

SPECIFICATIONS
&
SPECIAL CONDITIONS
FOR
INSTALLATION OF
MACHINERY

WATER SUPPLY & SANITATION
DEPARTMENT PUNJAB

PUMPING SET

SPECIFICATION OF SUBMERSIBLE PUMPING SET

Electric driven Submersible pumping set for pumping clear water conforming to IS 8034-1989/relevant ISO Standard, capable of delivering -----LPM against a head of m at duty point. It should also be capable of operating at various other specific operating conditions as described in the following paragraphs:

The submersible pumping set should conform to performance tests as per IS 8034-1989 with latest amendment. The unit will consist of a submersible pump and a submersible motor with shafts connected by a sleeve and operates beneath the surface of water. Maintenance-free pump set should be suspended vertically from rising main. The pumps will be multistage with radial or mixed flow impellers. Between pump and motor there will be suction casing. A non return valve should be fitted to the pump discharge. Submersible motor should be water filled, water lubricated squirrel cage type. The axial thrust generated by the pump is absorbed by thrust bearing fitted at the bottom of the motor. The diaphragm below the thrust bearing should be provided to absorb the over pressure which will result by thermal expansion of water filled or when the temperature of the winding rises, this will save the burning/jamming of motor pump set thus increasing the life and saving money to the department. Radial seal shall be provided to avoid mixing well water with the fill water. The pump should be fitted dynamically balance enclosed type impeller. Each impeller shall be balanced dynamically to grade of G 6.3 (6.3mm/s). The pump shaft shall be guided by bearing provided in each stage bowl & in the suction gland discharge casing. The surface finish of shaft or of the protecting sleeves should be 0.75 micron Ra Max. The inlet passage of the suction casing shall be stream lined to avoid eddies. The suction case shall be fitted with a strainer of corrosion resistant material. Suitable sand guard shall be provided just above the suction case bearing to prevent the entry of foreign material into suction case. The pump should be provided with the non return valve above the pump discharge case with standard flanged connection. The individual casting part or pump as a whole in assembled condition should be able to withstand a hydrostatic pressure of 1.5 time maximum discharge pressure. The gaskets & seals used shall conform to I.S. 5120-1968 or latest. The cable clamp of adequate size be supplied for fixing submersible cables to the rising main pipes.

The pump shall be directly coupled to a submersible motor. The submersible motor shall be squirrel cage induction motor conforming to IS 9283-1979 or latest. It shall be capable of delivering rated output with.

- a) The terminal voltage differing from rated voltage of 415V by +6% and -15%
- b) The frequency differing from its rated value of 50 Hz by not more than $\pm 3\%$
- c) Any combination of (a) and (b)

Both pump and motor shall run at 2900 RPM at rated frequency and Voltage. Insulation for winding wire should be 'F'. The water lubricated thrust bearing should be of adequate size to

withstand the weight of all rotating parts as well as the imposed hydraulic thrust. The motor shall be protected by means of cable glands, rubber seals etc. from ingress of bore well water, sand and other foreign material. The motor shall be provided with breathing attachment like bellows, diaphragm etc. to compensate the volumetric variation due to change in the temperature. The motor shall be made of corrosion resisting material or suitable materials to resist corrosion under normal conditions. The rotor shall be provided with shaft protecting sleeves having a surface finish of 0.75 micron Ra Max.

The efficiency of submersible pump shall be guaranteed to specified point of rating only i.e duty point & may not be guaranteed to cover the performance of the pump under condition varying there from nor for a sustained performance for any period of time. The pump discharge may be guaranteed for the range of head between - 25 & + 10% of the rated head when the rated head is 30 meters or above. If the rated head is below 30 meters the limits of operation shall be from - 25% to 25% or ± 3 meters whichever is less. **The H.P. of motor shall be minimum 15% in the excess of maximum HP required under all heads of working.** Performance guarantees shall be based on laboratory tests corrected for field performance so as to ensure that rated current of the motor does not exceed 1.5 times the motor HP at Standard voltage i.e. 415 V.

The flanged column pipe shall conform table 2 of IS 1239 (Part-1)- 1979 or latest (medium class). *Another CI NRV shall be provided on the column pipe after pressure gauge and water flow meter and before it joins the delivery pipe.* The NRV shall be as per relevant IS standards.

The pump should be at least 2m below the maximum expected drawdown at operating discharge level to compensate for drawdown and change in water tables as the same will go down after continuous running of the same.

MATERIAL OF CONSTRUCTION FOR VARIOUS PUMP SETS :

Sr. No.	Component	Material	Specifications
1.	Bearing Sleeve (As per IS: 8034-1989)	Stainless Steel or Cr Steel or 0 Bronze	12 % Chromium Steel Grade 04 Cr 13, 12 Cr or X20 Cr 13 of ISI 1570 (Part-5) 1985 or latest or AISI 410 grade as per ASTM A 276 or Bronze Grade LTB3, 4 or 5 of IS 318-1981 or latest.
2	Suction Casing	C.I.	FG 200 of IS : 210
3.	Stage Casing	C.I.	FG 200 of IS : 210
4.	Sand Guard	Bronze	LTB2 of IS : 318
5.	Casing wear ring	Bronze	LTB2,3, 4 or 5 of IS 5 318-1981 or latest.

Sr. No.	Component	Material	Specifications
6.	Bearing bush	Leaded Tin Bronze/resin moulded carbon metal/Rubber/rubber lined	LTB 3, 4 or 5 of IS 318-1981 or latest.
7.	Impeller	-do-	LTB2 of IS 318-1981 of latest Glass filled polyphenylene oxide (Modified PPO) Upto 400 LPM as per IS: 8034-1989, if available at the duty point, thereafter bronze
8.	Discharge casing	Cast iron	Grade FG200 of IS 210 of IS 1978 or latest.
9.	Pump bowl/diffuser	-do-	-do-
	Keys	Cr. Steel	AISI-410A of ASTM A-276
11.	Suction casing	Cast Iron	Grade FG - 200 of IS- 210,
12.	Pump shaft	Stainless steel	Stainless steel grade X04 Cr 12, X12 Cr 12 or X20 Cr 13 of IS 6603
13.	Stator pipe	Steel	AISI- 304 as per ASTM A 240
14.	Rotor Shaft	Cr.Steel	AISI 410H of ASTM A 276
15.	Diaphragm	Rubber	Non toxic, with stable polymers synthetic aging minimum 10 years without replacement of NB-60 grade
16.	Thrust bearing plate	C.I. +Carbon above 6" /Steel + Carbon up to 6"	FG 200 of IS 210/ AISI 410 of ASTM A 276
17.	Coupling Sleeve	Chromium Steel	As per relevant IS/AISI;
18.	Thrust bearing housing	Cast Iron	FG 200 of IS 210
19.	Thrust bearing segments	Cr. Steel	CA 40 A of ASTM A743
20.	Counter thrust bearing Plate	Bronze	As per relevant IS/AISI;
21.	Stage Sleeve	Cr. Steel/ Bronze	AISI 410 of A276/LTB2 of IS 318
22.	Wearing Ring (Mixed Flow)	Bronze	LTB 4 of IS 318
23.	Valve Body	C.I.	FG 200 of IS 210
24.	Valve Seat	C.I.	FG 200 of IS 210
25.	Valve Spring	Spring Steel	IS 4454
26.	Valve Dish	C.I.	FG 200 of IS 210
27.	Adaptor	C.I.	FG 200 of IS 210
28.	Sand Guard	Bronze	LTB 2 of IS 318
29.	Bearing Segment Carrier	C.I.	IS 210

INFORMATION TO BE FURNISHED BY THE AGENCY PRIOR TO INSPECTION OF MATERIAL (As per IS: 8034-1989)

DETAIL OF PUMP

CODE DESIGNATION OF PUMP

1. METHOD OF LUBRICATION:
2. MINIMUM BORE WELL DIA METER IN MM:
3. NUMBER OF STAGES
4. OUTSIDE DIAMETER OF BOWL
(The max, diameter pump fitted non return valve & max, overall diameter of the pump set including the cable guard)
5. DISCHARGE IN LPM
6. TOTAL HEAD M
7. SPEED IN RPM
8. PUMP INPUT AT DUTY POINT IN KW
9. OVER ALL EFFICIENCY IN %
10. MINIMUM SUBMERGENCE REQUIRED
11. Conformity to the material prescribed above.

DETAILS OF MOTOR

1. RATING IN KW
2. TYPE
(in accordance with IS 9283-1979)
3. DETAILS OF POWER SUPPLY FOR DUTY POINT SELECTION AND TESTING
4. RATED SPEED
5. Operational voltage range

ADDITIONAL INFORMATION

INSTRUCTIONS FOR INSTALLATION & MAINTENANCE, WEIGHT OF PUMP, MOTOR & CABLE & RISING MAIN PIPE FOR A SPECIFIC SETTING

SPECIFICATIONS OF LT ELECTRICAL CONTROL PANEL FOR PROPER OPERATION AND PROTECTION OF SUBMERSIBLE PUMPING SET

GENERAL REQUIREMENTS OF CONTRACT

1.1. This section covers mainly the job requirements before and after the supply of DOL/ closed transition Star-Delta Electrical Control Panel suitable for LT supply i.e. 415VAC, 50Hz, 3Phase, 4 Wire system particularly **suitable for uninterrupted operation even at -25% low voltage conditions of tropical and suitable for Hot and Humid monsoon environment**, with RH up to 95%, 45 degree ambient above which 1% derating upto 50degree rise in ambient and 2% derating per degree above 50degree centigrade ambient, dusty rural areas as per other requirements at sites in state of Punjab.

1.2. Prerequisites before supply of Panel

- i) Submission of drawings
 - a) General Arrangement Drawing as per IS:8623 1993
 - b) Single Line Diagram of DOL/Closed Transition Star-Delta as per IS/ANSI codes and symbols
 - c) Bill of Quantities
 - d) Circuit diagram will be submitted in minimum A3 size sheet along with the LT Electrical Control Panel For Proper Operation and Protection of Submersible Pumping Set.
 - e) Specifications, makes and quantity of the main components compliant sheet each marked with yes or no if any with proper justification.
- ii) The approval of the drawings by the EIC shall in no way relieve the contractor of contractual obligations or liabilities under the contract or his responsibilities for correctness of dimensions, material of construction, performance etc.
- iii) The contractor will have to use the higher rated equipment as per DNIT even if the drawing is approved of lower rating i.e. the rating can be increased to increase safety factor but cannot be decreased under any clause of terms and conditions.
- iv) If there is further requirement for improvement after the each amendment than contractor shall submit the fresh documents drawings and ratings. No charges whatsoever will be paid for preparing drawings estimates etc.
- v) The contractor shall inform 5 days prior to supply for inspection/inspections to be carried out.
- vi) The contractor will strictly follow Indian Standards (IS: code). If for a particular code for any item is not available than relevant IEC code will be applicable subject to the note at the end of this chapter.

- vii) The products of dual use i.e commercial as well as industrial can be of ISI marked e.g. wires, MCB.
- viii) All the material shall be covered by manufacturers warranty clause. The contractor shall provide the warranty card and test reports from the manufacturer for all the equipments/ machinery.
- ix) The installation should comply following statutory standards:
 - i) Indian Electricity Act, 1910.
 - ii) Indian Electricity Rules, 1956
 - iii) National Electrical Code, 1985
 - iv) The installation confirming to the instructions issued by the o/o Chief Electrical Inspector, Punjab & PSEB with upto date amendments

1.3 GENERAL REQUIREMENTS OF LT ELECTRICAL CONTROL PANEL FOR PROPER OPERATION AND PROTECTION OF SUBMERSIBLE PUMPING SET

- 1.1. Starter Panel board having size as per table given below for DOL/Closed Transition Star-Delta type starters so as to accommodate all the equipments in one enclosure. An independent meter box for housing power & light meter shall be provided as per PSEB requirement/specifications.
- 1.2. Fabricated by cutting, bending, welding etc in neat, symmetrical, aesthetic manner, providing easy access for Repair & Maintenance in clean manner of not less than 16swg CRCA sheet steel epoxy based powder coated with RAL 7032/SG 7032 (Siemens Grey) shade as per IS:5, 1978. All the equipments should be mounted on mounting plate of minimum 14swg or more thickness with 15 mm bend on sides.
- 1.3. The Panel should be dust and vermin proof wherever required & proper sponge neoprene/PU gasketing should be done.
- 1.4. The Panel should be as per low voltage i.e. 415 V AC 50 Hz, 3 Phase 4 wire system switchgear and controlgear assembly conforming to IS 8623:1993 with up to date amendments.
- 1.5. The Starter panel board should comprise of rigid welded structural frames The Starter panel will be complete with removable gland plates with provision of entry and exit of cable from glands duly fixed on the side plates of starter panel.
- 1.6. The mounting of panel will be made on wall four feet from ground level to the bottom of panel.
- 1.7. The board should be matt finished, covers should be rigid in construction wherever required door stiffeners should be used & free from flaws. It shall also be provided with discrete key lock system for every installation/panel.
- 1.8. The panel board should have the flush mounted instruments of 96x96mm bezel or 22.5mm cut out for pilot devices.

1.9. The LED type indicating lamps should be used as per IS:13947-5, 1993 for phases available RYB.

1.10. The Aluminium (Al) busbar should be of electrolytic grade aluminium. The size for a rating should be according to the formula 1mm^2 per 1.2A.

1.11. The SCPD (Short Circuit Protection Device i.e. MCB/MCCB) should be on the incomer side of the Starter control Panel so that in case of fault/ fire/ exigency the starter and subsequently pump could be isolated from Electricity board power supply by operator / attendant.

1.12. Only SCPD should be accessible from the front with door closed. All other devices like contactors, busbars, overload relays, soft starter if used, other protection relays and timers etc should not be accessible with door closed.

- i. Phase unbalance 5-50%
- ii. Phase reversal 01-30sec
- iii. Phase loss within 3 sec
- iv. Locked rotor protection.
- v. Alert setting 50-100% of OC setting.
- vi. Start time delay 01-200 sec
- vii. Trip time delay 1-30sec inverse characteristics
- viii. Trip time delay 0.2-30sec definite minimum time.
- ix. Control voltage 20V AC +/-15%
- X. Digital Ammeter
- xi. Trip cause memory display.
- xii. Range: 0.5-60A without external CTs if used in Phases can be rated upto 100A. 11-960A with external CT.
- xiii. Undercurrent protection range: 0.5A to less than "OC" setting.
- xiv. Time -Current characteristics
 - 0.5A to 10A : Definite/inverse selectable
 - Equal or more than 11A
 - definite (if inverse required, use with external CT)
- xv. Trip cause memory: Last 3 trip, stored regardless power failure.
- xvi. Reset manual /electrical (remote).
- xvii. Fail Safe (self diagnostics). The output relay of 'OL' is energized when control power applied.
- xviii. Power consumption less than 10w.
 - s) Electrostatic discharge IEC61000-4-2 level 3: Air discharge +/-6kv. Contact Discharge: +/-4kv
- xviii. Insulation between casing and circuit over 5 Mohm (DC 500V)
- xix. Dielectric strength -Between casing and circuit 2kv 60 Hz 1min.
 - Between contacts 1 kv 60 Hz 1 min.
 - Between circuits 2kv 60Hz 1min.

1.13. In case the SCPD device is a 25KA, 3 Pole, MCCB suitable for motor duty, it will be fuse less and Cat. A type MCCB as per IS 13947-II:1993 or IEC 947/60947.

- 1.14. All the controls, indications, metering devices/displays of the panel should be on the front side of the panel. The back can be welded.
- 1.15. All the Contactors should be air break type and AC3 duty as per IS13947-IV and of finger proof IP20 protection.
- 1.16. Digital Ammeter and Volt meter shall be provided.
- 1.17. CT operated Electronic overload relay phase connected Overload relay will operate in failsafe mode 0.5-960A only it shall be provided in case any starter other than soft starter is used.
- 1.18. The capacitor(S) will be with minimum 10%THD (Total Harmonic Distortion) in current with test certificates. The capacitors will be used in two ways
- Directly connected to incomer supply for neutralizing transformer magnetization current will be of rating 4 to 5% of KVA rating of transformer.
 - For improvement of PF between 0.90 lag to unity designated as Pump capacitor so that penalties could saved as are imposed by PSEB for low PF time to time. This will also reduce the running cost to the department.
 - Test voltage terminal to case 3KV for 10 sec.
 - Rated for maximum over current 1.5 x rated current.
 - Over voltage 110% of operating Voltage.
- 1.19 The capacitors shall be switched on after the motor has attained the full speed. To attain this separate MCB, Contactor, and timer shall be used for pump capacitor. This is done to avoid :
- To avoid resonance of capacitor with the inductor (Motor) and subsequent damage to Pump Capacitor.
 - To increase the life of switching equipment.
 - The capacitors will be switched through air core six turn reactors to limit the capacitor inrush current.
- 1.20 The capacitors shall be heavy duty as per IS: 13340-1993/ IS: 13341-1992. Agriculture duty type capacitors shall not be used.
- 1.21 The capacitor shall have safety features like pressure disconnection system, self healing type and discharge resistors to discharge capacitor to safe 50V range in 1 minute from rated voltage after switching off.
- 1.22 Peak inrush current shall be upto 140 to 160 times the rated current.
- 1.23 The capacitors shall be 440V rated, 110% tolerance in voltage. Three phase type, tolerance of only 5-10% of capacitance.

- 1.24 The wiring shall be done by 1100V PVC wires as per IS 694:1990 FR type. The class of wire will be class 5 or class 6. The temperature range will be -15degree to 70degree C.
- 1.25 The wire rating will considered as 70% of the rated wire rating as designated by manufacturer.
- 1.26 All the electrical equipment should be able to perform on Line voltage i.e. 415VAC. If any equipment is required to be used on 220VAC than separate step down control transformer be used of 415 to 220V AC.
- 1.27 Over voltage protection relay for fluctuation of 20% and above should be incorporated in the starter.
- 1.28 Starter should in no way operate the system at more than 120% of rated voltage. If required the PSEB should be contacted to reduce the tap of supply transformer.
- 1.29 All the wires should be terminated, crimped with the due size of thimble. No wire should be terminated directly.
- 1.30 All the wiring should have proper ferrules.
- 1.31 Two earth studs one each on LHS and RHS should be provided.
- 1.32 The door hinges should be strong enough to take the load of wiring, instrumentation etc.
- 1.33 Each panel will have discreet lock with key.
- 1.34 ELCB for current leakage protection.
- 1.35 The star delta starter will be closed transition star delta.
- 1.36 Output supply for flow meter shall be provided by providing with 2.5mm² terminal blocks of Connectwell, Wago, Phoenix make.
- 1.37 All the 220V AC machinery, equipments and instruments will be supplied through Neutral Isolation transformer only.

Design tables for different HP rating

Following norms should be observed for the manufacture of the Starter Control panel for the submersible pump set according to the ratings given below:-

Sr.No	Description of component	Rating	Remarks
7.5HP DOL			
1	Contactors	20A/25A	
2	RCBO/ (ELCB+MCB), TPN	32A	'C' curve
3	Capacitor, 440V AC, delta connected	3KVAr	
i)	Contactor	12A	3P
ii)	Timer	0-30seconds	Minimum 1 CO (changeover) for capacitor and Star-delta changeover 2 Nos.
iii)	MCB, TP	16A	C' curve or 1 rating lower for 'D' curve
iv)	PVC, Cu Wire	1.5mm ²	Class 5 or 6
4	Digital Ammeter	0-20/40A/60A, 96x96mm	CT operated
5	Ammeter selector switch	3 phase	
6	Digital Voltmeter	3 Ph., 0-500V AC, 96x96mm	
7	Voltmeter selector switch	3 phase 6/10A	
8	PVC, Cu Wire on incomer / motor side	4mm ²	Class 5 or 6
9	Over Voltage Relay	415VAC	
10	Control Transformer	415VAC/220VAC	
11	Single Phase preventer with one CO contact, Minilec	415V AC	3 Phase
12	Contactors for Phase Corrector	415VAC TP AC3 Duty	2 Nos. Phase corrector
Beyond 7.5HP TO 10HP Closed Transition Star- Delta			
1	Contactors	25A	3 nos. for main, star, delta
2	MCB, TPN	25A	'C' curve
3	Capacitor, 440V AC, delta connected	3KVAr	MPP-S
i)	Contactor	12A	3P
ii)	Timer	0-30seconds	Minimum 1 CO (changeover) for capacitor and Star-delta changeover 2 Nos.
iii)	MCB, TP	16A	C' curve or 1 rating lower for 'D' curve
iv)	PVC, Cu Wire	1.5mm ²	Class 5 or 6

Sr.No	Description of component	Rating	Remarks
4	Digital Ammeter	0-20/40A/60A, 96x96mm	CT operated
5	Ammeter selector switch	3 phase	
6	Digital Voltmeter	3 Ph., 0-500V AC, 96x96mm	
7	Voltmeter selector switch	3 phase 6/10A	
8 (i)	PVC, Cu Wire on incomer	4 mm ²	Class 5 or 6
8 (ii)	PVC, Cu Wire on motor side	2.5 mm ²	Flat
9	Over Voltage Relay	415VAC	
10	Control Transformer	415VAC/220VAC	
11	ELCB	32 A, 100mA, 3P	Industrial range
12	Auto Phase Corrector	25 A/20A, AC3, 4P Contactors	Single Phase preverter with one CO contact, Minilec
13	Contacto & timer for closed transition	20/25A	
14	Resistance for Transition phase	As per requirement	To be given in Tender
15	Dimension	600x600x250mm	
FROM 11 TO20 HP Closed Transition Star- Delta			
1	Contactors	40A	3 nos. for main, star, delta
2	MCCB, TP	60A	25KA
3	Capacitor, 440V AC, delta connected	5KVAR	MPP-S
i)	Contacto	32A	3P
ii)	Timer	0-30seconds	Minimum 1 CO (changeover) for capacitor and Star- delta changeover 2 Nos.
iii)	MCB, TP	32A	C' curve or 1 rating lower for 'D' curve
iv)	PVC, Cu Wire	4mm ²	Class 5 or 6
4	Digital Ammeter	0-40A/60A, 96x96mm	CT operated
5	Ammeter selector switch	3 phase	
6	Digital Voltmeter	3 Phase, 0-500V AC, 96x96mm	
7	Voltmeter selector switch	3 phase 6/10A	
8 (i)	PVC, Cu Wire on incomer	10mm ²	Class 5 or 6
8 (ii)	PVC, Cu Wire on motor side	6mm ²	Flat
9	Over Voltage Relay	415VAC	
10	Control Transformer	415VAC/220VAC	
11	ELCB	63 A, 100mA, 3P	Industrial range
12	Auto Phase Corrector	40 A/20A, AC3, 4P Contactors	Single Phase preverter with one CO contact, Minilec
13	Contacto & timer for closed transition	32A	

Sr.No	Description of component	Rating	Remarks
14	Resistance for Transition phase	As per requirement	To be given in Tender
15	Size	800x800x250mm	
21 to 30 HP Closed Transition Star- Delta			
1	Contactors	50A	3 nos. for main, star, delta
2	MCCB, TP	80A	25KA
3	Capacitor, 440V AC, delta connected	7.5KVAr	
i)	Contactor	40A	3P
ii)	Timer	0-30seconds	Minimum 1 CO for capacitor and Star-delta changeover 2 Nos.
iii)	MCB, TP	32A	C' curve or 1 rating lower for 'D' curve
iv)	PVC, Cu Wire	4mm ²	Class 5 or 6
4	Digital Ammeter	0-40A/60A, 96x96mm	CT operated
5	Ammeter selector switch	3 phase	
6	Digital Voltmeter	3 Ph., 0-500V AC, 96x96mm	
7	Voltmeter selector switch	3 phase 6/10A	
8 (i)	PVC, Cu Wire on incomer	16 mm ²	Class 5 or 6
8 (ii)	PVC, Cu Wire on motor side	10 mm ²	Flat
9	Over Voltage Relay	415VAC	
10	Control Transformer	415VAC/220VAC	
11	<u>ELCB APPROVED MAKES AND SPECIFICATION</u>	100 A, 100mA, 3P	Industrial range
12	Auto Phase Corrector	65 A, AC3, 4P Contactors	Single Phase preventer with one CO contact, Minilec
13	Contactor & timer for closed transition	50A	
14	Resistance for Transition phase	As per requirement	To be given in Tender
15	Size	900x900x250mm	

Following makes should be used for the manufacturing of Electrical Control Panels.

Submersible set	Calama, KSB, WPIL, SEEREX, Cromton
MCB	It shall have 'C' curve for motor / 'C' or 'D' curve for capacitors:- Siemens, Legrand, L&T make (upto 10 HP) as per IS:8898.
MCCB	Siemens (India/German), L&T, BCH (Above 10 HP) make as per IS13947-II, 1993.
Contactors	BCH, Siemens (India/German), L&T, Minilec as per IS 13947-IV, 1993
Electronic over-Current Relay	Siemens, BCH, C & S make as per relevant IS code
Timers	Contactors mounted can be used up to 20HP and separate mounted only for above 20HP motors: Siemens, BCH make as per IS13947-IV 1993.
Digital Voltmeter	Suitable for 0-500 V, Class-1 accuracy (i.e. $\pm 1\%$) 96x96 mm : Nippon, Alliance, Enercon make for direct acting indicating instruments as per IS:1248.
Digital Ammeter	Suitable for 5A CT secondary current, Class-1 accuracy (i.e. $\pm 1\%$) 96x96mm : Nippon, Alliance, Enercon make for direct acting indicating instruments as per IS:1248.
CT for Ammeter	Class-1 accuracy (i.e. $\pm 1\%$), 15 VA, 5A CT secondary current : Kappa, Nippon, Alliance, C&S make as per IS:2705.
Selector switch	ammeter & Voltmeter : L&T, Kaycee SG make
Terminal Blocks	Connectwell, Wago, Phoenix
Pilot Devices	(Led Type indicating Lamps) and actuator devices (push Buttons (22.5 mm dia):- Siemens, BCH, C & S (Raas Control), L&T(Ess Bee) make as per . IS 13947-V 1993
PVC flexible class IV/ V Copper Wires Fire Resistant	Polycab, KEI, Finolex make as per IS: 694 1990
THIMBLES	Dowells, Jainsons make.
Digital Soft Starter	BCH, Solocon, Siemens make
Copper Submersible Cable flat	Colour coding RYB:- Finolex, Polycab, KEI & BCH make
Aluminium Armored Cables 4 / 3.5 core	for out door connection if required of PVC/ XLPE with GI armor overall to be buried 1 m BGL covered with sand and B- class bricks.
Earthings	3 complete installation with DG set and 2 earthings for installations without DG set, 4m apart linked by GI strip of 25x6mm, 0.5m BGL. Earthing should be minimum 4 m deep or upto moisture level whichever is higher. Size of GI earthing plate shall be 200x200x6 covered with salt & coke or coal mixture and joined with equipments i.e. starter panel (2 earthing strips) / lighting panel (1 GI wire of minimum 1.5 mm dia) / DG set with canopy(1 earthing strip for alternator, 1 earthing strip for alternator body and canopy) , etc. by 25x6mm strip. The GI pipe of 20 mm i/d from the earthing pit to GI plate. Funnel shall be provided in the watering. Cover of sheet steel of 3mm thickness:

TESTS: The following tests should be performed on the panel board during the inspection at the manufacturer place at the cost of contractor.

1. General Visual Test.
2. High voltage test upto 2 KV for 1 min to determine any leakage or internal cracks in the insulation. While performing this test any electronic component may be disconnected.
3. No load operational test by energizing the panel.

NOTE:-

1. THE FOLLOWING FAMILY CURVE ALONG WITH THE CHARACTERISTICS CURVES SIGNED BY THE MANUFACTURER (not below the rank of REGIONAL MANAGER OF REGIONAL IN CHARGE) be attached with the tender. Photo copy of the same will not be accepted.
 - A. HEAD V/S DISCHARGE CURVE.
 - B. DISCHARGE V/S POWER INPUT CURVE.
 - C. DISCHARGE V/S OVERALL EFFICIENCY CURVE.
2. The inspection of the pump will be carried out at the manufacturers premises by the two representative of the Department.
3. The firm should supply the following information for all the pumping set.

DESCRIPTION	NET EFFECTIVE HEAD	GROSS EFFECTIVE HEAD INCLUDING LOSSES IN PUMPING SET	DISCHARGE	EFF. OF PUMP	COMBINED EFF. OF PUMP & MOTOR	MAX. BHP REQUIRED UNDER ALL HEADS OF OPERATION	BHP required = COL.(7) +15%
1	2	3	4	5	6	7	8
DUTY POINT.							
(-) 25% OF D.P							
+ 10% OF D.P							
+ 25% \pm 3% OF D.P when the head is less than 30m							

TERMS AND CONDITIONS

1. The pipes shall be inspected by two Sub Divisional Engineers of the department. Superintending Engineer shall appoint these Sub Divisional Engineers. One of these Sub Divisional Engineers shall be representative of Engineer in charge and the other shall be independent Sub Divisional Engineers from some other division.
2. The minimum size of the column pipe shall be taken as next size of delivery of pump.
3. Similarly the minimum size of the submersible cable shall be next higher size as depicted in the charts showing the current drawl and required cable size in addition voltage drop during summer season and length of cable from starter to pump set should also be kept in mind.
4. All the material shall be ISI Marked unless otherwise the make some other better make has been approved in these specifications.

SPECIFICATIONS OF HORIZONTAL ELECTRIC DRIVEN CENTRIFUGAL PUMPS (CLEAR WATER/ RAW WATER)

Electric driven horizontal split casing centrifugal Clear water / Raw water pump conforming to IS 6595-1993 (PART-1) capable of delivering -----LPM a against head of m. NPSHA at the inlet of the pump is----- . The Net NPSHA shall be at least 1m. The pump will be coupled to three phase horizontal induction motor through a flexible coupling on a common fabricated base frame. The motor will conform to IS 325-1978 of latest.

SPECIFICATIONS OF HORIZONTAL SPLIT CASING CENTRIFUGAL PUMP.

The pump shall meet the general requirement of IS - 6595-1993. The pump should split horizontally so that by removing the upper half casing and bearing cups, the entire rotating parts can be removed for inspection and repairs without disturbing the pump alignment & other connections. The suction passage shall be in volute & rotating parts shall be dynamically balanced. The casing shall be of robust construction & tested to withstand a hydrostatic test pressure of 1.5 times the maximum discharge pressure. The shaft shall be of sufficient size so as to withstand maximum stresses & vibration developed at high speed.

The pump shaft shall have specially designed stuffing boxes so as to accommodate liberal packing in addition to the split lantern rings. The lantern rings shall be able to seal stuffing boxes against leakage of water when the pump is working under suction lift.

The shaft shall be of tensile steel duly proportioned to transmit the maximum power without undue strain. The shaft be provided with bronze shaft sleeved to protect it from corrosion/abrasive action.

The impeller shall be provided with a pair of Bronze Casing Ring to form a seal against the leakage from the discharge chamber back to the suction.

The impellers should be double entry type.

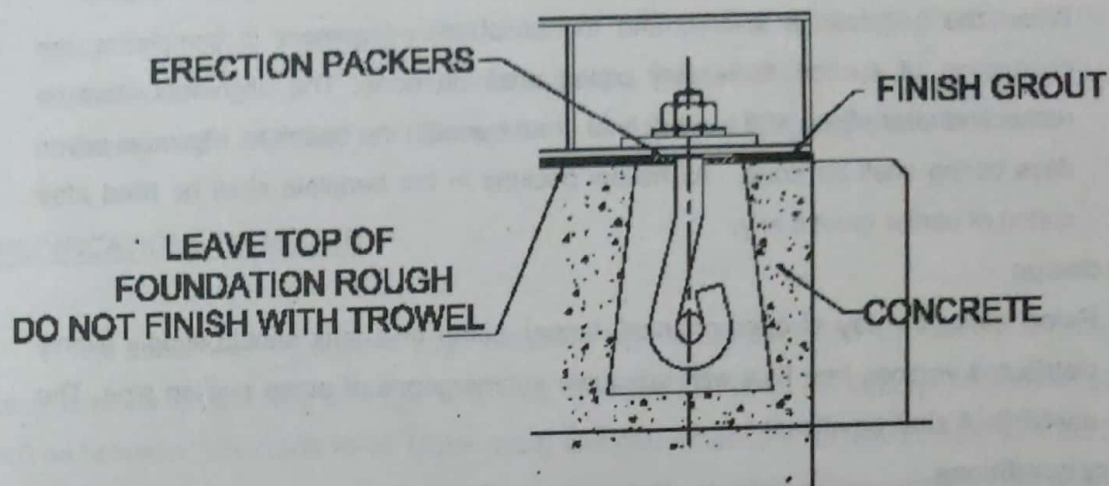
The companion flanges shall be faced & drilled as per ISI specification.

The rotational direction of the pump shall be as per rotational direction of the prime mover.

The pump shall be complete with priming funnel, air-vent cock, grease cups & foundation bolts.

The pump should be coupled to motor with Flexible type Coupling.

Installation:-



Typical installation diagram

The top surface over which the bedplate rests must be left rough to assist in keying of the final grout and sufficient allowance must be made for the thickness of the steel packing and leveling shims beneath the bedplate, the requirement being approximately 25 mm.

To avoid distortion due to uneven surface of foundation the base frame shall be placed over suitable base for leveling. The packer plates should be provided on mother concrete. Minimum requirement being one on each side of foundation bolts. Intermediate packers should be placed at 250 mm center to center. Thickness of MS plates should be between 25 and 35 mm.

Once the packer plates are positioned and leveled, the base frame shall be placed on them. Thereafter foundation bolts shall be inserted through hole in the base frame and insert nut. It shall be ensured that bolts protrude sufficiently to accommodate lock nut and they are centrally disposed in the holes.

Leveling of the bedplates:

a. "I" beam straight edge and an engineer's master level (with accuracy of 0.02 mm / meter) shall be used for leveling the bedplates. I-beam should rest on the machined surfaces of the bedplate, or on the leveling pads if provided.

These machined surfaces where level is being checked must be clean and free from paint, burrs etc.

b. Datum position of base frame shall be checked as given in G.A. The level of the bedplate shall be adjusted by inserting shims between the bed plate and the packer plate until the bed plate is leveled and supported on all the packing plates at the height required for the connection of suction and discharge branches. For checking

the levels across two pads, I-beam type straight edge should be used extensively in conjunctions with engineer's master level. Level should be achieved within 0.05 mm per 250 mm.

When the bedplate is leveled and the satisfactory-alignment is completed, the connection of suction & delivery piping shall be done. The alignment shall be rechecked after piping and run the final grout beneath the bedplate. Minimum seven days curing shall be done. All hollow pockets in the bedplate shall be filled after curing of earlier grout if any.

Intake design

Pump intake by way of open channel, tunnel, sump or a tank should supply evenly distributed vortices free flow with adequate submergence of pump suction pipe. The net NPSHA shall be atleast 1m.

Delivery conditions

A suitable sluice valve should be fitted in the delivery pipe as near to the pump as possible, along with non-return valve.

The performance of the pump at duty point -25% below duty point + 10% above duty point shall be mentioned by the tenderer. The speed of the pump & prime mover to be 1450/ 1500 RPM.

The performance test report as per IS 9137 from the manufacturer that the pump satisfies of required duties shall be submitted at the time of inspection.

Priming

The pump shall be capable of being primed either by running vacuum pump or by external water supply.

The tender must submit the following information before inspection of the material:-

- 1 The rate of flow of pump and total head of pump.
- 2 NPSH required at various operating conditions with respect to NPSHA available at site with the size & length of inlet pipes, specials etc.
- 3 The power observed, efficiency of the pump, combined efficiency with prime mover.
- 4 The performance curves of the pumps.
- 5 The Routine/Type test certificate from any Govt. recognized laboratory with reference to the material of the pump components.
- 6 Authorization certificate required to be submitted along with the tender from the Approved Makes manufacturers of pumps.

Routine test certificate of the motors offered.

MATERIAL OF COMPOSITION OF DIFFERENT COMPONENTS OF PUMP

Impeller	:	Bronze	:	Grade LTB2 of IS 318-1981
Delivery Casing	:	Cast Iron	:	Cast Iron FG 260 of IS 210-1978.
Shaft	:	Carbon steel	:	Grade 40c of IS 1570 (Part 2/sec1)1979
Shaft sleeve	:	Stainless Steel	:	Grade SS 410
Casing ring & impeller	:	Bronze	:	Grade LTB5 of IS 318-1981

SPECIFICATIONS OF MOTOR

The motor shall be squirrel cage induction type totally enclosed fan cooled, continuous S1 rating, capable of operating on $415 \pm 10\%$ volts, 3 phase 50 cycles AC supply. The preferred speed shall be between 1450/1500 RPM. Motor rating and performance shall fully comply with IS325-1996 or latest & shall have F class insulation. The motor shall not get over load through the entire range of -25% to +10% of specified duty point of the pumping set. The HP of motor shall be such that it will be 25 % in excess of the maximum power required under all head of working to compensate low voltage conditions as may be encountered in rural areas of Punjab. A test report from the manufacturer that the motor conforms to relevant I.S. shall be submitted at the time of inspection. The motor feet will be integral to the motor. The motors will be high efficiency type conforming IEEMA: 19-2000 clause.

SPECIFICATIONS OF LT ELECTRICAL CONTROL PANEL FOR PROPER OPERATION AND PROTECTION OF CENTRIFUGAL PUMPING SET

GENERAL REQUIREMENTS OF CONTRACT

1.1 This section covers mainly the job requirements before and after the supply of DOL/ closed transition Star-Delta Electrical Control Panel suitable for LT supply i.e. 415VAC, 50Hz, 3Phase, 4 Wire system particularly suitable for uninterrupted operation even at - 25% low voltage conditions of tropical and suitable for Hot and Humid monsoon environment, with RH up to 95%, 45 degree ambient above which 1% derating upto 50degree rise in ambient and 2% derating per degree above 50 degree centigrade ambient, dusty rural areas as per other requirements at sites in state of Punjab.

1.2 Prerequisites before supply of Panel

- a) Submission of drawings
- b) General Arrangement Drawing as per IS:8623 1993
- c) Single Line Diagram of DOL/Closed Transition Star-Delta as per IS/ANSI codes and symbols
- d) Bill of Quantities
- e) Circuit diagram will be submitted in minimum A3 size sheet along with the LT Electrical Control Panel for Proper Operation and Protection of Centrifugal Pumping Set.
- f) Specifications, makes and quantity of the main components compliant sheet shall be marked with yes or no if any with proper justification.
- g) The approval of the drawings by the EIC shall in no way relieve the contractor of contractual obligations or liabilities under the contract or his responsibilities for correctness of dimensions, material of construction, performance etc.
- h) The contractor will have to use the higher rated equipment as per DNIT even if the drawing is approved of lower rating i.e. the rating can be increased to increase safety factor but cannot be decreased under any clause of terms and conditions.
- i) If there is further requirement for improvement after the each amendment than contractor shall submit the fresh documents drawings and ratings. No charges whatsoever will be paid for preparing drawings estimates etc.
- j) The contractor shall inform 5 days prior to supply for inspection/inspections to be carried out.
- k) The contractor will strictly follow Indian Standards IS: code, subject to the at the end. If for a particular code for any item is not available than relevant IEC code will be applicable.
- l) The products of dual use i.e. commercial as well as industrial can be of ISI marked e.g. wires, MCB.

- m) All the material shall be covered by manufacturers warranty clause the contractor shall provide the warranty card and test reports from the manufacturer for all the equipments/ machinery.
- n) The installation should comply following statutory standards:
 - i) Indian Electricity Act, 1910.
 - ii) Indian Electricity Rules, 1956
 - iii) National Electrical Code, 1985
 - iv) The installation conforming to the instructions issued by the o/o Chief Electrical Inspector, Punjab & PSEB with upto date amendments

1.3 GENERAL REQUIREMENTS OF LT ELECTRICAL CONTROL PANEL FOR PROPER OPERATION AND PROTECTION OF CENTRIFUGAL PUMPING SET

- 1.4 Starter Panel board having size as per table given below for DOL/Closed Transition Star-Delta type starters so as to accommodate all the equipments in one enclosure. An independent meter box for housing power & light meter shall be provided as per PSEB requirement/specifications.
- 1.5 Fabricated by cutting, bending, welding etc in neat, symmetrical, aesthetic manner, providing easy access for Repair & Maintenance in clean manner of not less than 16swg CRCA sheet steel epoxy based powder coated with RAL 7032/SG 7032 (Siemens Grey) shade as per IS:5, 1978. All the equipments should be mounted on mounting plate of minimum 14swg or more thickness with 15 mm bend on sides.
- 1.6 The Panel should be dust and vermin proof wherever required & proper sponge neoprene/PU gasketing should be done.
- 1.7 The Panel should be as per low voltage i.e. 415 V AC 50 Hz, 3 Phase 4 wire system switchgear and controlgear assembly conforming to IS 8623:1993 with up to date amendments.
- 1.8 The Starter panel board should comprise of rigid welded structural frames The Starter panel will be complete with removable gland plates with provision of entry and exit of cable from glands duly fixed on the side plates of starter panel.
- 1.9 The mounting of panel will be made on wall four feet from ground level to the bottom of panel.
- 1.10 The board should be matt finished, covers should be rigid in construction wherever required door stiffeners should be used & free from flaws. It shall also be provided with discrete key lock system for every installation/panel.
- 1.11 The panel board should have the flush mounted instruments of 96x96mm bezel or 22.5mm cut out for pilot devices.

- 1.12 The LED type indicating lamps should be used as per IS:13947-5, 1993 for phases available RYB.
- 1.13 The Aluminium (Al) busbar should be of electrolytic grade aluminium. The size for a rating should be according to the formula 1mm^2 per 1.2A.
- 1.14 The SCPD (Short Circuit Protection Device i.e. MCB/MCCB) should be on the incomer side of the Starter control Panel so that in case of fault/ fire/ exigency the starter and subsequently pump could be isolated from Electricity board power supply by operator / attendant.
- 1.15 Only SCPD should accessible from the front with door closed. All other devices like contractors, busbars, overload relays, soft starter if used, other protection relays and timers etc should not be accessible with door closed.
- 1.16 In case the SCPD device is a 25KA, 3 Pole, MCCB suitable for motor duty, it will be fuse less and Cat. A type MCCB as per IS 13947-II:1993 or IEC 947/60947.
- 1.17 All the controls, indications, metering devices/displays of the panel should be on the front side of the panel. The back can be welded.
- 1.18 All the Contactors should be air break type and AC3 duty as per IS13947-IV and of finger proof IP20 protection.
- 1.19 Digital Ammeter and Voltmeter shall be provided.
- 1.20 CT operated Electronic overload relay phase connected Overload relay will operate in failsafe mode 0.5-960A only it shall be provided in case any starter other than soft starter is used.

- i Phase unbalance 5-50%
- ii Phase reversal 01-30sec
- iii Phase loss with in 3 sec
- iv Locked rotor protection.
- v Alert setting 50-100% of OC setting.
- vi Start time delay 01-200 sec
- vii Trip time delay 1-30sec inverse characteristics
- viii Trip time delay 0.2-30sec definite minimum time.
- ix Control voltage 20V AC+/-15%
- x Digital Ammeter
- xi Trip cause memory display.
- xii Range: 0.5-60A without external CTs if used in Phases can be rated upto 100A. 11-960A with external CT.
- xiii Undercurrent protection range: 0.5A to less than "OC" setting.
- xiv Time -Current characteristics
 - 0.5A to 10A : Definite/inverse selectable
 - Equal or more than 11A
 - definite (if inverse required, use with external CT)

- xv Trip cause memory: Last 3 trip, stored regardless power failure.
- xvi Reset manual /electrical (remote).
- xvii Fail Safe (self diagnostics). The output relay of 'OL' is energized when control power applied.
- xviii Power consumption less than 10w.
s) Electrostatic discharge IEC61000-4-2 level 3: Air discharge +/-6kv. Contact Discharge: +/-4kv
- xix Insulation between casing and circuit over 5 Mohm (DC 500V)
- xx Dielectric strength -Between casing and circuit 2kv 60 Hz 1min.
- Between contacts 1 kv 60 Hz 1 min.
- Between circuits 2kv 60Hz 1min.

1.21 The capacitor(S) will be with minimum 10%THD (Total Harmonic Distortion) in current with test certificates. The capacitors will be used in two ways

- a. Directly connected to incomer supply for neutralizing transformer magnetization current will be of rating 4 to 5% of KVA rating of transformer.
- b. For improvement of PF between 0.90 lag to unity designated as Pump capacitor so that penalties could saved as are imposed by PSEB for low PF time to time. This will also reduce the running cost to the department.
- c. Test voltage terminal to case 3KV for 10 sec.
- d. Rated for maximum over current 1.5 x rated current.
- e. Over voltage 110% of operating Voltage.

1.22 The capacitors shall be switched on after the motor has attained the full speed. To attain this separate MCB, Contactor, and timer shall be used for pump capacitor. This is done to avoid :

- a) To avoid resonance of capacitor with the inductor (Motor) and subsequent damage to Pump Capacitor.
- b) To increase the life of switching equipment.
- c) The capacitors will be switched through air core six turn reactors to limit the capacitor inrush current.

1.23 The capacitors shall be heavy duty as per IS: 13340-1993/ IS: 13341-1992. Agriculture duty type capacitors shall not be used.

1.24 The capacitor shall have safety features like pressure disconnection system, self healing type and discharge resistors to discharge capacitor to safe 50V range in 1 minute from rated voltage after switching off.

1.25 Peak inrush current shall be upto 140 to 160 times the rated current.

1.26 The capacitors shall be 440V rated, 110% tolerance in voltage. Three phase type, tolerance of only 5-10% of capacitance.

- 1.27 The wiring shall be done by 1100V PVC wires as per IS 694:1990 FR type. The class of wire will be class 5 or class 6. The temperature range will be -15°C to 70°C .
- 1.28 The wire rating will be considered as 70% of the rated wire rating as designated by manufacturer.
- 1.29 All the electrical equipment should be able to perform on Line voltage i.e. 415VAC. If any equipment is required to be used on 220VAC then separate step down control transformer be used of 415 to 220V AC.
- 1.30 Over voltage protection relay for fluctuation of 20% and above should be incorporated in the starter.
- 1.31 Starter should in no way operate the system at more than 120% of rated voltage. If required the PSEB should be contacted to reduce the tap of supply transformer.
- 1.32 All the wires should be terminated, crimped with the due size of thimble. No wire should be terminated directly.
- 1.33 All the wiring should have proper ferrules.
- 1.34 Two earth studs one each on LHS and RHS should be provided.
- 1.35 The door hinges should be strong enough to take the load of wiring, instrumentation etc.
- 1.36 Each panel will have discreet lock with key.
- 1.37 ELCB for current leakage protection.
- 1.38 The star delta starter will be closed transition star delta.
- 1.39 Output supply for flow meter shall be provided by providing 2.5mm^2 terminal blocks.
- 1.40 All the 220V AC machinery, equipments and instruments will be supplied through Neutral Isolation transformer only.

Design tables for different HP rating

Following norms should be observed for the manufacture of the Starter Control panel for the Centrifugal pump set according to the ratings given below:-

Sr.No	Description of component	Rating	Remarks
7.5HP DOL			
1	Contactors	20A/25A	
2	RCBO/ (ELCB+MCB), TPN	32A	'C' curve
3	Capacitor, 440V AC, delta connected	3KVAr	
i)	Contactors	12A	3P
ii)	Timer	0-30seconds	Minimum 1 CO (changeover) for capacitor and Star-delta changeover 2 Nos.
iii)	MCB, TP	16A	C' curve or 1 rating lower for 'D' curve
iv)	PVC, Cu Wire	1.5mm ²	Class 5 or 6
4	Digital Ammeter	0-20/40A/60A, 96x96mm	CT operated
5	Ammeter selector switch	3 phase	
6	Digital Voltmeter	3 Ph., 0-500V AC, 96x96mm	
7	Voltmeter selector switch	3 phase 6/10A	
8	PVC, Cu Wire on incomer / motor side	4mm ²	Class 5 or 6
9	Over Voltage Relay	415VAC	
10	Control Transformer	415VAC/220VAC	
11	Single Phase preventer with one CO contact, Minilec	415V AC	3 Phase
12	Contactors for Phase Corrector	415VAC TP AC3 Duty	2 Nos. Phase corrector
Beyond 7.5HP TO 10HPClosed Transition Star- Delta			
1	Contactors	25A	3 nos. for main, star, delta
2	MCB, TPN	25A	'C' curve
3	Capacitor, 440V AC, delta connected	3KVAr	MPP-S
i)	Contactors	12A	3P
ii)	Timer	0-30seconds	Minimum 1 CO (changeover) for capacitor and Star-delta changeover 2 Nos.

Sr.No	Description of component	Rating	Remarks
iii)	MCB, TP	16A	C' curve or 1 rating lower for 'D' curve
iv)	PVC, Cu Wire	1.5mm ²	Class 5 or 6
4	Digital Ammeter	0-20/40A/60A, 96x96mm	CT operated
5	Ammeter selector switch	3 phase	
6	Digital Voltmeter	3 Ph., 0-500V AC, 96x96mm	
7	Voltmeter selector switch	3 phase 6/10A	
8 (i)	PVC, Cu Wire on incomer	4 mm ²	Class 5 or 6
8 (ii)	PVC, Cu Wire on motor side	2.5 mm ²	Flat
9	Over Voltage Relay	415VAC	
10	Control Transformer	415VAC/220VAC	
11	ELCB	32 A, 100mA, 3P	Industrial range
12	Auto Phase Corrector	25 A/20A, AC3, 4P Contactors	Single Phase preventer with one CO contact, Minilec
13	Contactator & timer for closed transition	20/25A	
14	Resistance for Transition phase	As per requirement	To be given in Tender
15	Dimension	600x600x250mm	
FROM 11 TO 20 HP Closed Transition Star- Delta			
1	Contactors	40A	3 nos. for main, star, delta
2	MCCB, TP	60A	25KA
3	Capacitor, 440V AC, delta connected	5KVAR	MPP-S
i)	Contactator	32A	3P
ii)	Timer	0-30seconds	Minimum 1 CO (changeover) for capacitor and Star-delta changeover 2 Nos.
iii)	MCB, TP	32A	C' curve or 1 rating lower for 'D' curve
iv)	PVC, Cu Wire	4mm ²	Class 5 or 6
4	Digital Ammeter	0-40A/60A, 96x96mm	CT operated
5	Ammeter selector switch	3 phase	
6	Digital Voltmeter	3 Phase, 0-500V AC, 96x96mm	
7	Voltmeter selector switch	3 phase 6/10A	
8 (i)	PVC, Cu Wire on incomer	10mm ²	Class 5 or 6
8 (ii)	PVC, Cu Wire on motor side	6mm ²	Flat
9	Over Voltage Relay	415VAC	
10	Control Transformer	415VAC/220VAC	
11	ELCB	63 A, 100mA, 3P	Industrial range
12	Auto Phase Corrector	40 A/20A, AC3, 4P Contactors	Single Phase preventer with one CO contact, Minilec

Sr.No	Description of component	Rating	Remarks
13	Contactator & timer for closed transition	32A	
14	Resistance for Transition phase	As per requirement	To be given in Tender
15	Size	800x800x250mm	
21 to 30 HP Closed Transition Star- Delta			
1	Contactors	50A	3 nos. for main, star, delta
2	MCCB, TP	80A	25KA
3	Capacitor, 440V AC, delta connected	7.5KVA _r	
i)	Contactator	40A	3P
ii)	Timer	0-30seconds	Minimum 1 CO for capacitor and Star-delta changeover 2 Nos.
iii)	MCB, TP	32A	C' curve or 1 rating lower for 'D' curve
iv)	PVC, Cu Wire	4mm ²	Class 5 or 6
4	Digital Ammeter	0-40A/60A, 96x96mm	CT operated
5	Ammeter selector switch	3 phase	
6	Digital Voltmeter	3 Ph., 0-500V AC, 96x96mm	
7	Voltmeter selector switch	3 phase 6/10A	
8 (i)	PVC, Cu Wire on incomer	16 mm ²	Class 5 or 6
8 (ii)	PVC, Cu Wire on motor side	10 mm ²	Flat
9	Over Voltage Relay	415VAC	
10	Control Transformer	415VAC/220VAC	
11	ELCB	100 A, 100mA, 3P	Industrial range
12	Auto Phase Corrector	65 A, AC3, 4P Contactors	Single Phase preventer with one CO contact, Minilec
13	Contactator & timer for closed transition	50A	
14	Resistance for Transition phase	As per requirement	To be given in Tender
15	Size	900x900x250mm	

APPROVED MAKES AND SPECIFICATION

Following makes should be used for the manufacturing of Electrical Control Panels.

Makes of Pump	KIRLOSKAR, MATHER PLATT , KSB, WPIL
Makes of motor	Crompton, Siemens, GEC, NGEF, Bharat Bijlee, BCH, Kirloskar
MCB	It shall have 'C' curve for motor / 'C' or 'D' curve for capacitors:- Siemens, Legrand, L&T make (upto 10 HP) as per IS:8898.
MCCB	Siemens India/German, L&T, BCH (Above 10 HP) make as per IS13947-II, 1993.
Contactors	BCH, Siemens India/German, L&T as per IS 13947-IV, 1993
Electronic over-Current Relay	Siemens, BCH, C & S make as per relevant IS code
Timers	Contactors mounted can be used up to 20HP and separate mounted only for above 20HP motors: Siemens, BCH make as per IS13947-IV 1993.
Digital Voltmeter	Suitable for 0-500 V, Class-1 accuracy (i.e. $\pm 1\%$) 96xx96 mm : Nippon, Alliance, Enercon make for direct acting indicating instruments as per IS:1248.
Digital Ammeter	Suitable for 5A CT secondary current, Class-1 accuracy (i.e. $\pm 1\%$) 96xx96mm : Nippon, Alliance, Enercon make for direct acting indicating instruments as per IS:1248.
CT for Ammeter	Class-1 accuracy (i.e. $\pm 1\%$), 15 VA, 5A CT secondary current : Kappa, Nippon, Alliance, C&S make as per IS:2705.
Selector switch	ammeter & Voltmeter : L&T, Kaycee SG make
Capacitor	Capacitor 440VAC Moralized Poly-propylene (MPP) type, heavy duty gel filled with 8 micron metallization, with discharge resistors:- BCH, Epcos, Enercon make
Terminal Blocks	Connectwell, Wago, Phoenix
Pilot Devices	(Led Type indicating Lamps) and actuator devices (push Buttons (22.5 mm dia):- Siemens, BCH, C & S (Raas Control), L&T(EssBee) make as per . IS 13947-V 1993
PVC flexible class IV/ V Copper Wires Fire Resistant	Polycab, KEI, Finolex make as per IS: 694 1990
THIMBLES	Dowells, Jainsons make.
Digital Soft Starter	BCH, Solocon, Siemens make
Copper Cable from Panel to Motor	Colour coding RYB:- Finolex, Polycab, KEI & BCH make
Aluminium Armored Cables 4 / 3.5 core	for out door connection if required of PVC/ XLPE with GI armor overall to be buried 1 m BGL covered with sand and B- class bricks.
Earthings	3 complete installation with DG set and 2 earthings for installations without DG set, 4m apart linked by GI strip of 25x6mm, 0.5m BGL. earthing should minimum 4 m deep or upto moisture level whichever is higher. Size of GI earthing plate shall be 200x200x6 covered with salt & coke or coal mixture and joined with equipments i.e. starter panel (2 earthing strips) / lighting panel (1 GI wire of minimum 1.5 mm dia) / DG set with canopy(1 earthing strip for alternator, 1 earthing strip for alternator body and canopy) , etc. by 25x6mm strip. The GI pipe of 20 mm i/d from the earthing pit to GI plate. Funnel shall be provided in the watering. Cover of sheet steel of 3mm thickness:

Note: All the material shall be ISI Marked unless otherwise the make some other better make has been approved in these specifications.

TESTS: The following tests should be performed on the panel board during the inspection at the manufacturer place at the cost of contractor.

1. General Visual Test.
2. High voltage test upto 2 KV for 1 min to determine any leakage or internal cracks in the insulation. While performing this test any electronic component may be disconnected.
3. No load operational test by energizing the panel.

The firm should supply the following information for all the pumping sets before inspection of material:

DESCRIPTION	NET EFFECTIVE HEAD	GROSS EFFECTIVE HEAD INCLUDING LOSSES IN PUMPING SET	DISCHARGE	EFF. OF PUMP	COMBINED EFF. OF PUMP & MOTOR	MAX. BHP REQUIRED UNDER ALL HEADS OF OPERATION	BHP required = COL.(7) +15%
1	2	3	4	5	6	7	8
DUTY POINT.							
(-) 25% OF D.P							
+ 10% OF D.P							
+ 25% + 3% OF D.P when the head is less than 30m							

SPECIFICATION OF END SUCTION (BACK PULL OUT) ELECTRIC DRIVEN CENTRIFUGAL PUMPS WATER /RAW WATER)

Electric driven horizontal split casing centrifugal Clear water / Raw water pump conforming to IS 6595-1993 (PART-1) capable of delivering -----LPM a against head of m. NPSHA at the inlet of the pump is----- . The Net NPSHA shall be at least 1m. The pump will be coupled to three phase horizontal induction motor through a flexible coupling on a common fabricated base frame. The motor will conform to IS 325-1978 of latest.

Specification of End Suction (Back pull out) centrifugal pumps:

The pump shall meet the general requirement of IS-6596-1993. The pump shall be single stage single suction horizontal shaft & rotating parts shall be dynamically balanced. The casing shall be of end suction, volute type with top centre line discharge. It shall be of robust construction, tested to with stand a hydrostatic test pressure of 1.5 times of maximum discharge pressure. The shaft shall be of sufficient size so as to withstand maximum stresses and vibration developed at high speed. The shaft shall be accurately machined and ground and shall be supported by anti friction bearings. The shaft shall be protected by shaft sleeves from bear in stuffing box. The shaft shall be of tensile steel duly proportioned to transmit the maximum power, without undue strain.

The impeller will be enclosed type and dynamically balanced accurately. The companion flanges shall be faced & drilled as per ISI specification. The rotational direction of the pump should be as per rotational direction of the prime mover. The pump shall be complete with priming funnel, air-vent cock, grease cups & foundation bolts. The performance of the pump at duty point – 25% below duty points, + 10% above duty point shall be mentioned by the tender.

The speed of the pump & prime mover shall be 1450 RPM.

The Performance test report from the manufacturer that the pump satisfies the required duties shall be submitted at the time of inspection.

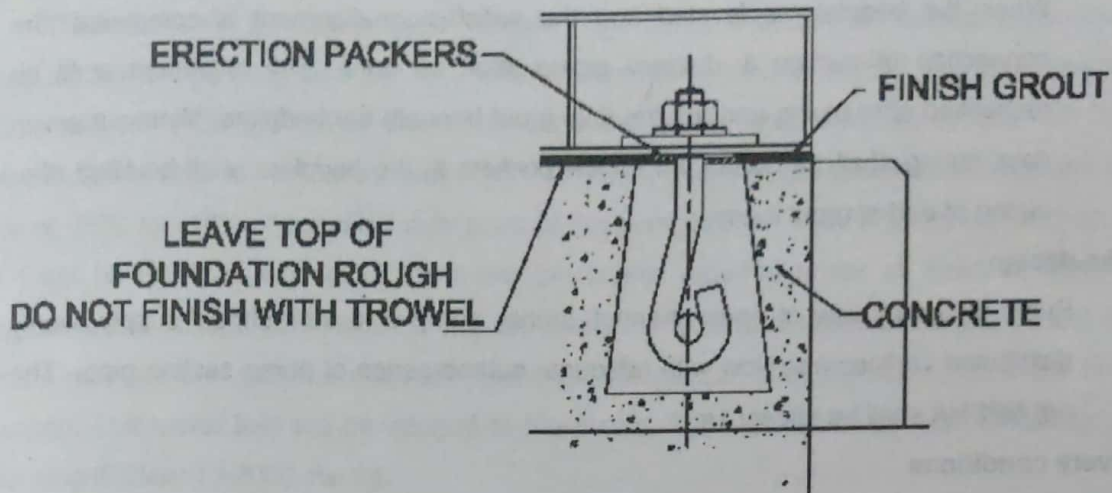
The impeller is of the fully enclosed type, with twisted vane design for maximum performance, giving higher efficiencies and suction lifts. Sweptback clearing vanes should be provided to balance the axial thrust and protect the gland packing and shaft from wear by abrasive particles. Impeller is hydraulically and dynamically balanced. It should be keyed at the end of the shaft and secured by means of an impeller nut.

The shaft should be ground all-over and sturdily proportioned to minimize deflection and provide long-term reliable service.

As a standard arrangement deep groove single row ball bearings have been provided. The coupling end bearing should be precisely located by means of a snap ring. A cast iron cover, which houses a lip seal to prevent ingress of dust etc, protects each bearing. A deflector is also provided on the shaft to prevent entry of water in the bearing from gland leakage.

The pump should be coupled to motor with Flexible type Coupling.

Installation:-



Typical installation diagram

The top surface over which the bedplate rests must be left rough to assist in keying of the final grout and sufficient allowance must be made for the thickness of the steel packing and leveling shims beneath the bedplate, the requirement being approximately 25 mm.

To avoid distortion due to uneven surface of foundation the base frame shall be placed over suitable base for leveling. The packer plates should be provided on mother concrete. Minimum requirement being one on each side of foundation bolts. Intermediate packers should be placed at 250 mm center to center. Thickness of MS plates should be between 25 and 35 mm.

Once the packer plates are positioned and leveled, the base frame shall be placed on them. Thereafter foundation bolts shall be inserted through hole in the base frame and insert nut. It shall be ensured that bolts protrude sufficiently to accommodate lock nut and they are centrally disposed in the holes.

Leveling of the bedplates:

- a. "I" beam straight edge and an engineer's master level (with accuracy of 0.02 mm / meter) shall be used for leveling the bedplates. I-beam should rest on the machined surfaces of the bedplate, or on the leveling pads if provided. These machined surfaces where level is being checked must be clean and free from paint, burrs etc.
- b. Datum position of base frame shall be checked as given in G.A. The level of the bedplate shall be adjusted by inserting shims between the bed plate and the packer plate until the bed plate is leveled and supported on all the packing plates at the height required for the connection of suction and discharge branches. For checking the levels across two pads, I-beam type straight edge should be used extensively in

conjunctions with engineer's master level. Level should be achieved within 0.05 mm per 250 mm.

When the bedplate is leveled and the satisfactory-alignment is completed, the connection of suction & delivery piping shall be done. The alignment shall be rechecked after piping and run the final grout beneath the bedplate. Minimum seven days curing shall be done. All hollow pockets in the bedplate shall be filled after curing of earlier grout if any.

Intake design

Pump intake by way of open channel, tunnel, sump or a tank should supply evenly distributed vortices free flow with adequate submergence of pump suction pipe. The net NPSHA shall be atleast 1m.

Delivery conditions

A suitable sluice valve should be fitted in the delivery pipe as near to the pump as possible, along with non-return valve.

Priming

The pump shall be capable of being primed either by running vacuum pump or by external water supply.

The tender must submit along with the tender the following details:-

- 1 The rate of flow of pump and total head of pump.
 - 2 NPSH required at various operating conditions with respect to NPSHA available at site with the size & length of inlet pipes, specials etc.
 - 3 The power observed, efficiency of the pump, combined efficiency with prime mover.
 - 4 The performance curves of the pumps.
 - 5 The Routine/Type test certificate from any Govt. recognized laboratory with reference to the material of the pump components.
 - 6 Authorization certificate required to be submitted along with the tender from the Approved Makes manufacturers of pumps.
- f. **Routine test certificate of the motors offered.**

MATERIAL OF COMPOSITION OF DIFFERENT COMPONENTS OF PUMP

Impeller	:	Bronze	: Grade LTB2 of IS 318-1981
Delivery Casing	:	Cast Iron	: Cast Iron FG 260 of IS 210-1978.
Shaft	:	Carbon steel	: Grade 40c of IS 1570 (Part 2/sec1)1979
Shaft sleeve	:	Stainless Steel	: Grade SS 410

Casing & impeller ring: Bronze : Grade LTB5 of IS 318-1981

SPECIFICATIONS OF MOTOR

The motor shall be squirrel cage induction type totally enclosed fan cooled, continuous S1 rating, capable of operating on $415 \pm 10\%$ volts, 3 phase 50 cycles AC supply. The preferred speed shall be between 1450/1500 RPM. The motor rating and performance shall fully comply with IS 325-1996 or latest & shall have F class insulation. The motor shall not get over load through the entire range of -25% to +10% of specified duty point of the pumping set. The HP of motor shall be such that it will be 20 % in excess of the maximum power required under all head of working to compensate low voltage conditions as may be encountered in rural areas of Punjab. A test report from the manufacturer that the motor conforms to relevant I.S. shall be submitted at the time of inspection. The motor feet will be integral to the motor. The motors will be high efficiency type conforming IEEMA: 19-2000 clause.

SPECIFICATION OF CONTROL PANEL:-

SPECIFICATIONS OF LT ELECTRICAL CONTROL PANEL FOR PROPER OPERATION AND PROTECTION OF CENTRIFUGAL PUMPING SET

GENERAL REQUIREMENTS OF CONTRACT

2.1 This section covers mainly the job requirements before and after the supply of DOL/ closed transition Star-Delta Electrical Control Panel suitable for LT supply i.e. 415VAC, 50Hz, 3Phase, 4 Wire system particularly suitable for uninterrupted operation even at -25% low voltage conditions of tropical and suitable for Hot and Humid monsoon environment, with RH up to 95%, 45 degree ambient above which 1% derating upto 50degree rise in ambient and 2% derating per degree above 50degree centigrade ambient, dusty rural areas as per other requirements at sites in state of Punjab.

2.2 Prerequisites before supply of Panel

- a) Submission of drawings
- b) General Arrangement Drawing as per IS:8623 1993
- c) Single Line Diagram of DOL/Closed Transition Star-Delta as per IS/ANSI codes and symbols
- d) Bill of Quantities
- e) Circuit diagram will be submitted in minimum A3 size sheet along with the LT Electrical Control Panel For Proper Operation and Protection of Centrifugal Pumping Set.
- f) Specifications, makes and quantity of the main components compliant sheet each marked with yes or no if any with proper justification.
- g) The approval of the drawings by the EIC shall in no way relieve the contractor of contractual obligations or liabilities under the contract or his responsibilities for correctness of dimensions, material of construction, performance etc.

- h) The contractor will have to use the higher rated equipment as per DNIT even if the drawing is approved of lower rating i.e. the rating can be increased to increase safety factor but cannot be decreased under any clause of terms and conditions.
- i) If there is further requirement for improvement after the each amendment than contractor shall submit the fresh documents drawings and ratings. No charges whatsoever will be paid for preparing drawings estimates etc.
- j) The contractor shall inform 5 days prior to supply for inspection/inspections to be carried out.
- k) The contractor will strictly follow Indian Standards (IS: code). If for a particular code for any item is not available than relevant IEC code will be applicable.
- l) The products of dual use i.e commercial as well as industrial can be of ISI marked e.g. wires, MCB.
- m) All the material will be new and shall be covered by manufacturers warranty clause the contractor shall provide the warranty card and test reports from the manufacturer for all the equipments/ machinery.
- n) The installation should comply following statutory standards:
 - i) Indian Electricity Act, 1910.
 - ii) Indian Electricity Rules, 1956
 - iii) National Electrical Code, 1985
 - iv) The installation conforming to the instructions issued by the o/o Chief Electrical Inspector, Punjab & PSEB with upto date amendments

2.3 GENERAL REQUIREMENTS OF LT ELECTRICAL CONTROL PANEL FOR PROPER OPERATION AND PROTECTION OF CENTRIFUGAL PUMPING SET

- 2.4 Starter Panel board having size as per table given below for DOL/Closed Transition Star-Delta type starters so as to accommodate all the equipments in one enclosure. An independent meter box for housing power & light meter shall be provided as per PSEB requirement/specifications.
- 2.5 Fabricated by cutting, bending, welding etc in neat, symmetrical, aesthetic manner, providing easy access for Repair & Maintenance in clean manner of not less than 16swg CRCA sheet steel epoxy powder coated with RAL 7032/SG 7032 (Siemens Grey) shade as per IS:5, 1978. All the equipments should be mounted on mounting plate of minimum 14swg or more thickness with 15 mm bend on sides.
- 2.6 The Panel should be dust and vermin proof wherever required & proper sponge neoprene/PU gasketing should be done.
- 2.7 The Panel should be as per low voltage i.e. 415 V AC 50 Hz, 3 Phase 4 wire system switchgear and controlgear assembly conforming to IS 8623:1993 with up to date amendments.

- 2.8 The Starter panel board should comprise of rigid welded structural frames The Starter panel will be complete with removable gland plates with provision of entry and exit of cable from glands duly fixed on the side plates of starter panel.
- 2.9 The mounting of panel will be made on wall four feet from ground level to the bottom of panel.
- 2.10 The board should be matt finished, covers should be rigid in construction wherever required door stiffeners should be used & free from flaws. It shall also be provided with discrete key lock system for every installation/panel.
- 2.11 The panel board should have the flush mounted instruments of 96x96mm bezel or 22.5mm cut out for pilot devices.
- 2.12 The LED type indicating lamps should be used as per IS:13947-5, 1993 for phases available RYB.
- 2.13 The Aluminium(Al) busbar should be of electrolytic grade aluminium. The size for a rating should be according to the formula 1mm^2 per 1.2A.
- 2.14 The SCPD (Short Circuit Protection Device i.e. MCB/MCCB) should be on the incomer side of the Starter control Panel so that in case of fault/ fire/ exigency the starter and subsequently pump could be isolated from Electricity board power supply by operator / attendant.
- 2.15 Only SCPD should accessible from the front with door closed. All other devices like contractors, busbars, overload relays, soft starter if used, other protection relays and timers etc should not be accessible with door closed.
- 2.16 In case the SCPD device is a 25KA, 3 Pole, MCCB suitable for motor duty, it will be fuse less and Cat. A type MCCB as per IS 13947-II:1993 or IEC 947/60947.
- 2.17 All the controls, indications, metering devices/displays of the panel should be on the front side of the panel. The back can be welded.
- 2.18 All the Contactors should be air break type and AC3 duty as per IS13947-IV and of finger proof IP20 protection.
- 2.19 Digital ammeter and voltmeter shall be provided.
- 2.20 CT operated Electronic overload relay phase connected Overload relay will operate in safe mode 0.5-960A. It shall be provided in case any starter other than soft starter is used.
- I Phase unbalance 5-50%
 - ii Phase reversal 01-30sec
 - iii Phase loss with in 3 sec
 - lv Locked rotor protection.
 - V Alert setting 50-100% of OC setting.

- vi Start time delay 01-200 sec
- vii Trip time delay 1-30sec inverse characteristics
- viii Trip time delay 0.2-30sec definite minimum time.
- ix Control voltage 20V AC +/-15%
- X Digital Ammeter
- xi Trip cause memory display.
- xii Range: 0.5-60A without external CTs if used in Phases can be rated upto 100A. 11-960A with external CT.
- xiii Undercurrent protection range: 0.5A to less than "OC" setting.
- xiv Time -Current characteristics
 - 0.5A to 10A : Definite/inverse selectable
 - Equal or more than 11A
 - definite (if inverse required, use with external CT)
- xv Trip cause memory: Last 3 trip, stored regardless power failure.
- xvi Reset manual /electrical (remote).
- xvii Fail Safe (self diagnostics). The output relay of 'OL' is energized when control power applied.
- xviii Power consumption less than 10w.
 - s) Electrostatic discharge IEC61000-4-2 level 3: Air discharge +/-6kv. Contact Discharge: +/-4kv
- xix Insulation between casing and circuit over 5 Mohm (DC 500 V)
- xx Dielectric strength -Between casing and circuit 2kv 60 Hz 1min.
 - Between contacts 1 kv 60 Hz 1 min.
 - Between circuits 2kv 60Hz 1min.

1.60 (A) The capacitor(S) will be with minimum 10%THD (Total Harmonic Distortion) in current with test certificates. The capacitors will be used in two ways

a) Directly connected to incomer supply for neutralizing transformer magnetization current will be of rating 4 to 5% of KVA rating of transformer.

b) For improvement of PF between 0.90 lag to unity designated as Pump capacitor so that penalties could saved as are imposed by PSEB for low PF time to time. This will also reduce the running cost to the department.

- a. Test voltage terminal to case 3KV for 10 sec.
- b. Rated for maximum over current 1.5 x rated current.
- c. Over voltage 110% of operating Voltage.

1.61 The capacitors shall be switched on after the motor has attained the full speed. To attain this separate MCB, Contactor, and timer shall be used for pump capacitor. This is done to avoid :

- a) To avoid resonance of capacitor with the inductor (Motor) and subsequent damage to Pump Capacitor.
 - a) To increase the life of switching equipment.
 - b) The capacitors will be switched through air core six turn reactors to limit the capacitor inrush current.
- 1.62 The capacitors shall be heavy duty as per IS: 13340-1993/ IS: 13341-1992. Agriculture duty type capacitors shall not be used.
- 1.63 The capacitor shall have safety features like pressure disconnection system, self healing type and discharge resistors to discharge capacitor to safe 50V range in 1 minute from rated voltage after switching off.
- 1.64 Peak inrush current shall be upto 140 to 160 times the rated current.
- 1.65 The capacitors shall be 440V rated, 110% tolerance in voltage. Three phase type, tolerance of only 5-10% of capacitance.
- 1.66 The wiring shall be done by 1100V PVC wires as per IS 694:1990 FR type. The class of wire will be class 5 or class 6. The temperature range will be -15degree to 70degree C.
- 1.67 The wire rating will considered as 70% of the rated wire rating as designated by manufacturer.
- 1.68 All the electrical equipment should be able to perform on Line voltage i.e. 415VAC. If any equipment is required to be used on 220VAC than separate step down control transformer be used of 415 to 220V AC.
- 1.69 Over voltage protection relay for fluctuation of 20% and above should be incorporated in the starter.
- 1.70 Starter should in no way operate the system at more than 120% of rated voltage. If required the PSEB should be contacted to reduce the tap of supply transformer.
- 1.71 All the wires should be terminated, crimped with the due size of thimble. No wire should be terminated directly.
- 1.72 All the wiring should have proper ferrules.
- 1.73 Two earth studs one each on LHS and RHS should be provided.
- 1.74 The door hinges should be strong enough to take the load of wiring, instrumentation etc.
- 1.75 Each panel will have discreet lock with key.
- 1.76 ELCB for current leakage protection.
- 1.77 The star delta starter will be closed transition star delta.
- 1.78 Output supply for flow meter by providing 2.5mm² terminal blocks of of approved makes.
- 1.79 All the 220V AC machinery, equipments and instruments will supplied through Neutral Isolation transformer only.

Design tables for different HP rating

Following norms should be observed for the manufacture of the Starter Control panel for the Centrifugal pump set according to the ratings given below:-

Sr.No	Description of component	Rating	Remarks
7.5HP DOL			
1	Contactors	20A/25A	
2	RCBO/ (ELCB+MCB), TPN	32A	'C' curve
3	Capacitor, 440V AC, delta connected	3KVAr	
i)	Contactor	12A	3P
ii)	Timer	0-30seconds	Minimum 1 CO (changeover) for capacitor and Star-delta changeover 2 Nos.
iii)	MCB, TP	16A	C' curve or 1 rating lower for 'D' curve
iv)	PVC, Cu Wire	1.5mm ²	Class 5 or 6
4	Digital Ammeter	0-20/40A/60A, 96x96mm	CT operated
5	Ammeter selector switch	3 phase	
6	Digital Voltmeter	3 Ph., 0-500V AC, 96x96mm	
7	Voltmeter selector switch	3 phase 6/10A	
8	PVC, Cu Wire on incomer / motor side	4mm ²	Class 5 or 6
9	Over Voltage Relay	415VAC	
10	Control Transformer	415VAC/220VAC	
11	Single Phase preventer with one CO contact, Minilec	415V AC	3 Phase
12	Contactors for Phase Corrector	415VAC TP AC3 Duty	2 Nos. Phase corrector
Beyond 7.5HP TO 10HP Closed Transition Star- Delta			
1	Contactors	25A	3 nos. for main, star, delta
2	MCB, TPN	25A	'C' curve
3	Capacitor, 440V AC, delta connected	3KVAr	MPP-S
i)	Contactor	12A	3P
ii)	Timer	0-30seconds	Minimum 1 CO (changeover) for capacitor and Star-delta changeover 2 Nos.
iii)	MCB, TP	16A	C' curve or 1 rating lower for 'D' curve
iv)	PVC, Cu Wire	1.5mm ²	Class 5 or 6
4	Digital Ammeter	0-20/40A/60A, 96x96mm	CT operated
5	Ammeter selector switch	3 phase	
6	Digital Voltmeter	3 Ph., 0-500V AC, 96x96mm	

Sr.No	Description of component	Rating	Remarks
7	Voltmeter selector switch	3 phase 6/10A	
8 (i)	PVC, Cu Wire on incomer	4 mm ²	Class 5 or 6
8 (ii)	PVC, Cu Wire on motor side	2.5 mm ²	Flat
9	Over Voltage Relay	415VAC	
10	Control Transformer	415VAC/220VAC	
11	ELCB	32 A, 100mA, 3P	Industrial range
12	Auto Phase Corrector	25 A/20A, AC3, 4P Contactors	Single Phase preventer with one CO contact, Minilec
13	Contactor & timer for closed transition	20/25A	
14	Resistance for Transition phase	As per requirement	To be given in Tender
15	Dimension	600x600x250mm	
FROM 11 TO 20 HP Closed Transition Star- Delta			
1	Contactors	40A	3 nos. for main, star, delta
2	MCCB, TP	60A	25KA
3	Capacitor, 440V AC, delta connected	5KVA _r	MPP-S
i)	Contactor	32A	3P
ii)	Timer.	0-30seconds	Minimum 1 CO (changeover) for capacitor and Star- delta changeover 2 Nos.
iii)	MCB, TP	32A	C' curve or 1 rating lower for 'D' curve
iv)	PVC, Cu Wire	4mm ²	Class 5 or 6
4	Digital Ammeter	0-40A/60A, 96x96mm	CT operated
5	Ammeter selector switch	3 phase	
6	Digital Voltmeter	3 Phase, 0-500V AC, 96x96mm	
7	Voltmeter selector switch	3 phase 6/10A	
8 (i)	PVC, Cu Wire on incomer	10mm ²	Class 5 or 6
8 (ii)	PVC, Cu Wire on motor side	6mm ²	Flat
9	Over Voltage Relay	415VAC	
10	Control Transformer	415VAC/220VAC	
11	ELCB	63 A, 100mA, 3P	Industrial range
12	Auto Phase Corrector	40 A/20A, AC3, 4P Contactors	Single Phase preventer with one CO contact, Minilec
13	Contactor & timer for closed transition	32A	
14	Resistance for Transition phase	As per requirement	To be given in Tender
15	Size	800x800x250mm	

Sr.No	Description of component	Rating	Remarks
21 to 30 HP Closed Transition Star- Delta			
1	Contactors	50A	3 nos. for main, star, delta
2	MCCB, TP	80A	25KA
3	Capacitor, 440V AC, delta connected	7.5KVAR	
i)	Contactor	40A	3P
ii)	Timer	0-30seconds	Minimum 1 CO for capacitor and Star-delta changeover 2 Nos.
iii)	MCB, TP	32A	C' curve or 1 rating lower for 'D' curve
iv)	PVC, Cu Wire	4mm ²	Class 5 or 6
4	Digital Ammeter	0-40A/60A, 96x96mm	CT operated
5	Ammeter selector switch	3 phase	
6	Digital Voltmeter	3 Ph., 0-500V AC, 96x96mm	
7	Voltmeter selector switch	3 phase 6/10A	
8 (i)	PVC, Cu Wire on incomer	16 mm ²	Class 5 or 6
8 (ii)	PVC, Cu Wire on motor side	10 mm ²	Flat
9	Over Voltage Relay	415VAC	
10	Control Transformer	415VAC/220VAC	
11	<u>ELCB APPROVED MAKES AND SPECIFICATION</u>	100 A, 100mA, 3P	Industrial range
12	Auto Phase Corrector	65 A, AC3, 4P Contactors	Single Phase preventer with one CO contact, Minilec
13	Contactor & timer for closed transition	50A	
14	Resistance for Transition phase	As per requirement	To be given in Tender
15	Size	900x900x250mm	

APPROVED MAKES AND SPECIFICATION

Following makes should be used for the manufacturing of Electrical Control Panels.

Makes of Pump	KIRLOSKAR, MATHER PLATT , KSB, WPIL
Makes of motor	Crompton, Siemens, GEC, NGEF, Bharat Bijlee, BCH, Kirloskar
MCB	It shall have 'C' curve for motor / 'C' or 'D' curve for capacitors:- Siemens, Legrand, L&T make (upto 10 HP) as per IS:8898.
MCCB	Siemens India/German, L&T, BCH (Above 10 HP) make as per IS13947-II, 1993.
Contactors	BCH, Siemens India/German, L&T as per IS 13947-IV, 1993
Electronic over-Current Relay	Siemens, BCH, C & S make as per relevant IS code
Timers	Contactors mounted can be used up to 20HP and separate mounted only for above 20HP motors: Siemens, BCH make as per IS13947-IV 1993.
Digital Voltmeter	Suitable for 0-500 V, Class-1 accuracy (i.e. $\pm 1\%$) 96xx96 mm : Nippon, Alliance, Enercon make for direct acting indicating instruments as per IS:1248.
Digital Ammeter	Suitable for 5A CT secondary current, Class-1 accuracy (i.e. $\pm 1\%$) 96xx96mm : Nippon, Alliance, Enercon make for direct acting indicating instruments as per IS:1248.
CT for Ammeter	Class-1 accuracy (i.e. $\pm 1\%$), 15 VA, 5A CT secondary current : Kappa, Nippon, Alliance, C&S make as per IS:2705.
Selector switch	ammeter & Voltmeter : L&T, Kaycee SG make
Capacitor	Capacitor 440VAC Moralized Poly-propylene (MPP) type, heavy duty gel filled with 8 micron metallization, with discharge resistors:- BCH, Epcos, Enercon make
Terminal Blocks	Connectwell, Wago ,Phoenix
Pilot Devices	(Led Type indicating Lamps) and actuator devices (push Buttons (22.5 mm dia):- Siemens, BCH, C & S (Raas Control), L&T (EssBee) make as per . IS 13947-V 1993
THIMBLES	Dowells, Jainsons make.
Digital Soft Starter	BCH, Solocon, Siemens make
Copper Cable from Panel to Motor	Colour coding RYB:- Finolex, Polycab, KEI & BCH make
Aluminium Armored Cables 4 / 3.5 core	for out door connection if required of PVC/ XLPE with GI armor overall to be buried 1 m BGL covered with sand and B- class bricks.
Earthings	3 complete installation with DG set and 2 earthings for installations without DG set, 4m apart linked by GI strip of 25x6mm, 0.5m BGL. earthing should minimum 4 m deep or upto moisture level which ever is higher. Size of GI earthing plate shall be 200x200x6 covered with salt & coke or coal mixture and joined with equipments i.e. starter panel (2 earthing strips) / lighting panel (1 GI wire of minimum 1.5 mm dia) / DG set with canopy(1 earthing strip for alternator, 1 earthing strip for alternator body and canopy) , etc. by 25x6mm strip. The GI pipe of 20 mm i/d from the earthing pit to GI plate. Funnel shall be provided in the watering. Cover of sheet steel of 3mm thickness:

Note: All the material shall be ISI Marked unless otherwise the make some other better make has been approved in these specifications.

TESTS: The following tests should be performed on the panel board during the inspection at the manufacturer place at the cost of contractor.

1. General Visual Test.
2. High voltage test upto 2 KV for 1 min to determine any leakage or internal cracks in the insulation. While performing this test any electronic component may be disconnected.
3. No load operational test by energizing the panel.

The firm shall supply the following information for all the pumping sets before inspection :

DESCRIPTION	NET EFFECTIVE HEAD	GROSS EFFECTIVE HEAD INCLUDING LOSSES IN PUMPING SET	DISCHARGE	EFF. OF PUMP	COMBINED EFF. OF PUMP & MOTOR	MAX. BHP REQUIRED UNDER ALL HEADS OF OPERATION	BHP required = COL.(7) +15%
1	2	3	4	5	6	7	8
DUTY POINT.							
(-) 25% OF D.P							
+ 10% OF D.P							
+ 25% ± 3% OF D.P when the head is less than 30m							

NOTE:

1. Every tenderer should submit family curves and characteristic curves of the Model of the pump quoted by them & should be signed by the manufacturer (Not below the rank of Zonal Manager).
2. Every curve should be signed in original Photocopy of the signatures will not be accepted.
HEAD V/S DISCHARGE CURVE
DISCHARGE V/S POWER INPUT CURVE
DISCHARGE V/S OVERALL EFFICIENCY CURVE.
3. PRICE FOR THE PUMPING SET AND CONTROL PANEL BE QUOTED SEPARATELY.
4. The inspection of the pump will be carried out at the manufacturer premises by the two representative of the Department.

List of drawing attached

1. Foundation Block of Horizontal Pump Set D-16

NOTE: The PWD specification book, relevant IS/ISO codes/ any other reference in works relevant to the various material and workmanship etc. shall be read apart from this schedule provided. However, wherever the provisions in this schedule are in variance with any provisions of the above mentioned specification book/ relevant IS/ISO codes/ any other reference, the specification of this schedule shall be followed.

GENERATING SET

TECHNICAL SPECIFICATIONS FOR CPCB APPROVED SILENT GENERATING SET

The Diesel-Generating Set shall comprise of: -

DIESEL ENGINE

It should be of approved make and of multi cylinder construction, four stroke cycle, industrial type, Air Cooled diesel engine capable of developing required BHP at rated speed of 1500 RPM under normal running conditions as in rural areas of Punjab & accordance with IS: 10000 and 10001-2 (Collectively) as amended upto date (IS Rating 'A'). It should be capable of withstanding 10% over load for one hour in 12 hours running and should comprise of following components:-

- | | |
|---|---|
| 1) Flywheel | 2) Electric Cooling Fan |
| 3) Air Cleaner | 4) Standard Fuel Tank with fittings |
| 5) Close coupled | 6) Exhaust Silencer (No piping) |
| 7) Acoustic Enclosure | 8) Lubricating oil pressure gauge |
| 9) 12 volts standard battery Exide/ Standard/ Pace Setter in pre-charged condition with battery cables of suitable AH as recommended by the engine Mfr. | |
| 10) Self start | |
| 11) Dynamo for battery charging battery Ammeter | 12) Panel with start push button, |
| 13) Internal wiring complete | 14) Battery leads |
| 15) Set of standard tools | 16) Starting device with 12 volts Electric Start for self start |
| 17) Low Lube Safety | 18) Fuel Gauge |

The Bidder should submit the following test reports from any Govt. agency / manufacturer at the time of inspection.

- | | |
|-----------------------------|----------------------------|
| i. Initial performance test | ii. Governing Test |
| iii. Test on various loads | iv. Final Performance Test |

A leaflet of the engine showing manufacturing details should also be submitted.

The Bidder shall furnish following information of diesel oil engine.

- | | |
|--|--|
| 1) Make | 2) Model |
| 3) Cooling System | 4) RPM |
| 5) BHP | 6) Over Loading |
| 7) Starting | 8) Fuel Consumption gm/BHP/hour
At 50%, 75% and 100% load |
| 9) Rotational Direction | 10) Type of Air Cleaner |
| 11) Length x Width x Height | 12) Total wet weight (engine+ radiator) |
| 13) Combustion air intake at 100% load | 14) Type of insulation |
| 15) Type of fuel | |
| 16) Type of Governor | 17) Service schedule |

ALTERNATOR

The above engine shall Close coupled on a string steel fabricated base frame to a 3 phase, 50 cycles, 1500 RPM, self regulating, self exciting Alternator and generates required KVA at 0.8 power factor at $415 \pm 2.5\%$ volts, 4 wire AC supply when running at 1500 RPM. The alternator should be screen protected and fitted with end shields bull/ roller bearing and should conform to IS: 4722-1968 & IS : 13364 to as amended upto date. The alternator should be provided with damper winding. The class of insulation should be class 'H'. it shall be of approved make.

The efficiency of the alternator offered shall be clearly stated and a certificate from the original manufacturer be furnished along with tender.

The tender should furnish the following information in respect of the alternator before inspection:-

1.	Make	4.	RPM
2.	Power in KVA	5.	No. of Phases
3.	Efficiency at 0.8power factor	6.	Class of insulation
		7.	Battery capacity

CONTROL PANEL

The Control Panel body will be fabricated out of 14 SWG / 16 SWG MS sheet. Panel will be canopy mounted, Indoor Installation, dust & vermin proof, Control cable of copper size 1.5 sq. mm is used. Cables are ferruled for proper maintenance/checking/wiring of panel. Detachable cable gland plates are provided. The panel will be equipped as follows as per manufacturer approved design:

- One No. circuit breaker of suitable capacity.
- Bus Bars of suitable capacity provided with termination.
- One No. AC Voltmeter with selector switch.
- One No. AC Ammeter with selector switch.
- 3 Nos. Current Transformers of suitable ratio.
- One set of Indication lamps for 'Load ON', 'Set running'.
- One set of instrument fuses.
- * 1No. Change Over Switch, panel mounted, front operated, of make Standard/ HAVELLS (to be installed in panel along with DG)

BATTERY

It should be standard / Exide/ Pace Setter make.

COMBINATION BASE PLATE

The Engine and Alternator shall be mounted on a specially designed combination of extremely rigid all welded construction and should be provided with vibration pads shall be housed inside acoustic enclosure with inbuilt fuel tank.

SELECTION OF AIR COOLED DIESEL ENGINE TO DRIVE AC GENERATOR

Sr.No.	Pump Rating	Required DG Rating	Required Engine Rating
1	Upto 10 HP	25 KVA	32 BHP
2	Upto 20 HP	40 KVA	56 BHP
3	Upto 30 HP	63 KVA	83 BHP

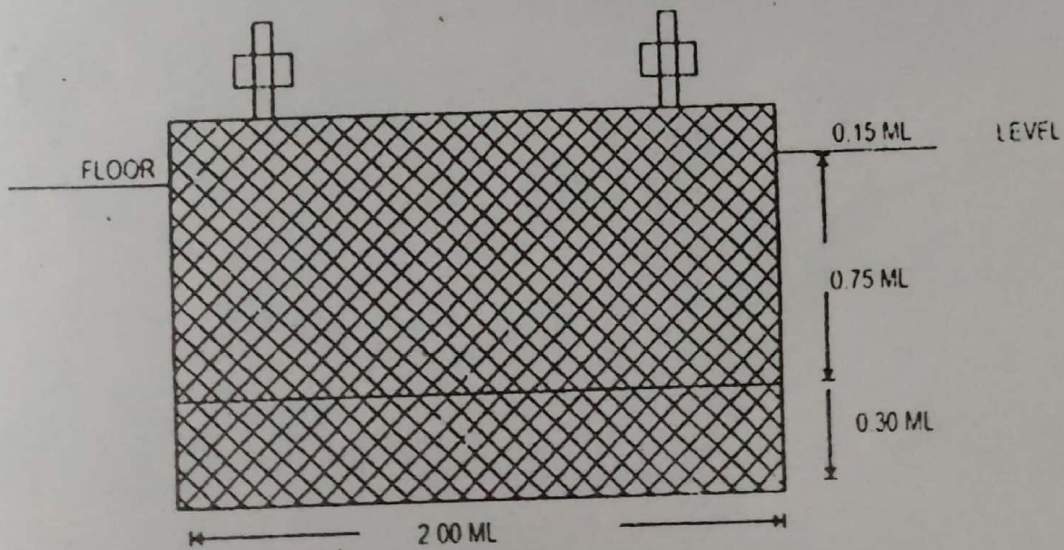
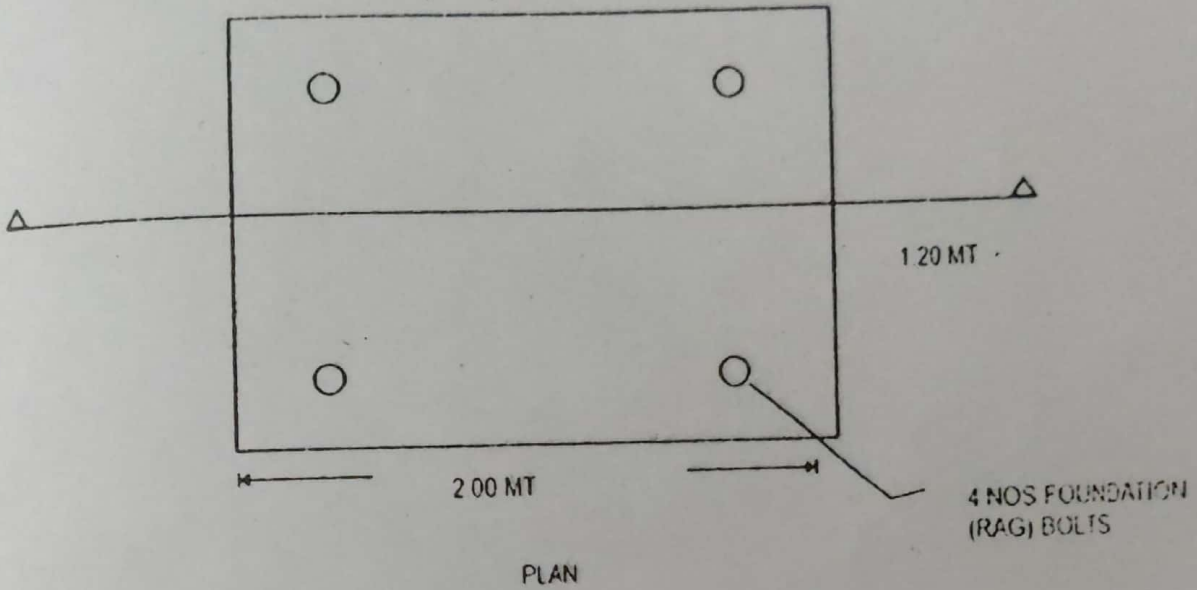
Specifications and Makes

Sr. No.	Brief Description	Relevant Code reference (with latest amendment)		Remarks
		Indian Standards (IS)	Pb. PWD Book of specification Chapter No.	
1	2	3	4	5
1	Diesel Engine Upto 20.00k.w. Above 20.00k.w.	10001-1981 10002-1981		KIRLOSKAR OIL ENGINES/ GREAVES/ CUMMINS/ CATERPILLER, COOPER / VOLVO PENTA
2.	Generating Set-Alternator	4722-1968		STAMFORD/ LEROY-SOMENS/KIRLOSKAR GREEN/ CROMPTON/ JYOTI/ GEC/

NOTE: All the material shall be ISI Marked unless otherwise the make some other better make has been approved in these specifications.

NOTE: The PWD specification book, relevant IS/ISO codes/ any other reference in works relevant to the various material and workmanship etc. shall be read apart from this schedule provided. However, wherever the provision in this schedule are in variance with any provisions of the above mentioned specification book/ relevant IS/ISO codes/ any other reference, the specification of this schedule shall be followed.

DETAIL OF FOUNDATION BLOCK OF HORIZONTAL SET



WATER SUPPLY AND SANITATION DEPARTMENT