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INSTALLATION & OPERATING INSTRUCTIONS



SCR, SCRI & SCRN
SERIES



EC DECLARATION OF CONFORMITY

IN ACCORDANCE WITH LV & EC MACHINERY DIRECTIVES UNDER SELF DECLARATION

Product Designation : Vertical Pressure Booster Pumpset
Model Reference : SCR / SCRI / SCRN 1-90 (Max. - 40.0 HP)
Intended End Use : For Vertical Pressure Booster Pumpset to be used for pumping water and water like liquid in industries, petrochemical, water treatment, commercial building and many other applications. This product is not use in potential explosive environment.

Conforming to the requirement of the following European Directive :

- a) Low Voltage Directive - 2006 / 95 / EC
- b) EC Machinery Directive - 2006 / 42 / EC

Applicable harmonised standards used :

EN ISO 12100-2010, EN 809:1998+A1:2009, EN 60335-1, EN 60335-2-41

We hereby declare that Vertical Pressure Booster Pumpset is intended to be incorporated into OR assembled with other machinery to constitute relevant machinery to comply with the Essential Health and Safety requirement of the above-mentioned directives.


This machinery, its components and sub-assemblies shall not be put in to service until the machinery into which it is to be incorporated has been declared in conformity with the provision of the applicable directives.

The criteria for selection, safety requirement of other associated equipment and installation guidelines are detailed in the instruction manual.

- Date of Manufacturer & First CE marking : 05 Nov 2015
- Place of Manufacturer : Shakti Pumps India Ltd, Pithampur.

Issued at : SHAKTI PUMPS (I) LTD.

Pithampur

Marking : 

The above pumpset must not be put into service/usage for other than specified in the instruction Manual on Date : 05 Nov 2015


Deo Kumar Thakur
(Manager-QA)

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INSTALLATION AND OPERATING INSTRUCTIONS

1. GENERAL : The SCR range is based on the inline multistage centrifugal pump first pioneered by SHAKTI. SCR is available in four basic materials and over one million configurations. SCR is suitable for pumping water and water-like liquids in industry, petrochemical, water treatment, commercial buildings, and many other applications. Some of SCR's outstanding characteristics are:

- superior efficiency • reliability • ease of maintenance • compact size and small footprint • quiet operation.

2. SHIPMENT INSPECTION : Examine the components carefully to make sure no damage has occurred to the pump during shipment. Care should be taken to ensure the pump is NOT dropped or mishandled.

2.1 ENSURE YOU HAVE THE RIGHT PUMP : Read the pump name plate to make sure that it is the one you ordered.

- SCR - Centrifugal pump with standard cast iron and 304 stainless steel construction
- SCRI - Centrifugal pump; all parts in contact with water are 304 stainless steel construction
- SCRN - Centrifugal pump; all parts in contact with water are 316 stainless steel construction

2.2 CHECKING THE CONDITION OF THE PUMP : The shipping carton in which your pump arrived is specially designed around your pump during production to prevent damage during shipment. As a precaution, the pump should remain in the carton until you are ready to install it. Examine the pump for any damage that may have occurred during shipping. Examine any other parts of the shipment as well for any visible damage.

NOTE : If the pump is shipped as a complete unit (motor attached to pump end), the position of the coupling (that connects the pump shaft to the motor shaft) is set at factory specifications. No adjustment is required. If the unit is delivered as a pump end only, follow the adjustment procedures in the section on replacing the motor.

Pump Without Motor (SCR (i) (n) 1s, 1, 3, 5, 10, 15, And 20 Only) : If you purchased a pump without a motor, the shaft seal has been set by the factory. Do not loosen the three set screws on the shaft seal when attaching the motor.

Pump Without Motor (SCR (n) 32, 45, 64, 90, 120, And 150 Only) : If you purchased a pump without a motor, you must install the seal. The seal is protected in its own sub boxing within the pump packaging crate. To protect the shaft and bearings during shipment, a shaft holder protective device is used. This device must be removed prior to installation of the seal. Read the seal installation instructions which are included in the pump package.

2.3 VERIFYING ELECTRICAL REQUIREMENTS : Verification of the electrical supply should be made to be certain the voltage, phase and frequency match that of the pump motor. The proper operating voltage and other electrical information can be found on the motor nameplate. These motors are designed to run on $\pm 6\%$ of the nameplate-rated voltage. For dual-voltage motors, the motor should be internally connected to operate on the voltage closest to the 10% rating, i.e., a 208 voltage motor wired per the 208 volt connection diagram. The wiring connection diagram can be found on either a plate attached to the motor or on a diagram inside the terminal box cover. If voltage variations are larger than $\pm 6\%$, do not operate the pump.

3. CONFIRMING PROPER APPLICATION : Compare the pump's nameplate data or its performance curve with the application in which you plan to install it. Will it perform the way you want it to perform? Also, make sure the application falls within the following limits.



INSTALLATION AND OPERATING INSTRUCTIONS

TYPE	DESIGNED TO PUMP
SCR	Hot and chilled water, boiler feed, condensate return, glycols and solar thermal fluids.
SCRI/SCRN	Deionized, demineralized and distilled water. Brackish water and other liquids unsuitable for contact with iron or copper alloys. (Consult manufacturer for specific liquid compatibilities.)

4. CHECKING OPERATING CONDITION:

4.1 Fluid Temperatures:

PUMP	FLUID TEMPERATURES
SCR(I)(N) 1s, 3, 5, 10, 15, and 20	-4 to +248 °F (-20 to +120 °C)
SCR(N) 32, 45, 64, and 90	-22 to +248 °F (-30 to +120 °C)
SCR(N) 120 and 150(up to 60 hp)	-22 to +248 °F (-30 to +120 °C)
SCR(N) 120 and 150(75 and 100 hp)	+32 to +248 °F (0 to +120 °C)

All motors are designed for continuous duty in +104 °F (+40 °C) ambient air conditions. For higher ambient temperature conditions consult Shakti.

4.2 Minimum Inlet Pressures:

All SCR, SCRI, SCRN	See Page - 25
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4.3 Maximum Inlet Pressures:

PUMP TYPE/CONNECTION	50 HZ STAGES	60 HZ STAGES	MAX. PSI / BAR
SCR, SCRI, SCRN 1s	2 to 36	2 to 36 27	145 / 10 217 / 15
SCR, SCRI, SCRN 1	2 to 36	2 to 36 27	145 / 10 217 / 15
SCR, SCRI, SCRN 3	2 to 29 31 to 36	2 to 15 17 to 25	145 / 10 217 / 15
SCR, SCRI, SCRN 5	3 to 16 18 to 36	2 to 9 10 to 24	145 / 10 217 / 15
SCR, SCRI, SCRN 10	1 to 6 7 to 22	1 to 5 6 to 18	116 / 8 145 / 10

INSTALLATION AND OPERATING INSTRUCTIONS

PUMP TYPE/CONNECTION	50 HZ STAGES	60 HZ STAGES	MAX. PSI/BAR
SCR, SCRI, SCRN 15	1 to 3 4 to 17	1 to 2 3 to 12	116 / 8 145 / 10
SCR, SCRI, SCRN 20	1 to 3 4 to 17	1 2 to 10	116 / 8 145 / 10
SCR, SCRN 32	1-1 to 4 5-2 to 10 11 to 14	1-1 to 2 3-2 to 6 7-2 to 11-2	58 / 4 145 / 10 217 / 15
SCR, SCRN 45	1-1 to 2 3-2 to 5 6-2 to 13-2	1-1 to 1 2-2 to 3 4-2 to 8-1	58 / 4 145 / 10 217 / 15
SCR, SCRN 64	1-1 to 2-2 2-1 to 4-2 4-1 to 8-1	1-1 1 to 2-1 2 to 5-2	58 / 4 145 / 10 217 / 15
SCR, SCRN 90	1-1 to 1 2-2 to 3-2 3 to 6	1-1 to 1 2-2 to 4-1	58 / 4 145 / 10 217 / 15
SCR, SCRN 120	1 to 2-1 2 to 5-1 6-1 to 7	1-1 to 1 2-2 to 3 4-1 to 5-2	145 / 10 217 / 15 290 / 20
SCR, SCRN 150	1-1 to 1 2-1 to 4-1 5-2 to 6	1-1 1 to 2 3-2 to 4-2	145 / 10 217 / 15 290 / 20

4.4 Maximum Operating Pressures:

PUMP TYPE	STAGES	MAXIMUM PERMISSIBLE OPERATING PRESSURE MAX. BAR
SCR, SCRI, SCRN 1s	All	25
SCR, SCRI, SCRN 1	All	25
SCR, SCRI, SCRN 3	All	25
SCR, SCRI, SCRN 5	All	25
SCR, SCRI, SCRN 10	10-1 to 10-16	16
SCR, SCRI, SCRN 10	10-17 to 10-22	25
SCR, SCRI, SCRN 15	15-1 to 15-10	16
SCR, SCRI, SCRN 15	15-12 to 15-14	25
SCR, SCRI, SCRN 20	20-1 to 20-10	16
SCR, SCRI, SCRN 20	20-12 to 20-17	25

INSTALLATION AND OPERATING INSTRUCTIONS



PUMP TYPE	STAGES	MAXIMUM PERMISSIBLE OPERATING PRESSURE MAX. BAR
SCR, SCRN 32	32-1-1 to 32-7	16
SCR, SCRN 32	32-8-2 to 32-14	30
SCR, SCRN 45	45-1-1 to 45-5	16
SCR, SCRN 45	45-6-2 to 45-11	30
SCR, SCRN 45	45-12-2 to 45-13-2	33
SCR, SCRN 64	64-1-1 to 64-5	16
SCR, SCRN 64	64-6-2 to 64-8-1	30
SCR, SCRN 90	90-1-1 to 90-4	16
SCR, SCRN 90	90-5-2 to 90-6	30
SCR, SCRN 120	All	30
SCR, SCRN 150	All	30

5. Handling Correct procedure of handling



Warning

Do not use the lifting eyes of the motors of the SCR, SCRI, SCRN, 1, 3, 5, 10, 15 and 20 pumps for lifting the entire pump.

When lifting the entire pump with motor, follow these instructions:

- Pump with motor sizes 0.37 - 7.5 kW:
Lift the pump in the motor flange by means of straps or the like.
- Pump with motor sizes 11-75 kW:
Lift the pump by means of the motor eyebolts.

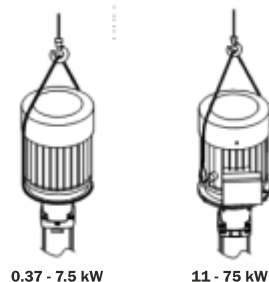


Fig. 1 Correct procedure of handling

INSTALLATION AND OPERATING INSTRUCTIONS

6. INSTALLING THE PUMP:



WARNING : Do not energize pump until properly installed.

6.1 Pump Location : The pump should be located in a dry, well-ventilated area which is not subject to freezing or extreme variation in temperature. Care must be taken to ensure the pump is mounted at least 6 inches (150 mm) clear of any obstruction or hot surfaces. The motor requires an adequate air supply to prevent overheating and adequate vertical space to remove the motor for repair. For open systems requiring suction lift the pump should be located as close to the water source as possible to reduce piping losses.

6.2 Foundation : Concrete or similar foundation material should be used to provide a secure, stable mounting base for the pump. See table of bolt hole center line dimensions for the various pump types. Secure the pump to the foundation using all four bolts and shim pump base to assure the pump is vertical and all four pads on the base are properly supported (uneven surfaces can result in pump base breakage when mounting bolts are tightened).

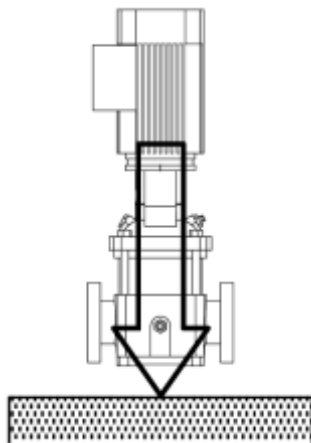


Fig. 2 Correct Installation

INSTALLATION AND OPERATING INSTRUCTIONS

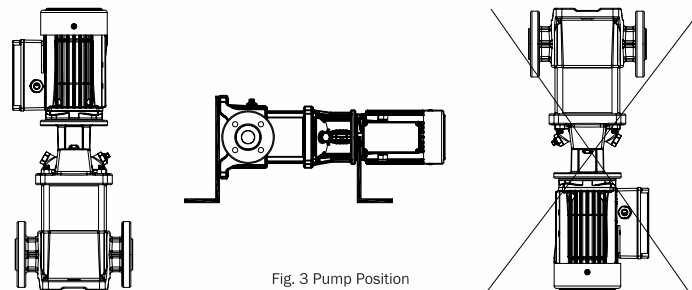


Fig. 3 Pump Position

The pump can be installed vertically or horizontally; see fig. 3. Ensure that an adequate supply of cool air reaches the motor cooling fan. The motor must never fall below the horizontal plane. Arrows on the pump base show the direction of flow of liquid through the pump. To minimize possible noise from the pump, it is advisable to fit expansion joints on either side of the pump and anti-vibration mountings between the foundation and the pump.

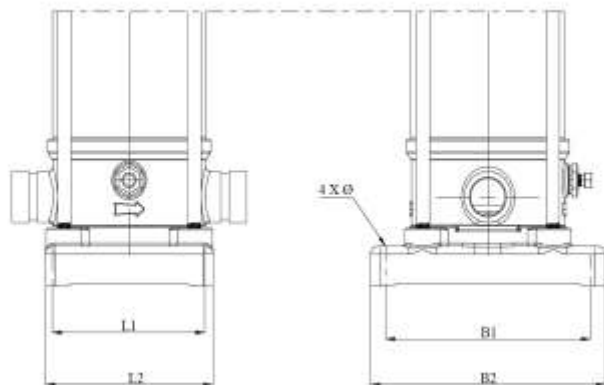
NOTE : Care should be taken to ensure that the vent plug is located in the uppermost position.

Isolating valves should be fitted either side of the pump to avoid draining the system if the pump needs to be cleaned, repaired or replaced.

INSTALLATION AND OPERATING INSTRUCTIONS

6.3 Pump Mounting Position

SCRI /SCRN Mounting Position

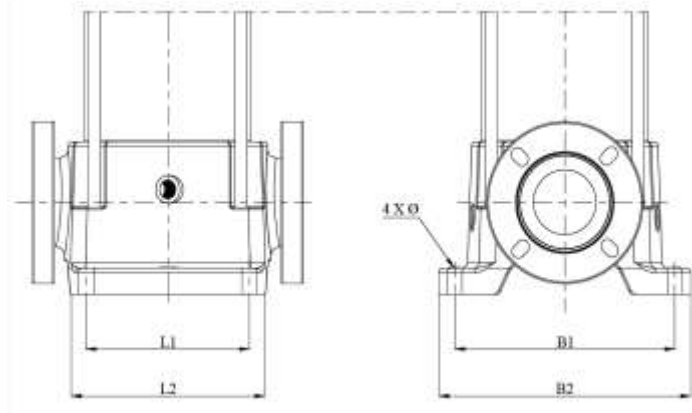


MODELS	L1	L2	B1	B2	Ø
SCRI/SCRN - 1,3&5	100	150	180	210	13
SCRI/SCRN -10	120	200	215	248	13
SCRI/SCRN - 15 & 20	130	200	215	243	13
SCRI/SCRN - 32	170	226	239	298	14
SCRI/SCRN - 45 & 64	190	251	270	332	14
SCRI/SCRN - 90	205	264	276	349	14
SCRI/SCRN - 120 & 150	275	330	380	446	18

INSTALLATION AND OPERATING INSTRUCTIONS

Mounting Position

SCR Mounting Position



MODELS	L1	L2	B1	B2	Ø
SCR - 1,3&5	100	154	186	220	13
SCR -10	120	187	215	246	13
SCR - 15 & 20	130	187	215	243	13
SCR - 32	170	245	239	298	14
SCR - 45 & 64	190	270	270	332	14
SCR - 90	205	282	276	349	14
SCR - 120 & 150	275	330	380	446	18

INSTALLATION AND OPERATING INSTRUCTIONS

6.3 Pump Mounting:

WARNING: SCR, SCRI, SCRN pumps are shipped with covered suction and discharge. The covers must be removed before the final pipe flange to pump connections are made.

6.3.1 Recommended Installation Torques:

MODEL	RECOMMENDED FOUNDATION TORQUE(NM)	RECOMMENDED FLANGE TORQUE(NM)
SCR, SCRI, SCRN1s/1/3/5	40	50-60
SCR, SCRI, SCRN 10/15/20	50	60-70
SCR, SCRN32/45/64/90/120/150	70	70-80

6.4 Suction Pipe: The suction pipe should be adequately sized and run as straight and short as possible to keep friction losses to a minimum (minimum of four pipe diameters straight run prior to the suction flange). Avoid using unnecessary fittings, valves or accessory items. Butterfly or gate valves should only be used in the suction line when it is necessary to isolate a pump because of a flooded suction condition. This would occur if the water source is above the pump; see fig. 4 and fig.5 Flush piping prior to pump installation to remove loose debris.

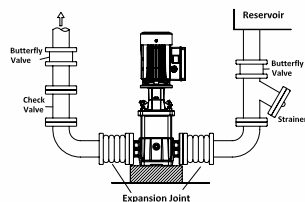


Fig. 4 Flooded suction

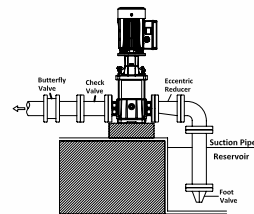


Fig. 5 Suction lift

6.5 Minimum Suction Pipe Sizes : The following recommended suction pipe sizes are the smallest sizes which should be used with any specific SCR pump type. The suction pipe size should be verified with each installation to ensure good pipe practices are being observed and excess friction losses are not encountered. High temperatures may require larger diameter pipes to reduce friction and improve NPHSA.

INSTALLATION AND OPERATING INSTRUCTIONS



MODEL	MIN. (in Inches)	SUCTION PIPE SIZE
SCR(I)(N) 1s, 1, 3	1-1/4	Nominal diameter sch 40 pipe
SCR(I)(N) 5	1-1/4	Nominal diameter sch 40 pipe
SCR(I)(N) 10,	1-1/2	Nominal diameter sch 40 pipe
SCR (I) (N) 15-20	2-1/2	Nominal diameter sch 40 pipe
SCR(N) 32	2-1/2	Nominal diameter sch 40 pipe
SCR(N) 45	4	Nominal diameter sch 40 pipe
SCR(N) 64, 90	4	Nominal diameter sch 40 pipe
SCR(N) 120, 150	5	Nominal diameter sch 40 pipe

6.6 Discharge Piping: It is suggested that a check valve and isolation valve be installed in the discharge pipe. Pipe, valves and fittings should be at least the same diameter as the discharge pipe or sized in accordance with good piping practices to reduce excessive fluid velocities and pipe friction losses.

NOTE: Pipe, valves and fittings must have a pressure rating equal to or greater than the maximum system pressure.

Before the pump is installed it is recommended that the discharge piping be pressure checked to at least the maximum pressure the pump is capable of generating or as required by codes or local regulations.

Whenever possible, avoid high pressure loss fittings, such as elbows or branch tees directly on either side of the pump. The piping should be adequately supported to reduce thermal and mechanical stresses on the pump.

Good installation practice recommends the system be thoroughly cleaned and flushed of all foreign materials and sediment prior to pump installation. Furthermore, the pump should never be installed at the lowest point of the system due to the natural accumulation of dirt and sediment.

If there is excessive sediment or suspended particles present, it is advised a strainer or filter be used. Shakti recommends that pressure gauges be installed on inlet and discharge flanges or in pipes to check pump and system performance.

6.7 Nozzle Loads: If not all loads reach the maximum permissible value stated in the forces and moments tables included here with fig. 6, one of these values may exceed the normal limit. Contact Shakti for further information.

Y-direction: Direction of chamber stack
Z-direction: 90° from inlet/outlet
X-direction: Inlet/outlet

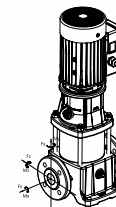


Fig. 6 Nozzle forces and moments

INSTALLATION AND OPERATING INSTRUCTIONS

6.8 Bypass Orifice : A bypass should be installed in the discharge pipe if there is any possibility the pump may operate against a closed valve in the discharge line. Flow through the pump is required to ensure adequate cooling and lubrication of the pump is maintained. See 6.9 Minimum continuous duty flow rates for minimum flow rates. Elbows should be a minimum of 12 inch from the orifice discharge to prevent erosion.

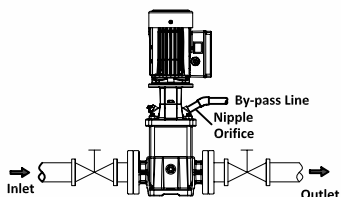


Fig. 7 Optional bypass arrangement

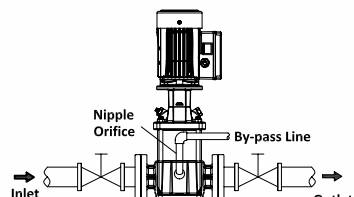


Fig. 8 Optional bypass arrangement for SCR (N) 32, 45, 64, and SCR 90, 120, and 150 only

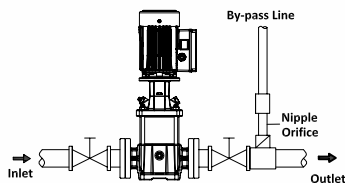


Fig. 9 Recommended bypass arrangement

Flange (in inches)	SCR, SCRI, SCRN	FORCES		
		Y-DIRECTION[LB]	Z-DIRECTION[LB]	X-DIRECTION[LB]
1-1/4	1s to 5	171	263	175
2	10, 15 and 20	303	371	337
2-1/2	32	382	466	422
3	45	461	562	506
4	64 and 90	607	753	674
5 & 6	120 and 150	607	753	674

INSTALLATION AND OPERATING INSTRUCTIONS



Flange (in inches)	SCR, SCRI, SCRN	MOMENTS		
		Y-DIRECTION[LB]	Z-DIRECTION[LB]	X-DIRECTION[LB]
1-1/4	1s to 5	505	715	900
2	10, 15 and 20	738	848	1033
2-1/2	32	793	904	1106
3	45	848	959	1180
4	64 and 90	922	1069	1291
5 & 6	120 and 150	922	1069	1291

6.9 Minimum Continuous Duty Flow Rates:

Pump Type	Min. Flow in GPM at Liquid Temperature			Cool Top
	MIN °F TO 176 °F (MIN °C TO 80 °C)	AT 210 °F (AT 99 °C)	AT 248 °F (AT 120 °C)	AT 356 °F (AT 180 °C)
SCR, SCRI, SCRN 1s	0.5	0.7	12	1.2*
SCR, SCRI, SCRN 1	0.9	1.3	2.3	2.3*
SCR, SCRI, SCRN 3	1.6	2.4	4	4.0*
SCR, SCRI, SCRN 5	3	4.5	7.5	7.5*
SCR, SCRI, SCRN 10	5.5	8.3	14	14*
SCR, SCRI, SCRN 15	9.5	14	24	24*
SCR, SCRI, SCRN 20	11	17	28	28*
SCR, SCRN 32	14	21	35	35*
SCR, SCRN 45	22	33	55	55*
SCR, SCRN 64	34	51	85	85*
SCR, SCRN 90	44	66	110	110*
SCR, SCRN 120	60	90	N/A	N/A
SCR, SCRN 150	75	115	N/A	N/A

* Shakti Cool-Top is only available in the following pump types

Pump Type	1s	1	3	5	10	15	20	32	45	64	90
Standard SCR								*	*	*	*
Standard SCRI	*	*	*	*	*	*	*	*	*	*	*
Standard SCRN	*	*	*	*	*	*	*	*	*	*	*

INSTALLATION AND OPERATING INSTRUCTIONS

6.10 Check Valves:

A check valve may be required on the discharge side of the pump to prevent the pump's inlet pressure from being exceeded.

For example, if a pump with no check valve is stopped because there is no demand on the system (all valves are closed), the high system pressure on the discharge side of the pump will "find" its way back to the inlet of the pump.

If the system pressure is greater than the pump's maximum inlet pressure rating, the limits of the pump will be exceeded and a check valve needs to be fitted on the discharge side of the pump to prevent this condition.

6.11 Temperature Rise: It may sometimes be necessary to stop the flow through a pump during operation.

At shut-off, the power to the pump is transferred to the pumped liquid as head, causing a temperature rise in the liquid.

The result is risk of excess heating of and consequent damage to the pump. The risk depends on the temperature of the pumped liquid and for how long the pump is operating without flow; see the following temperature rise chart.

PUMP TYPE	TIME FOR TEMPERATURE RISE OF 18 °F (10 °C)	
	SECONDS	MINUTES
SCR 1s, 1, 3	210	3.5
SCR 5	240	4.0
SCR 10	210	3.5
SCR 15	150	2.5
SCR 20	120	2.0
SCR 32, 45, 64, 90, 120, 150	60	1.0

6.12 Conditions/reservations:

The listed times are subject to the following conditions/reservations:

- No exchange of heat with the surrounding.
- The pumped liquid is water with a specific heat of 1.0 Btu/lb. °F (4.18 kJ/kg °C).
- Pump parts (chambers, impellers and shaft) have the same thermal capacity as water.
- The water in the base and the pump head is not included.

These reservations should give sufficient safety margin against excessive temperature rise.

The maximum temperature must not exceed the pump maximum rating.

INSTALLATION AND OPERATING INSTRUCTIONS



6.13 Electrical:

WARNING: The safe operation of this pump requires that it be grounded in accordance with the national electrical code and local governing codes or regulations. Connect the ground wire to the grounding screw in the terminal box and then to the ACCEPTABLE grounding point. All electrical work should be performed by a qualified electrician in accordance with the latest edition of the National Electrical Code, local codes and regulations.

6.14 Motor:

Shakti SCR pumps are supplied with heavy-duty 2-pole (3600 rpm nominal), ODP or TEFC, NEMA C frame motors selected to our rigid specifications. Motors with other enclosure types and for other voltages and frequencies are available on a special-order basis.

If you are replacing the pumping unit, but are using a motor previously used on another SCR pump, be sure to read point 10 on page 18. Replacing the motor for proper adjustment of the coupling height.

6.15 Position Of Terminal Box:

The motor terminal box can be turned to any of four positions in steps of 90°.

To rotate the terminal box, remove the four bolts securing the motor to the pump but do not remove the shaft coupling. Turn the motor to the desired location; replace and securely tighten the four bolts; see fig. 9.

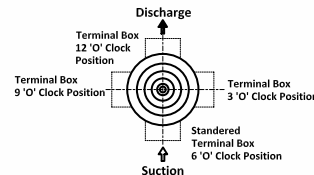


Fig. 10 Motor terminal box positions (top view)

Wire sizes should be based on the current carrying properties of a conductor as required by the latest edition of the National Electrical Code or local regulations. Direct on line (D.O.L.) starting is approved due to the extremely fast run-up time of the motor and the low moment of inertia of the pump and motor. If D.O.L. starting is not acceptable and reduced starting current is required, an auto transformer, resistant starter or soft start should be used. It is suggested that a fused disconnect be used for each pump where service and standby pumps are installed.

6.16 Motor Protection:

6.16.1 Single-Phase Motors:

With the exception of Shakti 3 HP motors which require external protection, single-phase SCR pumps are equipped with multi-voltage, squirrel-cage induction motors with built-in thermal protection.

INSTALLATION AND OPERATING INSTRUCTIONS

6.16.2 Three - Phase Motors :

SCR pumps with three-phase motors must be used with the proper size and type of motor-starter to ensure the motor is protected against damage from low voltage, phase failure, current imbalance and overloads.

A properly sized starter with manual reset and ambient-compensated extra quick trip in all three legs should be used. The overload should be sized and adjusted to the full-load current rating of the motor. Under no circumstances should the overloads be set to a higher value than the full load current shown on the motor nameplate. This will void the warranty.

Overloads for auto transformers and resistant starters should be sized in accordance with the recommendations of the manufacturer.

NOTE : Standard allowable phase imbalance difference is 5%.

7. STARTING THE PUMP FIRST TIME :

7.1 Priming : To prime the pump in a closed system or an open system where the water source is above the pump, close the pump isolation valve(s) and open the priming plug on the pump head; see fig. 11 and fig. 12

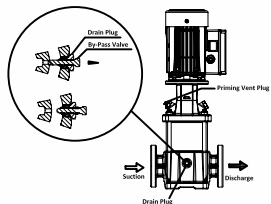


Fig. 11 Plug and valve locations

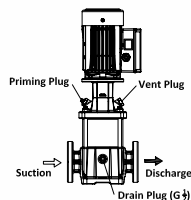


Fig.12 Plug/valve locations SCR(N)
32, 45, 64, 90, 120, 150



Fig. 13 Vent plug

INSTALLATION AND OPERATING INSTRUCTIONS



Fig. 14 Procedure to remove float gauge

Gradually open the isolation valve in the suction line until a steady stream of airless water runs out the priming port. Close the plug and securely tighten. Completely open the isolation valves. In open systems where the water level is below the pump inlet, the suction pipe and pump must be filled and vented of air before starting the pump. Close the discharge isolation valve and remove the priming plug. Pour water through the priming hole until the suction pipe and pump are completely filled with water. If the suction pipe does not slope downward from the pump toward the water level, the air must be purged while being filled. Replace the priming plug and securely tighten.

Follow these steps:

1. Switch power off.
2. Check to make sure the pump has been filled and vented.
3. Every pump set is supplied with float gauge in assembled condition, please ensure the pump float with available float gauge, also check at regular interval.
4. Remove the float gauge (As indicate by arrow) don't run the pump with the float gauge.
5. Rotate the pump shaft by hand to be certain it turns freely.
6. Verify that the electrical connections are in accordance with the wiring diagram on the motor.
7. Switch the power on and observe the direction of rotation. When viewed from the top, the pump should rotate counter-clockwise.
8. To reverse the direction of rotation, first switch OFF the supply power.
9. On three-phase motors, interchange any two power leads at the load side of the starter. On single-phase motors, see connection diagram on nameplate. Change wiring as required.
10. Switch on the power and again check for proper motor rotation. Once rotation has been verified, switch off power again. Do not attempt to reinstall the coupling guards with the motor energized. Replace the coupling guard if the rotation is correct. After guards are in place the power can be reapplied. Note: SCR, SCRI, SCRN 1s to 5: The bypass valve connects the suction and discharge sides of the pump, thus making the filling procedure easier. When the operation is stable, the bypass valve must be closed.

CAUTION :

Motors should not be run unloaded or uncoupled from the pump at any time; damage to the motor bearings will occur. Do not start the pump before priming or venting the pump; see fig. 12. Never operate the pump dry.

INSTALLATION AND OPERATING INSTRUCTIONS

7.2 Operating Parameters :

SCR multi-stage centrifugal pumps installed in accordance with these instructions and sized for correct performance will operate efficiently and provide years of service. The pumps are water-lubricated and do not require any external lubrication or inspection. The motors may require periodic lubrication as noted in point 8. Maintaining the pump's motor.

Under no circumstances should the pump be operated for any prolonged periods of time without flow through the pump. This can result in motor and pump damage due to overheating. A properly sized relief valve should be installed to allow sufficient water to circulate through the pump to provide adequate cooling and lubrication of the pump bearings and seals.

7.3 Pump Cycling : Pump cycling should be checked to ensure the pump is not starting more than the following.

Shakti SMG motors:

- 200 times per hour on 1/3 to 5 hp models
- 100 times per hour on 7 ½ to 15 hp models
- 40 times per hour on 20 to 30 hp models.

Rapid cycling is a major cause of premature motor failure due to increased heat build-up in the motor. If necessary, adjust controls to reduce the frequency of starts and stops.

7.4 Boiler-feed Installations : If the pump is being used as a boiler-feed pump, make sure the pump is capable of supplying sufficient water throughout its entire evaporation and pressure ranges. Where modulating control valves are used, a bypass around the pump must be installed to ensure pump lubrication (see "Minimum Continuous Duty Flow Rates").

7.5 Freeze Protection : If the pump is installed in an area where freezing could occur, the pump and system should be drained during freezing temperatures to avoid damage. To drain the pump, close the isolation valves, remove the priming plug and drain plug at the base of the pump. Do not replace the plugs until the pump is to be used again. Always replace the drain plug with the original or exact replacement. Do not replace with a standard plug. Internal recirculation will occur, reducing the output pressure and flow.

INSTALLATION AND OPERATING INSTRUCTIONS



8. PREVENTATIVE PUMP MAINTENANCE : At regular intervals depending on the conditions and time of operation, the following checks should be made:

1. Pump meets required performance and is operating smoothly and quietly.
2. There are no leaks, particularly at the shaft seal.
3. The motor is not overheating.
4. Remove and clean all strainers or filters in the system.
5. Verify the tripping of the motor overload protection.
6. Check the operation of all controls. Check unit control cycling twice and adjust, if necessary.
7. If the pump is not operated for unusually long periods, the unit should be maintained in accordance with these instructions. In addition, if the pump is not drained, the pump shaft should be manually rotated or run for short periods of time at monthly intervals.
8. To extend the pump life in severe duty applications, consider performing one of the following actions:
 - Drain the pump after each use.
 - Flush the pump, through system, with water or other fluid that is compatible with the pump materials and process liquid.
 - Disassemble the pump liquid components and thoroughly rinse or wash them with water or other fluid that is compatible with the pump materials and process liquid.

9. MAINTAINING THE PUMP'S MOTOR : Warning Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt installation, operation, and maintenance of this equipment.

9.1 Motor Inspection : Inspect the motor at regular intervals, approximately every 500 hours of operation or every three months, whichever occurs first. Keep the motor clean and the ventilation openings clear.

The following steps should be performed at each inspection:

1. Check that the motor is clean. Check that the interior and exterior of the motor is free of dirt, oil, grease, water, etc. Oily vapor, paper, pulp, textile lint, etc. can accumulate and block motor ventilation. If the motor is not properly ventilated, overheating can occur and cause early motor failure.
2. Use an Ohmmeter ("Megger") periodically to ensure that the integrity of the winding insulation has been maintained. Record the Ohmmeter readings. Immediately investigate any significant drop in insulation resistance.
3. Check all electrical connectors to be sure that they are tight.

INSTALLATION AND OPERATING INSTRUCTIONS

9.2 Motor Lubrication : Electric motors are pre-lubricated at the factory and do not require additional lubrication at start-up. Motors without external grease fittings have sealed bearings that cannot be re-lubricated. Motors with grease fittings should only be lubricated with approved types of grease. Do not over-grease the bearings. Over-greasing will cause increased bearing heat and can result in bearing/motor failure. Do not mix petroleum grease and silicon grease in motor bearings.

Bearing grease will lose its lubricating ability over time, not suddenly. The lubricating ability of a grease (over time) depends primarily on the type of grease, the size of the bearings, the speed at which the bearings operate and the severity of the operating conditions.

Good results can be obtained if the following recommendations are used in your maintenance program. It should also be noted that pumps with more stages, pumps running to the left of the performance curve, and certain pump ranges may have higher thrust loads. Pumps with high thrust loads should be greased according to the next service interval level.

10. REPLACING THE MOTOR : If the motor is damaged due to bearing failure, burning or electrical failure, the following instructions detail how to remove the motor for replacement.

CAUTION : It must be emphasized that motors used on SCR pumps are specifically selected to our rigid specifications. Replacement motors must be of the same frame size, should be equipped with the same or better bearings and have the same service factor. Failure to follow these recommendations may result in premature motor failure.

10.1 Disassembly : For disassembly, proceed as follows:

1. Turn off and lock out power supply. The power supply wiring can now be safely disconnected from the motor wires. Remove the coupling guards. Note: SCR 1s, 1, 3, 5, 10, 15, and 20: do not loosen the three shaft seal securing allen screws.
2. Using the proper metric Allen wrench, loosen the four cap screws in the coupling. Completely remove coupling halves. On SCR1s-SCR20, the shaft pin can be left in the pump shaft. SCR(N)32, 45, 64, 90, 120, and 150 do not have a shaft pin.
3. With the correct size wrench, loosen and remove the four bolts which hold the motor to the pump end.
4. Lift the motor straight up until the shaft has cleared the motor stool. shaft seal spacer and hang it on inside of coupling guard.

INSTALLATION AND OPERATING INSTRUCTIONS



10.2 Assembly : For assembly, proceed as follows:

1. Remove key from motor shaft, if present, and discard.
2. Thoroughly clean the surfaces of the motor and pump end mounting flange. The motor and shaft must be clean of all oil/grease and other contaminants where the coupling attaches. Set the motor on the pump end.
3. Place the terminal box in the desired position by rotating the motor.
4. Insert the mounting bolts, then diagonally and evenly tighten:
 - for M6, M8 bolts (1/2 to 2 hp), torque to 17 ft-lb
 - for M8, M10, M12 bolts (3 to 40 hp) torque to 30 ft-lb
 - for M12, M16 bolts (50 - 100 hp) torque to 59 ft-lb
 - follow instructions for particular pump model in sections 9.2.1 Torque specifications for SCR 1s, 1, 3, and 5 through 9.2.3 SCR (N) 32, 45, 64, 90, 120, and 150.

10.2.1 Torque specifications for SCR 1s, 1, 3, and 5 : Insert shaft pin into shaft hole. Reinstall the coupling halves onto shaft and shaft pin. Reinstall the coupling screws and leave loose. Check that the gaps on either side of the coupling are even, and that the motor shaft is centered in the coupling half.

Tighten the screws to the correct torque; see torque specifications table below.

Torque specifications SCR (I) (N) 1s, 1, 3, 5, 10, 15, and 20	
Coupling bolt size	Min. torque
M6	13 Nm
M8	31 Nm
M10	62 Nm

10.2.2 SCR 10, 15 and 20 : Insert shaft pin into shaft hole. Insert plastic shaft seal spacer beneath shaft seal collar. Reinstall the coupling halves onto shaft and shaft pin. Reinstall the coupling screws and leave loose. Check that the gaps on either side of the coupling are even and that the motor shaft is centered in the coupling half. Tighten the screws to the correct torque. Remove plastic shaft seal spacer and hang it on inside of coupling guard.

INSTALLATION AND OPERATING INSTRUCTIONS

Using a large screwdriver, raise the pump shaft by placing the tip of the screwdriver under the coupling and carefully elevating coupling to its highest point; see fig. 15.

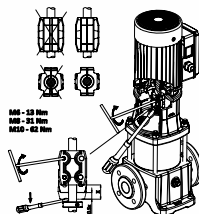


Fig. 15 Coupling adjustment SCR pump

NOTE: The shaft can only be raised approximately 0.20 in (5mm). Now lower the shaft halfway back down the distance you just raised it and tighten the coupling screws (finger tight) while keeping the coupling separation equal on both sides. When the screws are tight enough to keep the couplings in place, then torque the screws evenly in a criss-cross pattern.

- Note the clearance below the coupling
- Raise the coupling higher, as far as it will go
- Lower it halfway back down($\frac{1}{2}$ the distance you just raised it)
- Tighten screws (see torque specifications below)

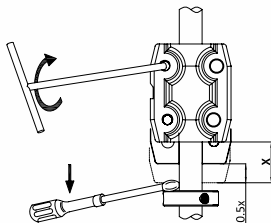


Fig. 16 Coupling adjustment clearance SCR pump

10.2.3 SCR(N) 32, 45, 64, 90, 120, and 150:

1. Make sure shaft is all the way down. Tighten the set screws on the mechanical seal.

INSTALLATION AND OPERATING INSTRUCTIONS

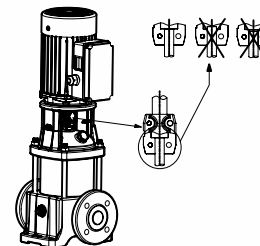


Fig. 17 Coupling adjustment SCR(N) 32, 45, 64, 90, 120, and 150

2. Fit the coupling on the shaft so that the top of the pump shaft is flush with the bottom of the clearance chamber in the coupling; see fig. 17.
3. Lubricate the coupling screws with an anti-seize and lubricating compound. Tighten the coupling screws (finger tight) while keeping the coupling separation equal on both sides and the motor shaft centered in the coupling half.
4. When the screws are tight enough to keep the couplings in place, then torque the screws evenly in a crisscross pattern.
5. Torque coupling screws to 84Nm (75 and 100 hp motors to 100Nm).
6. Check to see that the gaps between the coupling halves are equal. Loosen and readjust, if necessary.
7. Be certain the pump shaft can be rotated by hand. If the shaft cannot be rotated or it binds, disassemble and check for misalignment.
8. Prime the pump.
9. Follow the wiring diagram on the motor label for the correct motor wiring combination which matches your supply voltage. Once this has been confirmed, reconnect the power supply wiring to the motor.
10. Check the direction of rotation, by bump-starting the motor. Rotation must be left to right (counter-clockwise) when looking directly at the coupling.
11. Shut off the power, then re-install the coupling guards. After the coupling guards have been installed the power can be turned back on.

11. PARTS LIST : For each SCR pump model Shakti offers an extensive Parts List and diagram of part used in that pump and is recommended to have on hand for future maintenance. In addition, the listings also provide information about prepackaged Service Kits for those pump components most likely to exhibit wear over time, as well as the complete Impeller Stack needed to replace the "guts" of each model.

INSTALLATION AND OPERATING INSTRUCTIONS

12. DIAGNOSING SPECIFIC PROBLEMS :

PROBLEM	POSSIBLE CAUSE	REMEDY
The pump does not run.	1. No power at motor.	Check voltage at motor terminal box. If no voltage at motor, check feeder panel for tripped circuits and reset circuit.
	2. Fuses are blown or circuit breakers are tripped.	Turn off power and remove fuses. Check for continuity with ohmmeter. Replace blown fuses or reset circuit breaker. If new fuses blow or circuit breaker trips, the electrical installation, motor and wires must be checked.
	3. Motor starter overloads are burned or have tripped out.	Check for voltage on line and load side of starter. Replace burned heaters or reset. Inspect starter for other damage. If heater trips again, check the supply voltage and starter holding coil.
	4. Starter does not energize.	Energize control circuit and check for voltage at the holding coil. If no voltage, check control circuit fuses. If voltage, check holding coil for shorts. Replace bad coil.
	5. Defective controls.	Check all safety and pressure switches for operation. Inspect contacts in control devices. Replace worn or defective parts or controls.
	6. Motor is defective.	Turn off power and disconnect wiring. Measure the lead to lead resistances with ohmmeter (RX-1). Measure lead to ground values with ohmmeter (RX-100K). Record measured values. If an open or grounded winding is found, remove motor and repair or replace.
	7. Defective capacitor (single-phase motors).	Turn off power and discharge capacitor. Check with ohmmeter (RX-100K). When the meter is connected to the capacitor, the needle should jump towards 0 ohms and slowly drift back to infinity (h). Replace if defective.

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PROBLEM	POSSIBLE CAUSE	REMEDY
The pump runs but at reduced capacity or does not deliver water.	8. Pump is bound.	Turn off power and manually rotate pump shaft. If shaft does not rotate easily, check coupling setting and adjust as necessary. If shaft rotation is still tight, remove pump and inspect. Disassemble and repair.
	1. Wrong rotation.	Check wiring for proper connections. Correct wiring.
	2. Pump is not primed or is airbound.	Turn pump off, close isolation valve(s), remove priming plug. Check fluid level. Refill the pump, replace plug and start the pump. Long suction lines must be filled before starting the pump.
	3. Strainers, check or foot valves are clogged.	Remove strainer, screen or valve and inspect. Clean and replace. Reprime pump.
	4. Suction lift too large.	Install compound pressure gauge at the suction side of the pump. Start pump and compare reading to performance data. Reduce suction lift by lowering pump, increase suction line size or removing high friction loss devices.
	5. Suction and/or discharge piping leaks.	Pump spins backwards when turned off. Air in suction pipe. Suction pipe, valves and fittings must be airtight. Repair any leaks and retighten all loose fittings.
	6. Pump worn.	Install pressure gauge, start pump, gradually close the discharge valve and read pressure at shutoff. Convert measured pressure (in psi) to head (in feet): (Measured psi x 2.31 ft/psi = ____ ft). Refer to the specific pump curve for shutoff head for that pump model. If head is close to curve, pump is probably OK. If not, remove pump and inspect.

INSTALLATION AND OPERATING INSTRUCTIONS

PROBLEM	POSSIBLE CAUSE	REMEDY
	7. Pump impeller or guide vane is clogged.	Disassemble and inspect pump passageways. Remove any foreign materials found.
	8. Incorrect drain plug is installed.	If the proper drain plug is replaced with a standard plug, water will recirculate internally. Replace with proper plug.
	9. Improper coupling setting.	Check/reset the coupling; see page 18.
Pump cycles too much	1. Pressure switch is not properly adjusted or is defective.	Check pressure setting on switch and operation. Check voltage across closed contacts. Readjust switch or replace if defective.
	2. Level control is not properly adjusted or is defective.	Check setting and operation. Readjust setting (refer to level control manufacturer's data). Replace if defective.
	3. Insufficient air charging or leaking tank or piping.	Pump air into tank or diaphragm chamber. Check diaphragm for leak. Check tank and piping for leaks with soap and water solution. Check air to water volume. Repair as necessary.
	4. Tank is too small.	Check tank size and air volume in tank. Tank volume should be approximately 10 gallons for each gpm of pump capacity. The normal air volume is 2/3 of the total tank volume at the pump cut-in pressure. Replace tank with one of correct size.
	5. Pump is oversized.	ports. Start and run pump under normal conditions, record gauge readings. Convert psi to feet (Measured psi x 2.31 ft/psi = ____ ft) Refer to the specific pump curve for that model, ensure that total head is sufficient to limit pump delivery within its design flow range. Throttle pump discharge flow if necessary.

INSTALLATION AND OPERATING INSTRUCTIONS



13. MINIMUM INLET PRESSURE - NPSH

The maximum suction lift "H" in metres head can be calculated as follows:

$$H = P_b \times 10.2 - NPSH - H_f - H_v - H_s$$

P_b = Barometric pressure in bar. (Barometric pressure can be set to 1 bar.)

In closed system P_b indicates the system pressure in bar.

NPSH = Net Positive Suction Head in metres head

H_f = Friction loss in suction pipe in metres head at the highest flow pump will be delivering.

H_v = Vapour pressure in metres head

t_m = Liquid temperature.

H_s = Safety margin = minimum 0.5 metres head.

If the calculated "H" is positive, the pump can operate at a suction lift of maximum "H" metres head.

If the calculated "H" is negative, an inlet pressure of minimum "H" metres head is required.

There must be a pressure equal to the calculated "H" during operation

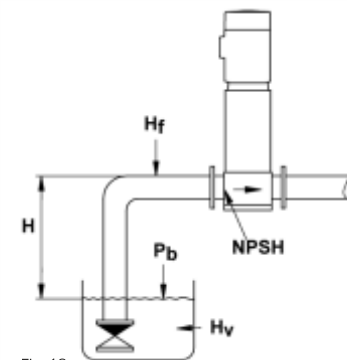
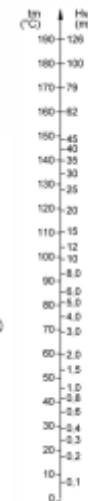
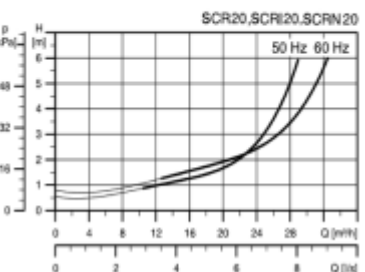
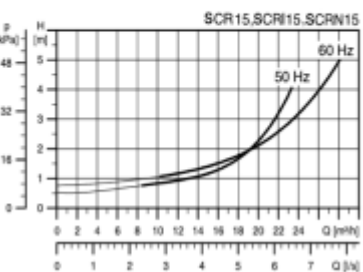
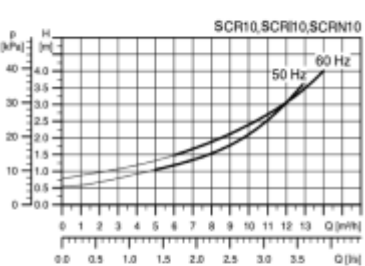
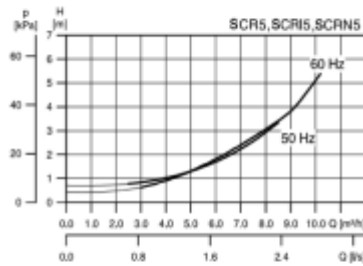
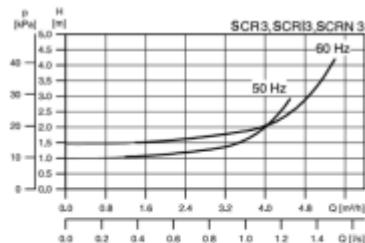
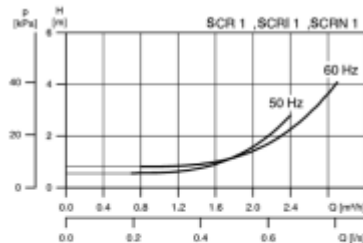


Fig. 18

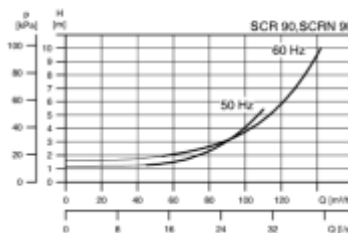
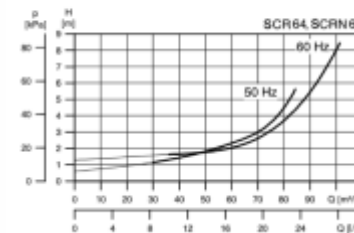
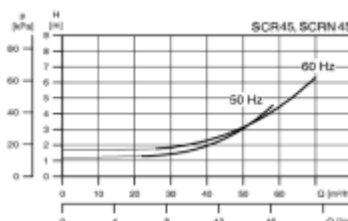
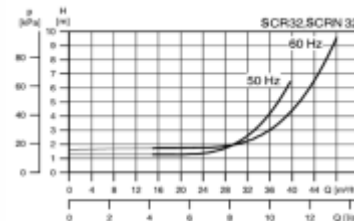


INSTALLATION AND OPERATING INSTRUCTIONS

NPSH Curve



INSTALLATION AND OPERATING INSTRUCTIONS



Symbols used in this document



Warning : If these safety instructions are not observed, it may result in personal injury.



Warning : If these instructions are not observed, it may lead to electric shock with consequent risk of serious personal injury or death.



Caution : If these safety instructions are not observed, it may result in malfunction or damage to the equipment.



Note : Notes or instructions that make the job easier and ensure safe operation.

INSTALLATION AND OPERATING INSTRUCTIONS

WARRANTY CERTIFICATE

Dear Customer,
Congratulation, for purchasing our product.

Pump and Motor are warranted against defects in workmanship and material under normal use, service & specified duty conditions. We provide one time warranty service for twelve months from the date of purchase by the first user.

Shakti Pumps (India) Ltd warrants this product to be free from damage/ defects in material and workmanship under normal use and service for Twelve Months from the date of purchase by the first user. The user shall produce valid and original copy of invoice for availing warranty. The user shall carry defective pump set to nearest authorized service center

This warranty does not cover any loss or damage/ defect of any nature resulting from wrong product selection/ improper installation or installation by unauthorized/ untrained person/ sandy condition/ dry running and improper use of the pump sets.

The warranty also does not cover consequential losses/ damages arising due to failure of pump/ motor.

No warranty will be provided on mechanical seal, rubber parts, fasteners, cables in pump, motor / pump sets. our obligation is limited t to recycling or repairing or replacing product/ parts ex-factory. Equipment for repairs should be returned free of cost to us.

The forgoing is subject to the provision that the user does not open the unit and make any change or repair without prior approval of authorized service center during the warranty period.

This warranty excludes every condition whether statutory or otherwise, whatsoever not herein expressly set out.

Customer name:Customer's phone:.....

Customer Address:

Invoice number:Invoice date:.....

Model Name:Model Serial Number:.....

Dealer's Name:Dealer's phone:.....

Dealer's Address:.....

APPROVED BY:

DATE OF ISSUE

17 - 05 - 2016



INSTALLATION AND OPERATING INSTRUCTIONS

INSTALLATION REPORT

Customer's Name: - _____

Customer's Address: - _____

Customer's Ph. No.: _____

Dealer's Name: - _____

Dealer's Address: _____

Dealer's Ph. No. _____

Pump Model:- _____ S.L.No: _____

Project/Application: _____

Pressure In Kg:- _____ Flow in m³/hr: _____

Liquid:- _____ Temp.: _____

Voltage:- _____ Current: _____

Packing Condition:- _____

Remarks: _____

Date:- _____

Customer's Signature

BOOK-POST

SHAKTI PUMPS (INDIA) LIMITED

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Stamp

