liquid industries with an efficient and thoroughly dependable pump that fully meets today's requirements for hygienic duties. It also provides the Chemical industries with an off-the-shelf pump suitable for use in many applications where corrosion resistance is important.

The PUMA is of crevice-free design and constructed from stainless steel type 316. It is simple to clean and maintain, the pump casing being removable in a matter of seconds without the use of tools. Impellers are 'tuned' to specific duties for accuracy of performance, yet can be changed without difficulty; replacement parts are obtainable from stock. Also available are standard packs comprising consumable spares such as rubber joints and seal rings so that maintenance down-time is reduced to a minimum.

The illustration below shows a shrouded pump for hygienic duties. Unshrouded pumps for industrial duties are also obtainable. *See page 9.*





Pump characteristics

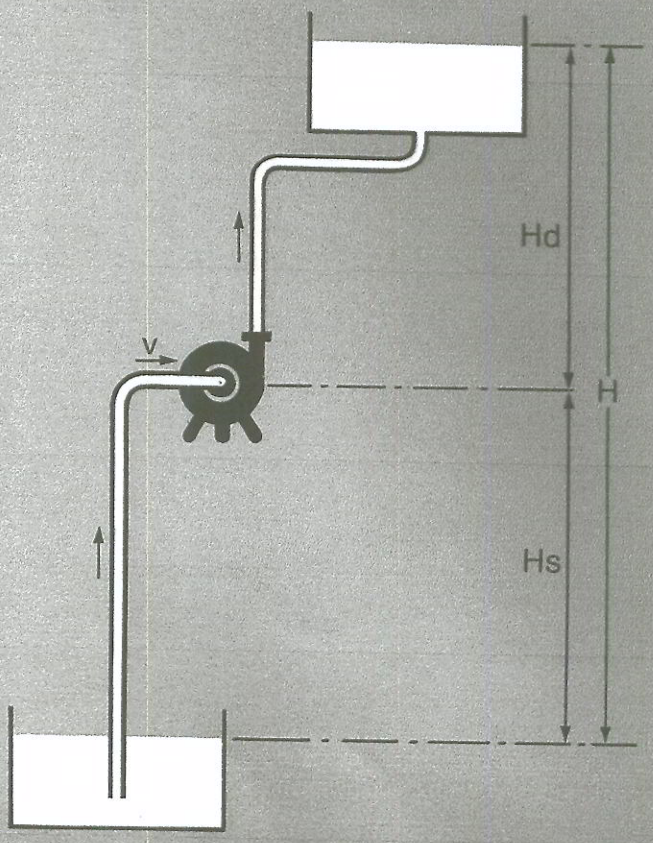
The pump characteristics on pages 6 and 7 plot total developed pressure and power required against flow for a range of impeller sizes. A pump is selected by finding a point on the graph to represent the flow and pressure required.

For the majority of applications it is only necessary to calculate the simple manometric head rise across the pump—i.e. ignore the change in kinetic head as the liquid velocity changes across the pump.

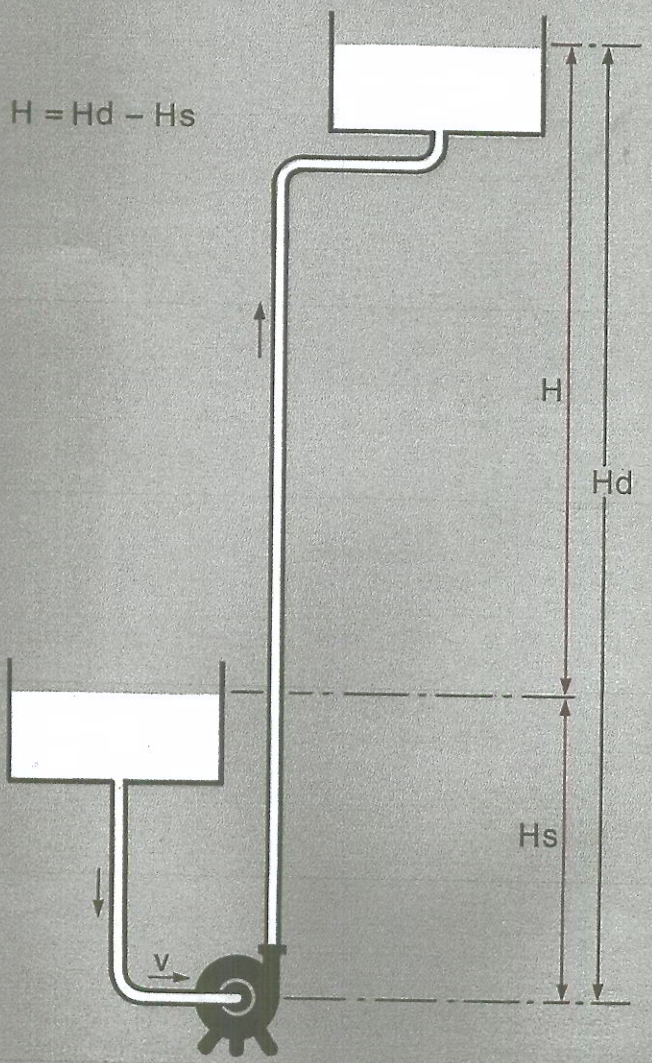
Manometric pressure rise across pump
= head delivered against ± suction head available,
that is: $H = Hd \pm Hs$.

In certain cases, pump performance can be affected by the suction conditions. These are described on the opposite page.

$H = Hd + Hs$



$H = Hd - Hs$



Selecting a PUMA pump

Why centrifugal ?

The most important characteristic of the centrifugal type of pump is the relationship which exists between the quantity of fluid and the head against which it can be pumped. This enables a process engineer to fix the design duty in the sure knowledge that if only one of the two variables (flow or head) is controlled, the other will always be of a previously established value. Furthermore, this characteristic results in a maximum level of head or pressure at a no-flow condition, thus enabling the design pressures of associated process equipment to be fixed and safeguarded without the use of a relief valve.

Type of duty

In selecting a pump the type of duty must be decided before further consideration can be given to the size of the pump, impeller or motor required. Assuming normal pumping duties under non-cavitating conditions, there are five alternative types of duty:

1 Fixed pressure, where the delivery pressure of the pump is controlled at a minimum value by a device such as a back pressure valve.

2 Fixed flow, where the flow delivered by the pump may be held at a constant rate by some form of flow control device.

3 Variable duty, where the normal operating conditions are known, but where in certain cases the flow may be increased to an unknown maximum limit by operating the pump on open discharge.

4 Fixed duty, where the pump is delivering against a fixed load such as a heat exchanger or a given static head so that the operating pressure and flow are either specified or can be calculated from known circuit conditions.

5 Semi-variable duty. Where the pump duty can be varied—for example where the CIP rate is required to be greater than the product rate—it is imperative that each possible set of pressure-flow conditions are examined to establish the maximum power requirements.

Operating conditions

A number of factors can significantly affect pump performance:

1 Frequency of the electricity supply. This affects the speed of the pump and hence its delivery pressure and power requirements. Performance curves are based on 50 Hz; figures for 60 Hz may be obtained on request.

2 Density of liquid. This affects the delivered pressure and the power required.

3 Suction pressure, which may be positive, atmospheric or negative (extracting from a vacuum). PUMA pumps will operate under vacuum extraction conditions if adequately primed and fitted with impellers which have no balancing holes.

4 Temperature of liquid, which may vary from boiling to cold.

5 Viscosity of liquid. This affects the performance of the pump.

Suction conditions

Although in most cases pumps can be selected by reference to the graphs on pages 6 and 7, the characteristics can be seriously affected if the liquids are hot, under vacuum or with a large suction lift. In such cases, a special selection routine must be followed.

All liquids in equilibrium with a contacting air or vapour interface generate a pressure known as vapour pressure, and this increases as the temperature of the liquid rises. If the pressure above the liquid is less than the vapour pressure corresponding to its temperature, it will boil. It therefore follows that if the pressure in the suction side of the pump is less than the liquid vapour pressure at the suction temperature, vapourisation of the liquid will take place and the performance of the pump will be seriously affected. This phenomenon is known as cavitation.

The parameter calculated to determine whether cavitation occurs is called the Net Positive Suction Head (NPSH), and there is a minimum value below which cavitation may take place. This value increases as the flow rate increases. The available NPSH value calculated by the equation below should always exceed by a margin the required value. Specific cases should be referred to APV.

Available NPSH = Hp + Hs — Hf — Hv — Hvp

where Hp is the absolute pressure of vapour or gas above the liquid surface in the vessel;
Hs is the static head above the pump centreline (deduct if below);
Hf is the friction loss in the pipework;
Hv is the kinetic head required to accelerate the liquid from rest to the velocity in the suction connection and is equal to $\frac{V^2}{2g}$ where V is the liquid velocity in the pump suction.
Hvp is the vapour pressure at the temperature of the fluid.

Note: It is of course essential that units should be consistent.

High pressure duties

For duties requiring output pressures above the maxima given in the charts on pages 6 and 7 PUMA pumps may be used in series. In such cases the sum of the discharge pressures is the final pressure obtained. The pumps have a pressure limit of 15.5 bar (225 lbf/in²).

High flow duties

To obtain flow rates in excess of those given in the charts, PUMA pumps may be coupled in parallel. The sum of the flow rates is the final flow rate obtained.
In both the above cases care must be taken to balance the appropriate system.

Dry running

Puma pumps may be run without product for a maximum period of 12 hours, provided they are fitted with water cooled seals operated according to APV recommendations.

Performance curves

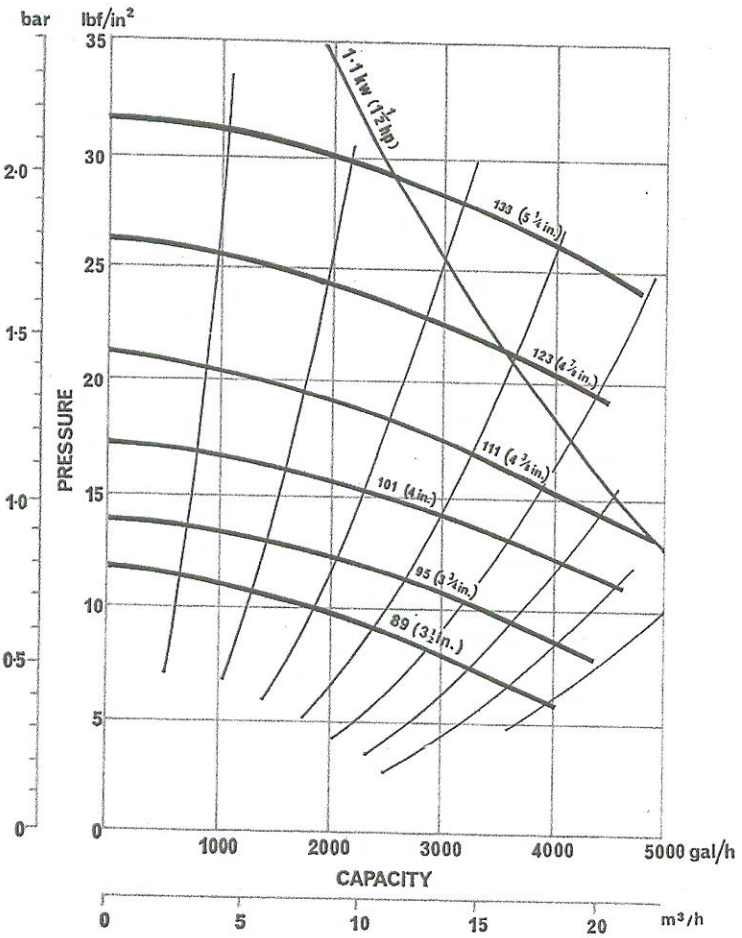
Note: The performance curves refer to operation with water at ambient temperature and under non-cavitating conditions at a synchronous motor speed for 50 Hz frequency. For 60 Hz motors corrections must be made to produce higher pressures and throughputs and amended curves can be obtained from APV.

As a rough guide:
Throughput is directly proportional to the speed;
Pressure is proportional to speed^2;
Power is proportional to speed^3.

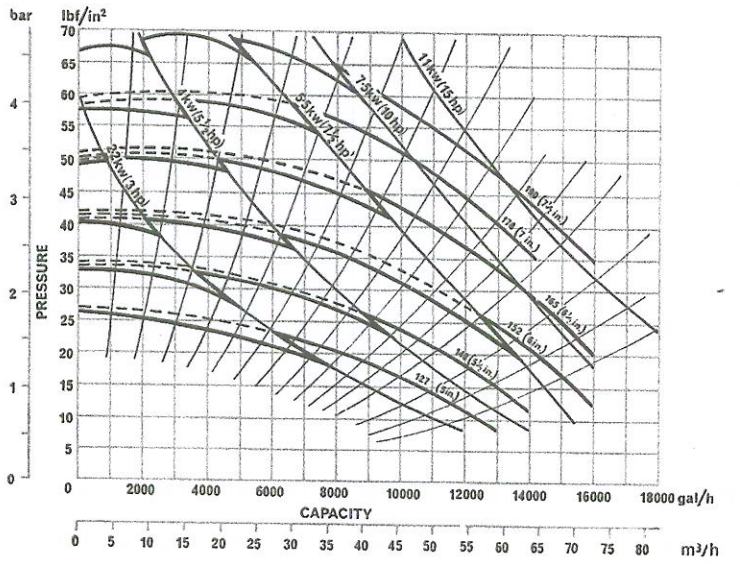
PUMA pumps are obtainable with half-speed motors suitable for duties with low available NPSH. Further details from APV.

Pumping viscous liquids
PUMA performance curves are based on liquids with the consistency of water. Any increase in viscosity reduces pumping efficiency but in general centrifugal pumps are economic for viscosities up to 250-300 centipoise. Higher viscosity applications should be referred to APV.

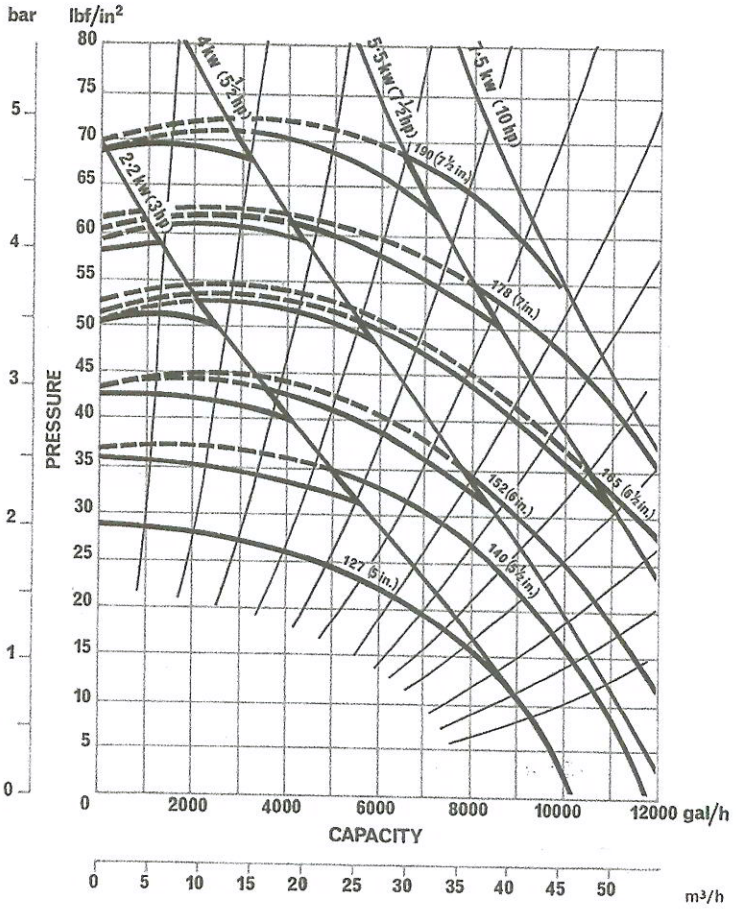
Type1½/2/7



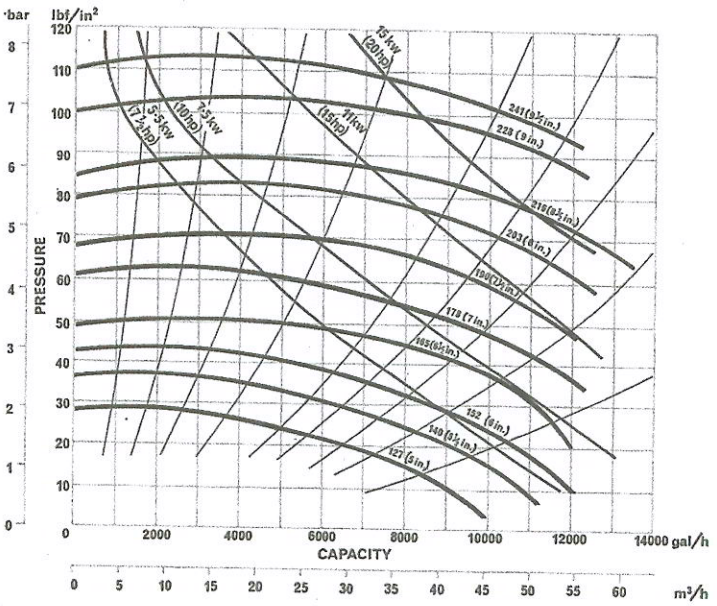
Type 2/3/9



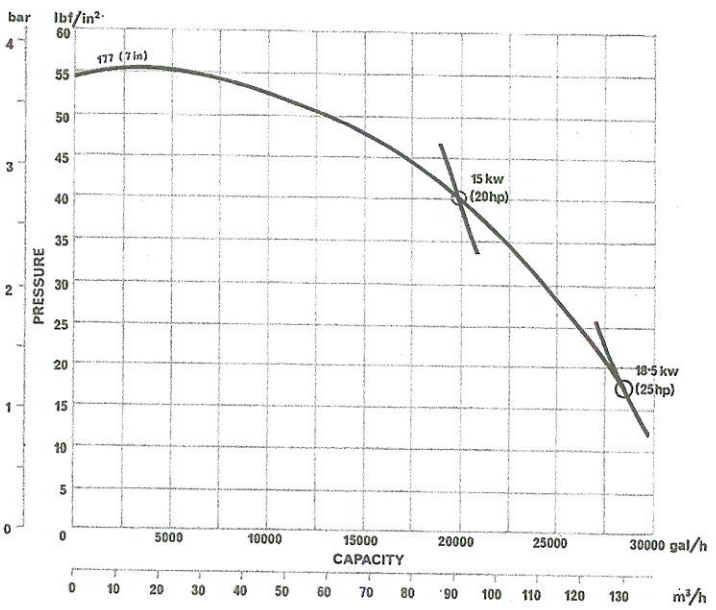
Type 2/2/9 (2.2 and 4 kW/3 and 5½ hp)
Type 2/2½/9 (5.5 and 7.5 kW/7½ and 10 hp)



Type 2/3/11



Type 3/4/11



Seals

Seals

The APV PUMA pump is fitted with a hardened stainless steel seal face ring, reversible for double length of life. Flexibox rotary carbon seals, for completely hygienic sealing, are fitted as standard. Alternative seals can be accommodated by special request to APV.

Only one size of product seal and water-cooled seal (see below) is used for the entire PUMA pump range. This feature enables spares to be held to a minimum, even where various pump sizes are used.

Water-cooled seals

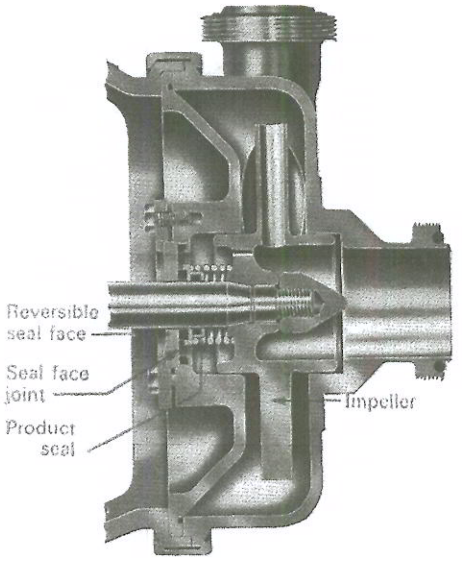
Localised boiling around the seal area can cause deterioration of the seal faces and all PUMA pumps may therefore be equipped with water cooling of the seal area if required. Reference to the curve in the diagram, which is relevant to all aqueous solutions such as beer, milk, sugar syrups, detergents etc., indicates whether or not water cooling is necessary. In this selection graph, duties falling above the curve require a water-cooled seal, while those below do not. However, it is advisable to use water cooling if there is a possibility of product crystallisation or solidification in the event of seepage past the seal faces. Vegetable and mineral oils do not require a water-cooled seal because their boiling points are very high. Viscous products and those not covered by the term aqueous solutions must be considered with regard to vapour pressure; such cases should be referred to APV.

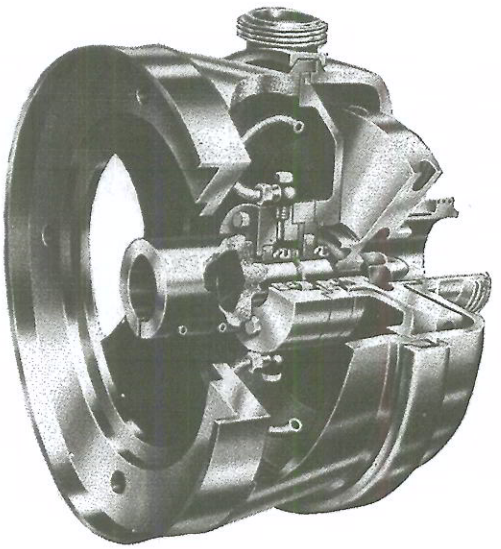
Operating temperatures

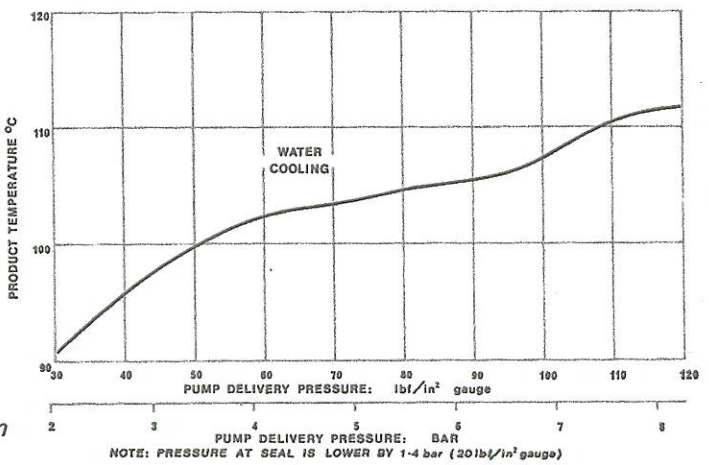
A maximum continuous operating temperature of 90°C (194°F) is recommended for extended seal life but higher temperatures can be accommodated if required.

Steam blanketed seals

Pump sizes 2/3/9 and 2/3/11 are obtainable with special seals for aseptic duties where it is necessary to steam sterilise the atmospheric side of the product seal. Further details can be obtained from APV.







(top right) Section through PUMA pump.
(centre) Section through pump showing steam blanketed seal.

The PUMA range

The APV PUMA range includes both shrouded pumps (up to 7.5 kW or 10 hp) and unshrouded pumps (larger sizes). They are available in six sizes, each with motors of alternative power ratings and impellers of various diameters. The pumps are designated by figure groups which refer to the nominal diameter in inches of discharge, suction and pump body respectively. They are:

1½/2/7 2/2/9 2/2½/9 2/3/9 2/3/11 3/4/11.

Connections

Up to 3 in: ISS (Interchangeable with IDF recommended unions), RJT (to BS1864) clamp (to ISO standards) American 3A or DIN.

4 in: RJT or clamp.

All sizes can be provided with flanged ends to BSTE standard or to specific customer requirements.

Motors

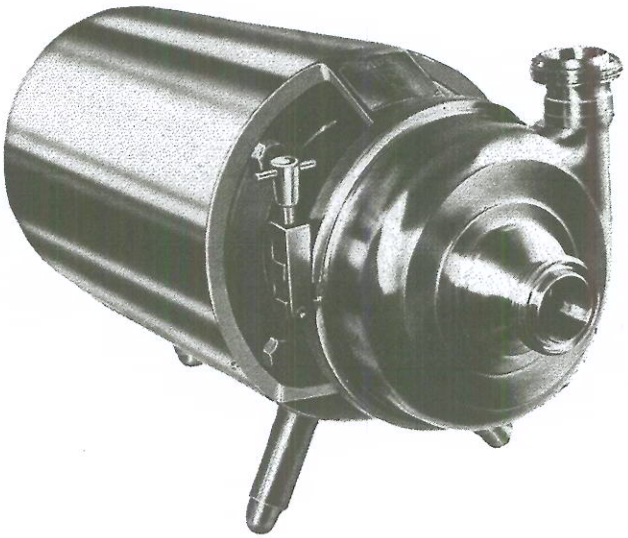
Standard electric motors are employed to allow easy replacement. Motors with Class B insulation normally conform to BS2613 (IEC publication 34/1) in performance and to BS3979 (IEC publication 72) in dimensions. The latter standard specifies metric dimensions, a feature of particular advantage overseas since locally-produced units can often be used.

In shrouded pumps the motors are accommodated integrally within the frame. For industrial duties (unshrouded pumps) flameproof motors can be supplied. Pumps can also be supplied with other types of standard motors on request, or without motors to allow local fitting of drive units such as CEMA or NEMA according to customer choice.

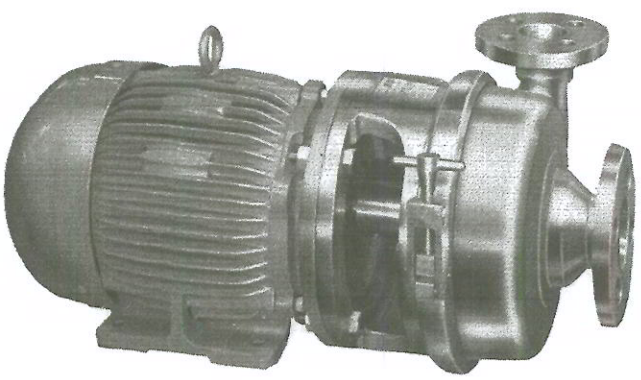
Two types of starter are employed, direct-on-line or star delta, according to motor size and customer requirement.

All pump enquiries or orders should be accompanied by the completed PUMP ENQUIRY SHEET opposite page 10, from which APV engineers will be able to define your requirements.

Shrouded pump



Unshrouded pump

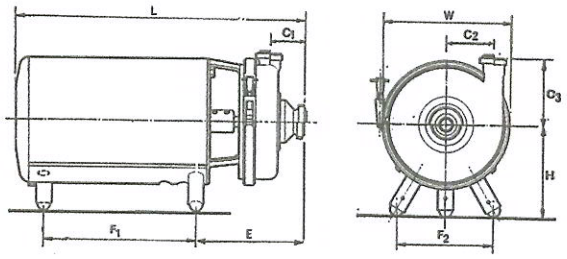


'Tuned' impellers

A range of tuned impellers is available for each size of pump, allowing selection of the impeller most applicable to a specific requirement. Precision machined for accuracy of performance, tuned impellers overcome the problems inherent in pumps with only one impeller size.

In addition to increasing the versatility of a pump employed on varying duties, e.g. when used in a CIP circuit, tuned impellers do not create excess flow rates or additional pressure heads which then have to be eliminated by valves. Foaming and beating of the product are also minimised. Tuned impellers are available for vacuum duties.

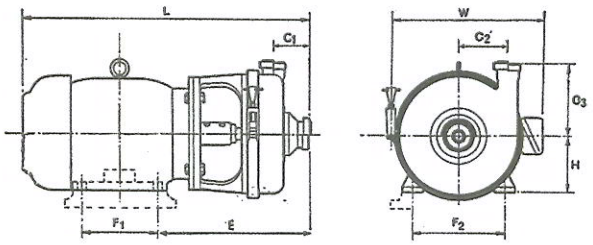
Sizes



Dimensions to connections are for pumps with ISS unions (RJT for size 3/4/11). With other fittings these dimensions will vary slightly.

Shrouded pumps

Size	Motor	L	W	C_1	C_2	C_3	H	E	F_1	F_2
1½/2/7	1.1kW(1½hp)	598(23½)	208(8 3/16)	68(2 1/16)	68(2 1/16)	121(4¾)	138(5 7/16)	227(9)	306(12)	152(6)
2/2/9	2·2 & 4kW (3 & 5½hp)	714(28⅛)	322(12⅝)	87(3 7/16)	97(3 13/16)	151(5 15/16)	241(9½)	254(10)	394(15½)	244(9⅝)
2/2½/9		,,	,,	,,	,,	,,	,,	,,	,,	,,
2/3/9		,,	,,	,,	94(3 11/16)	,,	,,	,,	,,	,,
2/3/11	4kW(5½hp)	,,	,,	,,	122(4 13/16)	176(6 15/16)	,,	,,	,,	,,
2/2½/9	5·5 & 7·5kW (7½ & 10hp)	741(29⅛)	,,	,,	94(3 11/16)	151(5 15/16)	,,	280(11)	,,	,,
2/3/9		,,	,,	,,	,,	,,	,,	,,	,,	,,
2/3/11		,,	,,	,,	122(4 13/16)	176(6 15/16)	,,	,,	,,	,,



Unshrouded pumps

Size	kW	hp	L	W	C_1	C_2	C_3	H	E	F_1	F_2
1½/2/7	1·1	1½	491(19 5/16)	243(9 9/16)	68(2 1/16)	48(1 5/16)	121(4¾)	89(3½)	262(10 5/16)	76(3)	102(4)
2/3/9	11	15	806(31¾)	437(17¼)	87(3 7/16)	94(3 11/16)	151(5 15/16)	160(6 5/16)	418(16 7/16)	210(8¼)	254(10)
,,	15	20	,,	,,	,,	,,	,,	,,	,,	,,	,,
2/3/11	11	15	,,	,,	,,	122(4 13/16)	176(6 15/16)	,,	,,	,,	,,
,,	15	20	,,	,,	,,	,,	,,	,,	,,	,,	,,
3/4/11	15	20	836(32⅞)	461(18⅛)	106(4 3/16)	102(4)	200(7⅞)	,,	448(17⅝)	,,	,,
,,	18·5	25	880(34⅝)	,,	,,	,,	,,	,,	,,	254(10)	,,