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VERTICAL SUMBERGED TYPE PUMP JACKETED CONSTRUCTION – MODEL SP-SJ2

1. Introduction:

Chemlin range of Pumps is developed and manufactured with state-of-the-art manufacturing facility. The products are committed to continuous quality control and improvements using modern quality techniques, inspection procedures and instruments.

Chemlin manufactures products conforming to Indian / International Standards viz. ISO 2858, IS 5120, etc. and has ISO 9001:2008 Certification.

Proper care in Installation and Operation of Chemlin Pump will give trouble free performance over long periods of operation.

The Pump must not be operated beyond the specified parameters. For any of the query regarding the suitability of the Pump for the application intended, contact 'Chemlin' for solution and proper guidance.

2. Inspection:

On receipt of the consignment, the Pump/Spares must be checked immediately against the necessary Dispatch/Shipping Documents and that there has been no damage in transportation. Any shortage and damage must be informed in writing to 'Chemlin' immediately within seven Days on receipt of the consignment and the matter to be taken up with the transporter/ Insurance agency.

3. Storage & Handling:

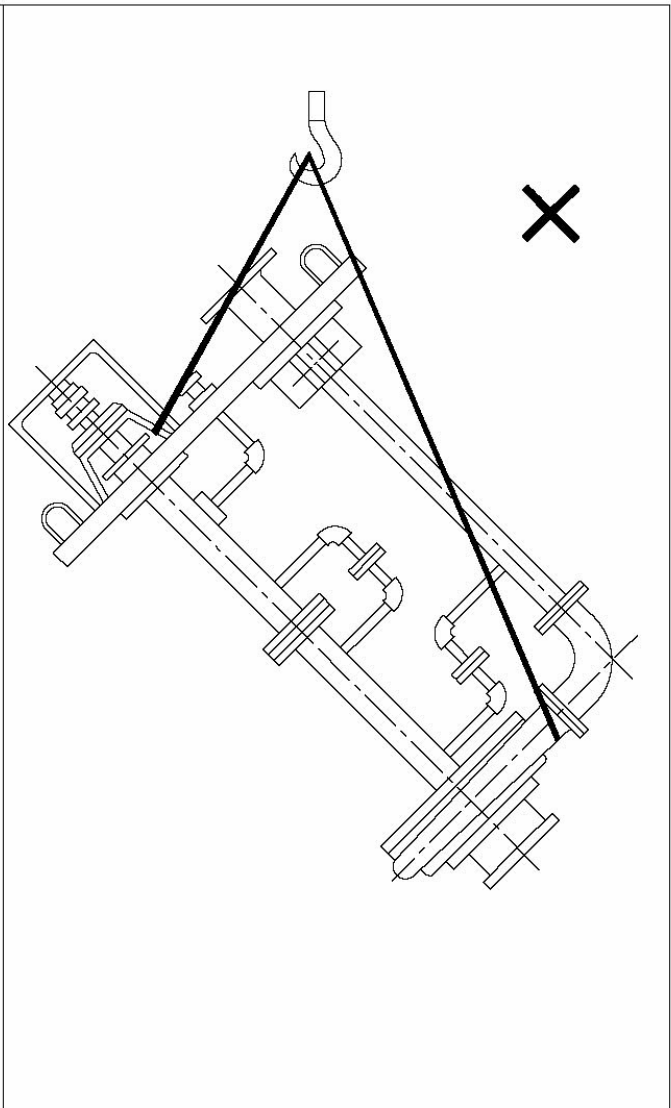
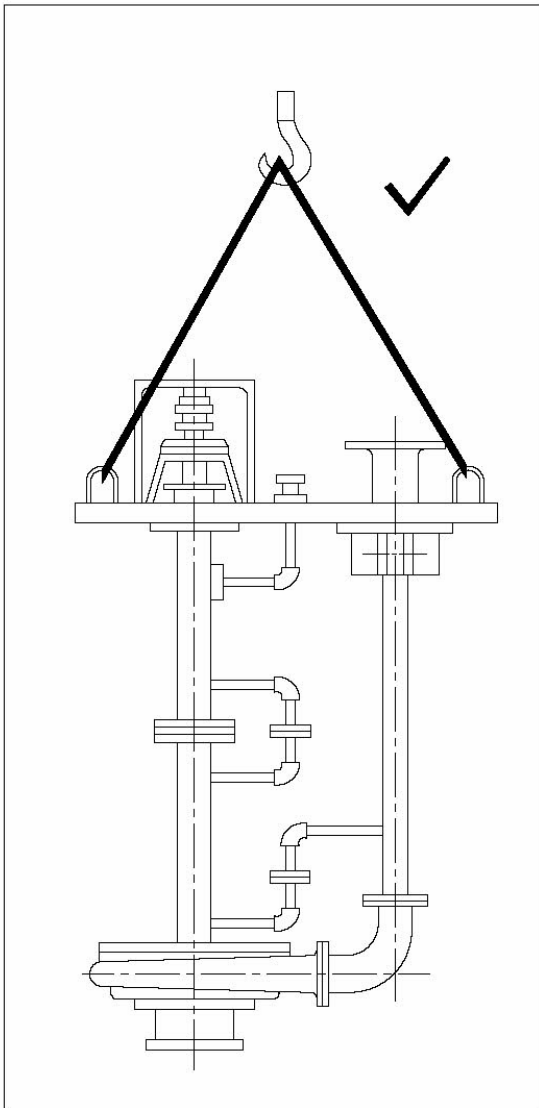
The Boxes or Cartons may be unloaded using Forklifts or suitable handling devices and stored in position with no strains applied on any part of the Pump.

The Pumps and Motors have integral lifting lugs or eyebolts, which are intended for use in only lifting the individual equipment. Take care to lift the components or assembly above the centre of gravity to avoid the flipping. Also there should not be any bend or damage to external flushing or lubrication piping during handling.

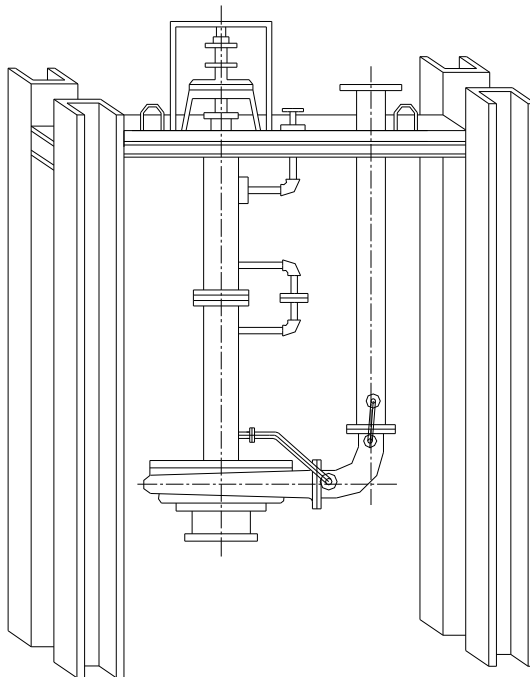
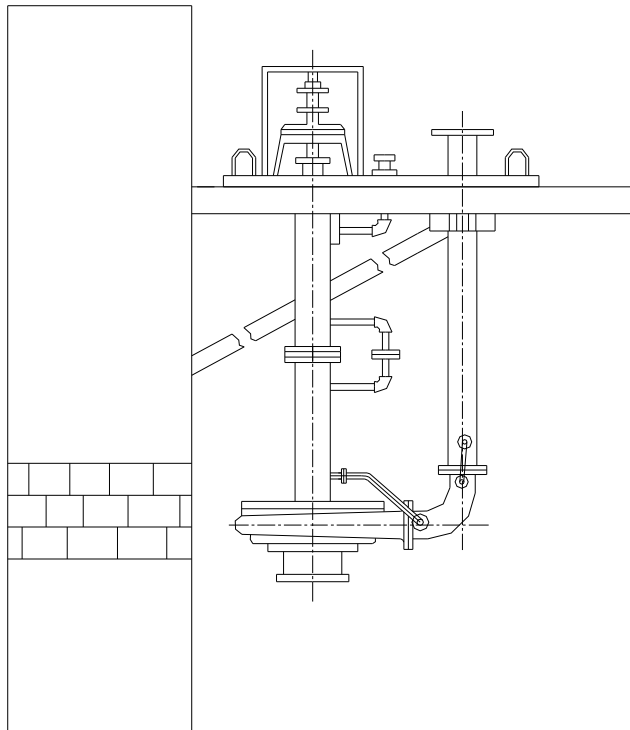
1. It is advisable that the pumping unit be stored vertically on a structural stand supporting the pump cover plate from below as shown in the drawing.
2. All loose un-mounted items to be packed in water proof material like plastic bag or box.
3. In case of assemblies ordered with external piping, individual components may be disassembled for easy handling.
4. Desiccant [Silica Gel] bags are to be placed inside the Pump and Component packages.
5. Generally pump openings are covered at the factory and should be retained to avoid access of dirt, dust particles and foreign matter while being stored.

When a new unit is not to be installed immediately then it should be stored in a Vertical Position and in clean and dry place, possibly indoors, insuring that all mounting surfaces are clean and coated with grease.

When the service life of the product or the components is over, the same should be recycled or disposed using environmentally acceptable methods. If the product contains harmful substances, care must be taken for disposing of safely using/wearing protective equipments.



Pump Storage Arrangement:



4. **Safety Precautions:**

- **Always** lock out the power to the pump driver when performing maintenance on the pump
- **Always** lock out the suction and discharge valves when performing maintenance on the pump
- **Never** operate the pump without safety devices installed.
- **Never** operate the pump with suction and/or discharge valves closed
- **Never** operate the pump out of its design specifications
- **Never** start the pump without making sure that the pump is primed
- **Never** use heat to disassemble pump
- **Never** attempt to remove the safety guards while operating.
- **Never** put hands in the openings of the pump while in operation.
- **Never** Step on the Pump/Piping connected to the Pump in case the pump is handling corrosive liquids.
- Inspect the entire system before start-up
- Monitor the system during operation and perform maintenance periodically or as required by the application.
- Before performing maintenance on the pump, check with appropriate personnel to determine if skin, eye or lung protection is required and how best to flush the pump
- When performing maintenance, pay special attention to all cautionary statements given in this manual.

Failure to observe safety precautions can result in personal injury, equipment damage or malfunction.

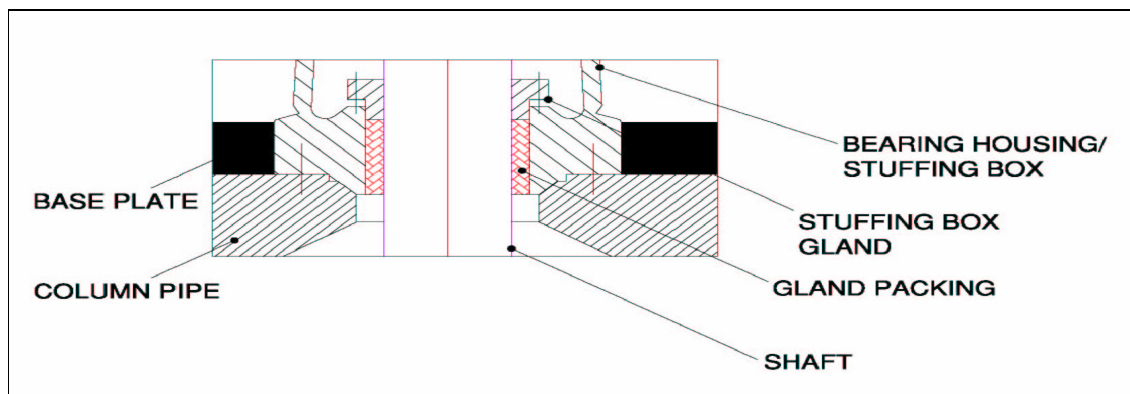
5. **Installation:**

All personnel involved in the operation, installation, inspection and maintenance of the Pumps must be qualified or trained to carry out the respective work. If not, necessary knowledge and skill, appropriate training and instructions must be provided. Customer can call for the training provided by supplier.

All plant safety requirements, health laws and regulations are to be followed.

01. Check that the submergence designed will maintain the liquid level within the proper range.
02. Check that the Pump is easily accessible for maintenance and inspection and has adequate ventilation.
03. Clean thoroughly all surface of pump. Remove pump Coverings and clean the flange faces.
04. The tank openings, which receive the pump coverplate, should be perfectly horizontal (within 1/32") and substantially rigid.
05. The foundation should provide rigid support for the pump and motor and should be sufficient to absorb any vibration.
06. A full-face asbestos gasket (1.5 mm) or an asbestos rope gasket may be used. Care should be taken that it is perfectly uniform.
07. Install and align the Pump.
08. It should be noted that the running clearances in the bearings are designed to maintain a flow of liquid for lubrication and any external stress or strain will distort the alignment & cause pump to bend. Operation in this condition will result in reduction of pump life.
09. Discharge line must be properly supported to avoid any strain and bending moments to the pump unit, which may result in internal misalignments causing failure of bearings & internal parts.

10. Pump shaft must be checked for freeness without packing stuffing box & before connecting motor coupling. This will help to track high spots in internal bearings. In case, the pump shaft does not rotate freely,
 - Check the discharge pipeline above pump cover plate for stress on pump.
 - Check thickness of gasket on tank opening for evenness.
 - Check tightening of cover plate bolts. Pack stuffing box & tighten Gland reasonably.
11. When the Packing is compressed, the Gland must be in line with the Bearing Housing/Stuffing Box and Shaft. **[Fig. A]**
12. Check direction of rotation of motor, which is shown on upper part of bearing housing, before connecting the motor coupling to pump couplings.
13. Connect motor coupling to the pump ensuring proper alignment of coupling.
14. Check lubrication of motor bearings.
15. Don't run pump dry as the rotating parts may damage.
16. The minimum liquid level 'at Pump starting' must be maintained according to the approved drawing.
17. Before starting the pump, check that no foreign matter such as stones, bricks, welding slag etc. exists in tank. They will be drawn into the Pump and cause premature failure of the Pump Bearings and Wear Rings. Also it is desirable to start, the pump with discharge valve partially open (1/4 to 1/3).
18. Protection / Detection device should be installed to monitor the liquid temperature does not rise to an unsafe level.
19. Power monitor/ Liquid Level indicators should be installed to stop the pump against dry run or start up empty.
20. It is recommended that leakage/ hazardous gas detection system to be installed wherever necessary.
21. It is recommended that condition monitoring systems to be installed for controlling surface temperatures at Ball bearing and vibrations of the pump system.

Fig. A

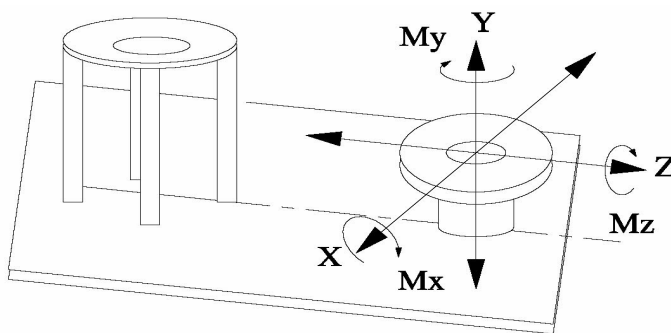
***NOTE:**
DRY & SATURATED STEAM AT A PRESSURE OF 35 PSI (2.47 kg/cm²) SHOULD BE GIVEN TO PUMP JACKET. ANY OTHER PRESSURE OR TEMPERATURE WILL CHANGE THE VISCOSITY OF SULPHUR AND MAY FOUL THE SUBMERGED BEARING.

5.1. Nozzle Loading:

Discharge piping should be constructed to fit the discharge piping flange. The pump can accommodate fair amount of loads without affecting the operation of the pump. However, the installation should not impose unnecessary loads to the discharge flange.

The API 610 standard covers nozzle loads for horizontal pumps and vertically suspended pumps for nozzle sizes up to 16 in. (400 mm).

Generally, small pumps not anchored to their foundations can tolerate higher nozzle loads than anchored ones.



Location/Orientation	Nozzle-Loading Force as a Function of Flange Size - SI Units N				
	Nominal Size of flange (DN)				
	≤50	80	100	150	200
Each Top Nozzle					
<i>F_x</i>	710	1070	1420	2490	3780
<i>F_y</i>	580	890	1160	2050	3110
<i>F_z</i>	890	1330	1780	3110	4890
<i>FR</i>	1280	1930	2560	4480	6920
Each Side Nozzle					
<i>F_x</i>	710	1070	1420	2490	3780
<i>F_y</i>	890	1330	1780	3110	4890
<i>F_z</i>	580	890	1160	2050	3110
<i>FR</i>	1280	1930	2560	4480	6920
Each End Nozzle					
<i>F_x</i>	890	1330	1780	3110	4890
<i>F_y</i>	710	1070	1420	2490	3780
<i>F_z</i>	580	890	1160	2050	3110
<i>FR</i>	1280	1930	2560	4480	6920
	Moment (N-m)				
Each Nozzle					
<i>M_x</i>	460	950	1330	2300	3530
<i>M_y</i>	230	470	680	1180	1760
<i>M_z</i>	350	720	1000	1760	2580
<i>MR</i>	620	1280	1800	3130	4710

6. Maintenance:

- i) Lubrication of motor bearings should be carried out according to the instruction of motor manufacturer.
- ii) Bearing temperature may rise above normal initially but will stabilize shortly. Lubricate ball bearing as required. Avoid frequent greasing. Over greasing is the reason for over heating of bearing. It is advisable to pack half of the bearing with grease. High melting point grease must be used as lubricant.
 - Asbestos packing (Graphited) in various grades is used for packing stuffing box. While repacking the stuffing box remove old Packing, clean thoroughly the stuffing box and shaft. Ensure shaft for binding if any. Apply thin film of oil on shaft & in stuffing box. Insert required numbers of packing rings staggering joints by 90° & press them down the box by tightening the gland nuts. Then loosen the nut and box by tightening the gland nuts. Then loosen the nut and retighten with fingers. Excessive tightening of gland nuts Results in overheating of gland. Ensure gland bore does not rub on shaft. Refer table for number of rings of packing.

Rings of Packing 6 mm	
Pump size mm	Number of Rings
32	5
40	5
50	6
65	6

*** NOTE: In case of Mechanical seal please write to us for specific guidance.**

- iii) a) Sleeve bearing is lubricated by the pumped liquid and requires no external lubrication.
- b) Ball Bearing temperature may rise above normal initially, but will become normal (70°C or 160°F) depending on ambient temperature. Increase in temperature attracts attention for correction.
- iv) In case of Intermediate Bearing, check-up the ID of the Bearing. If the clearance is more than 1.25 mm and the level of vibration is observed on higher side, then change the intermediate Bearing.

6.1. Required Tools/Tackles:

It is required to keep the following essential tools during disassembly/assembly of the pump for maintenance,

- Induction Heater for Bearings
- Files
- Dial Indicators
- Soft Mallet
- V-Blocks
- Set of Spanners
- Hand Wrenches
- Bearing Pullers
- Circlip Plyers

6.2. Diagnosing Operating Difficulties:

1. Rise in Bearing Temperature

- i) Over greasing of ball bearings
- ii) Misalignment in pump and motor coupling
- iii) Improper Installation of Ball Bearing
- iv) Damaged Ball Bearing
- v) Shaft may have bend

2. Increased Power Consumption

- i) Higher revolutions of motor
- ii) Liquid pumped may be of higher specific gravity and/or Viscosity than that for which the pump was designed.
- iii) Shaft may have bend
- iv) Excessive tightening of gland
- v) Metal binding of rotating elements
- vi) Larger Impeller diameter
- vii) Check Steam temperature and Pressure in the Jacket.

3. Noise in Pump

- i) Motor Ball Bearing may be worn out
- ii) Misalignment between Pump & Motor Coupling
- iii) Tank frame receiving pump cover plate may not be rigid
- iv) Shaft may have bend
- v) Metal binding of rotating elements
- vi) Pump Ball Bearing may be damaged
- vii) Head may be lower than specified resulting in increase in discharge
- viii) Check the clearance in intermediate bearing (if provided) only for pumps with submersion length more than 1.5 Mtr

4. Insufficient or No Discharge

- i) Low Liquid level in tank
- ii) Wrong direction of rotation
- iii) Impeller may be clogged, or suction cover may be choked
- iv) Discharge line is blocked.
- v) Turbulence, Cavitation due to insufficient suction head, air or gas entrapment with liquid
- vi) Impeller diameter is smaller than required
- vii) Damaged Impeller
- viii) Higher discharge head
- ix) Discharge valve in closed position

7. Servicing 'Chemlin' Vertical Sulphur Pump

A. Dismantling

After taking out the pump from tank, remove Sulphur by passing dry hot steam through Jacket & thereafter to Casing & Head plate to make the shaft free. Clean the pump thoroughly inside and outside. Place Pump in Vertical Position as shown in storage and handling and dismantle part by part as follows:-

1. Remove the Discharge Elbow (32)
2. Remove Suction Cover (45)
3. Remove the Impeller Nut (19)
4. Remove the Impeller (16)
5. Remove the Volute Journal (27)
6. Remove the Bearing Housing Bolts (125A)
7. Remove the Pump Shaft Assembly upwards.
8. Remove Pump Coupling (03)
9. Remove Ball Bearing Housing Cap upwards (23)
10. Remove Bearing Nut and Lock Nut.
11. Remove Bearing Housing (07) backward up to Ø63 mm step.
12. Remove the Ball Bearing by using puller (06)
13. Maintain Impeller Nut, Bearing Nut, Lock Nut and both keys on Shaft.
14. If necessary remove Steam connection between Column and Discharge Pipe.
15. In case of double Column Pump remove Intermediate Bearing Housing.

B. Cleaning

Clean all parts thoroughly. Ball Bearing should be cleaned & kept carefully, ensure that no foreign matter gets into it. Check for clean passages in the Jacket areas.

C. Inspection

Inspect the Impeller Rings (17), Casing Ring (18), Volute Journal (27), Volute Bearing (28), Impeller Nut (19), Ball Bearing (06), and Nuts & Bolts for wear. Inspect the pump shaft for wear at Impeller and Journal. No attempts to be made to build the wear if any. Replace worn out parts with new parts. Inspect shaft for bending.

If the pump is in operation for more than 3 years, check up the pipe jackets for Hydraulic leakage. **Hydraulic Test pressure to be minimum 1.5 times the Shut-off pressure on liquid pumped.**

D. Assembling

- Apply grease to Volute (20) bore and press the Volute Bearing (28) by means of wood block and hammer into the volute bore until it flushes with the end face of the bearing bore.
- Place Casing Ring (18) in position and by means of wood block and hammer drive it until the end face of the Ring is uniformly seated in the step.
- Replace the Studs & Bolts in the Volute, if necessary.
- Assemble Column Pipe & Discharge Pipe with motor stand and bolt casing to lower flange of column pipe place 'C' Clamp (31) on Discharge pipe and bolt it to motor stand base plate.

- Insert Bearing housing on the shaft and hold it against Ø63. Then place the Ball Bearing on the shaft after greasing properly. Then tighten the Bearing Nut and Lock Nut. Then push the Bearing Housing (07) on the Ball Bearing until it rest against the step in the Bearing Housing. Then put the Bearing housing cap and pump coupling (03) on the shaft and tighten it by Grub Screw. Then Lower the Shaft Assembly through column pipe from top. For pump with Intermediate Bearing housing, after checking the running clearance between shaft/sleeve OD and intermediate bush ID, the same alongwith column pipe lower should be fixed to the Column pipe upper.
- Insert Volute journal upwards so that it engages with key on shaft.
- Place Impeller Ring in position on Impeller & drive it by means of wooden block and hammer so that end face of ring flushes with end face of Impeller boss. Place Impeller to engage with same key on shaft and tighten the Impeller gaskets between the joints of Volute, Discharge Elbow And Discharge Pipe and tighten the Bolts uniformly. Care should be taken so that no strain is produced.
- If all the steps are carefully followed the shaft should be free of strain. Repack Stuffing Box. Rebuild the steam connections if they are removed. Store pump in Vertical position only.

8. Recommended Spares

Following are the recommended spares, which should be maintained along with the pump.

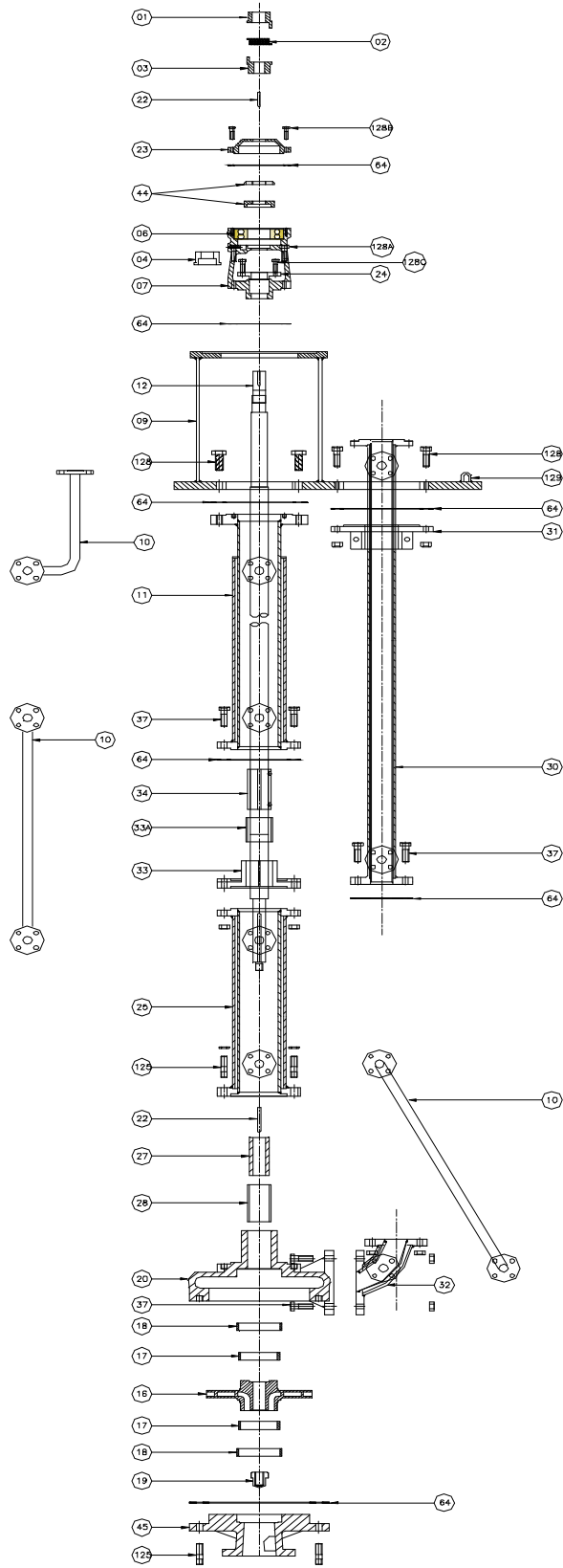
i.	Impeller (16)	1 No.
ii.	Impeller Ring (17)	1 No.
iii.	Casing Ring (18)	1 No.
iv.	Volute Journal (27)	1 No.
v.	Volute Bearing (28)	1 No.
vi.	Shaft (12) complete with Nuts (19, 21) & Keys (22)	1 Set
vii.	Ball Bearing (06)	1 No.
viii.	Set of Coupling with Rubber Spider (01, 02, 03)	1 Set
ix.	Split gland follower (24)	1 Set
x.	Set of Packing Rings (64)	1 Set
xi.	Set of Nuts & Bolts (37)	1 Set
xii.	Intermediate Bush (34)	1 Set
xiii.	Set of Studs & Cap Nuts (91, 125)	1 Set

9. Part List & Exploded Views:-

9.1. Part List of Jacketed Construction – VCP Model SP-SJ2

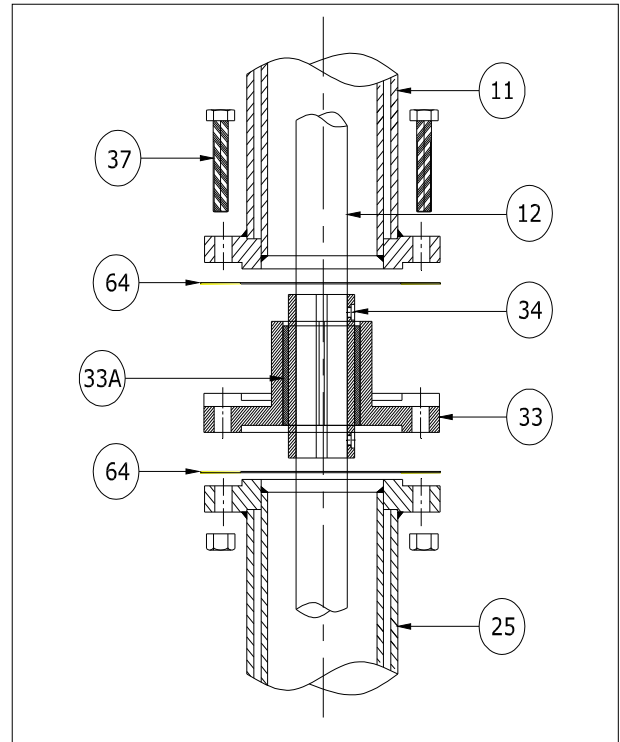
Part Name	Part No.
Motor Half Coupling	01
Coupling Pins/Spiders	02
Pump Half Couplings	03
Thimble	04
Ball Bearing	06
Ball Bearing Housing	07
Motor Stand	09
Steam Connection Pipes	10
Upper Boot	11
Shaft	12
Gland Packing	14
Impeller	16
Impeller Ring	17
Casing Ring	18
Impeller Nut	19
Volute Casing	20
Shaft Keys	22
Ball Bearing Housing Cap	23
Stuffing Box Gland	24
Lower Boot	25
Oil Seal	26
Volute Journal	27
Volute Bearing	28
Discharge Pipe	30
Discharge Pipe Clamp	31
Discharge Elbow	32
Intermediate Bearing Housing	33
Intermediate Bearing	33A
Intermediate Sleeve	34
Nuts & Bolts	37
Bearing Lock Nut	44
Suction Head	45
Gasket Set	64
Snap Ring	111
Studs	125
Full Thread Bolts	128
Full Thread Bolts	128A
Full Thread Bolts	128B
Full Thread Bolts	128C
Lifting Lugs/Eye Bolts	129

9.2. Exploded View of Jacketed Construction – VCP Model SP-SJ2



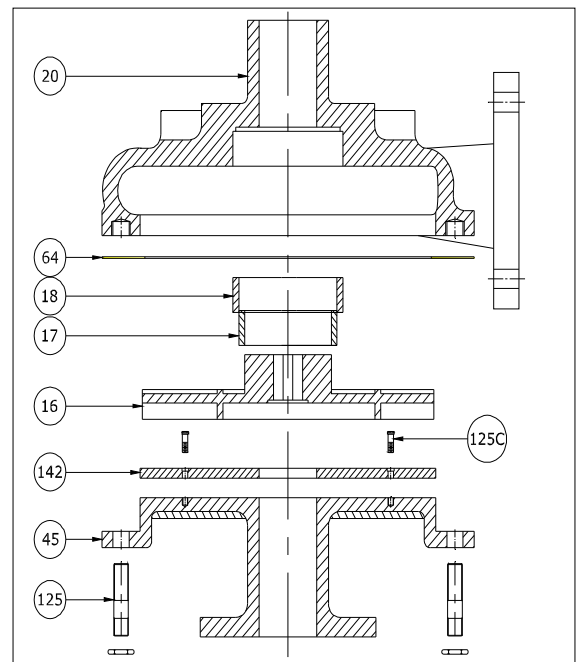
9.3. Exploded view-I: Intermediate Bearing assembly

Part Name	Part No.
Upper Boot	11
Shaft	12
Lower Boot	25
Intermediate Bearing Housing	33
Intermediate Bearing	33A
Intermediate Sleeve	34
Nuts & Bolts	37
Gasket	64



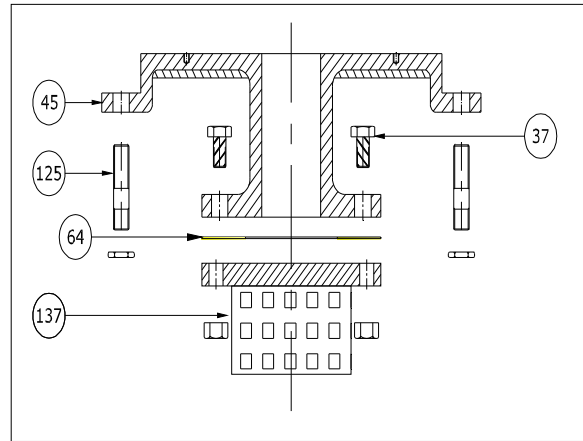
9.4. Exploded view-II: Wear Plate assembly

Part Name	Part No.
Impeller	16
Impeller Ring	17
Casing Ring	18
Volute Casing	20
Suction Cover	45
Gasket	64
Studs	125
Full Thread Bolts	125C
Wear Plate (Optional)	142



9.5. Exploded view-III: Suction Sprout/Strainer assembly

Part Name	Part No.
Suction Head	45
Studs	125
Nuts with Bolts	37
Gasket	64
Suction Sprout	127
Suction Strainer	137



10. Contact Details:

Difficulties encountered other than mentioned in this manual may please be forwarded with complete details to the following:

Head Office:-

Chemlin Pumps & Valves Pvt. Ltd.,
 F-5, "Atharva Estate", 268/2,
 "E" Ward Tarabai Park,
 Kolhapur : 416 003, (Maharashtra) India
 Tel : (0231) 2653123, 2651964.
 Fax : (0231) 2655389.

E-Mail : sales@chemlinindia.com
 Website : www.chemlinindia.com

Works/Factory:-

Chemlin Pumps & Valves Pvt. Ltd.,
 235/6, Poona-Bangalore Road
 Kagal : 416 216, (Maharashtra) India
 Tel : (02325) 244108

E-Mail : works@chemlinindia.com

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