

No. - 3/19/ST/2014/NISE
NATIONAL INSTITUTE OF SOLAR ENERGY
(An autonomous Institute of Ministry of New & Renewable Energy)
GURGAON

**NOTICE INVITING TENDER for DESIGN, SUPPLY, INSTALLATION
and COMMISSIONING OF SCADA SYSTEM FOR OPERATION OF CST
TEST FACILITY**

Sealed Tenders are invited by office of the Director General, National Institute of Solar Energy from original developers or their authorized Indian distributors for the supply of installation and commissioning of SCADA based control system for Concentrated Solar Thermal (CST) test facility. The bidder should be a reputed firm having sufficient experience in supplying similar system. Please visit National Institute of Solar Energy website: www.nise.res.in or www.mnre.gov.in for complete Tender Document and detailed Specifications.

Sealed tenders may be submitted in two parts i.e. Part-I containing Technical Bid along with a Demand Draft for EMD and Part-II containing only commercial invoice in a separate, sealed envelope, super scribed as "Commercial Bid". Both the technical and commercial envelopes should be kept in a large size sealed envelope super-scribed as tender for "DESIGN, SUPPLY, INSTALLATION and COMMISSIONING OF SCADA SYSTEM FOR OPERATION OF CST TEST FACILITY" and addressed to: The Director General, National Institute of Solar Energy, Faridabad- Gurgaon Road, Gwal Pahari, Gurgaon, Haryana, India. Closing time and date for receipt of tenders at NISE is 01.00 Noon on 6th December, 2016. Technical bids will be opened on 6th December, 2016 at 03:00 PM.

BID DOCUMENT

For

**Design, Supply, Installation and Commissioning of SCADA System For
operation of CST Test Facility at NISE**



NIT NO: 3/19/ST/2014/NISE

Last Date of submission of bids: 6th December, 2016

At

NATIONAL INSTITUTE OF SOLAR ENERGY (NISE)

Gwal Pahari, Gurgaon-Faridabad Road,

Gurgaon-122003, Haryana, INDIA

Telefax No. : +91-124-2579207

No. 3/19/ST/2014/NISE

National Institute of Solar Energy
(An Autonomous Institute of Ministry of New and Renewable
Energy) Gwal pahari, Gurgaon-Faridabad Road,
Gurgaon, 122003 (HR).
Phone: 091-124-2579213
Fax: 091-124-2579207

Tender Document

Sub: DESIGN, SUPPLY, INSTALLATION AND COMMISSIONING OF SCADA SYSTEM FOR OPERATION OF CONCENTRATED SOLAR THERMAL (CST) TEST FACILITY at National Institute of Solar Energy, Gwal pahari, Gurgaon, Haryana, India.

On behalf of the Director General (DG), National Institute of Solar Energy (NISE), sealed tenders are invited for Supply, Installation and Commissioning of SCADA Based Control System for CST Test Facility at the National Institute of Solar Energy, Gwal Pahari, Gurgaon, Haryana, India. The bidder should be a reputed firm with sufficient experience. Preference may also be given to those bidders who can offer trouble free post procurement maintenance and those having their authorized service centre.

1	Tender No.	No.- 3/19/ST/2014/NISE
2	Scope of Work	Design, Supply, Installation And Commissioning of SCADA System For operation of CST Test Facility at the National Institute of Solar Energy, Gwal Pahari, Gurgaon, Haryana, India.
2	Details of System	SCADA based control system with specified specification mentioned in the Annexure B
3	Earnest Money Deposit (EMD) (Refundable without interest)	Rs.5,000/-
4	Place of issue & submission of bid document and address for communication The Envelop should be super scribed as Tender for " SUPPLY, INSTALLATION AND COMMISSIONING OF SCADA BASED CONTROL SYSTEM FOR CST TEST FACILITY ".	NATIONAL INSTITUTE OF SOLAR ENERGY Gurgaon-Faridabad Road, Gwal Pahari, Gurgaon, Haryana - 122003, India
5	Closing time & date for submission of bids	01:00 PM on 6 th December, 2016
6	Opening of Technical Bids	03:00 PM on 6 th December, 2016
7	Opening of Financial bids of technically qualified bidders	03:00 PM on 13 th December, 2016

8	Time of supply	Maximum five weeks, after issue of P.O.
9	Validity of offer	The offer will remain valid for 4 months from the date of tender publication date
10	Validity of earnest money	The earnest money shall be submitted by the bidder in the form of CDR/FDR/BG from any bank operations in India pledged to the Director General, NISE. This shall remain valid for 12 months from the date of submission of bids.

The bidder may visit to NISE campus to see and understand the existing PLC system at CST test facility before the last date of submission of bids.

2. SCOPE OF CONTRACT:

The contract should cover the Design, Supply, Installation and Commissioning of SCADA System for operation of CST Test Facility at the National Institute of Solar Energy, Gwal Pahari, Gurgaon, Haryana, India

3. SCOPE OF WORK

A SCADA based control system has to be put up in CST test facility

The Scope of work for SCADA based control system would cover the following:

- a) SCADA system should be installed and commissioned by replacing the present PLC based control system with a given control logic as per the control requirements and specification.
- b) All the equipments should be controlled and data acquisition can be done through SCADA.
- c) System should have Control logic for automatic operation of test facility as mentioned in Annexure B.
- d) All hardware such as VFD and valves etc. to be installed and commissioned as per specifications.
- e) The Electronic hardware's in exiting PLC system at NISE should be used effectively. The details of the same should be mentioned in the Technical bid.
- f) Laying and connecting power cable, control cables etc.
- g) The details of the existing PLC system are given in Annexure A.
- h) The technical specification of SCADA system is given in Annexure B.

The tendered rate shall be deemed to include for all material, equipment, accessories, transportation, insurance and all connected works required for successful erection, testing, man power and commissioning of above equipment / system including necessary foundations for equipments.

4. SPECIFICATIONS & QUANTITY: See Annexure A and Annexure B

5. EARNEST MONEY DEPOSIT (EMD)

A sum of Rs.5,000/- should be submitted as Earnest Money Deposit (EMD) **along with the technical bid** in the form of nationalized bank's demand draft drawn in favour of "National Institute of Solar Energy payable at Gurgaon". The EMD of the accepted tender will be retained as Security Deposit and the EMD of other unsuccessful bidders would be refunded without any interest.

6. DELIVERY PERIOD

SCADA system complete in all respects as per specifications above, should be delivered at the site/consignee within One month from the date of issue of confirmed supply order.

7. INSPECTION

The supplier should satisfy themselves that the equipment supplied, fully conform to the specifications with authorized license by carrying out complete pre-inspection of each component before dispatch. Final inspection will be carried out in the presence of firm's representative after the installation of the equipment at National Institute of Solar Energy, Gwal Pahari, Gurgaon- Faridabad Road, Gurgaon (Pin-122003), Haryana, India.

8. CONSIGNEE

Director General, National Institute of Solar Energy (NISE), Gwal Pahari, Gurgaon-Faridabad Road, Gurgaon (Pin-122003), Haryana, India.

9. PAYMENT TERMS

- 90% of the amount is paid after supply of equipment.
- Remaining 10% will be paid after the commissioning at site.

10. PENALTY

The supplier shall supply the stores in accordance with the particulars as expressly specified at the time/times and at the place/places only. The time for and the date of the stores stipulated shall be deemed to be the essence of the supply/work order. If the supplies are not completed within the period prescribed, the supply order will be liable to be cancelled at the risk and cost of the contract besides forfeiting the Earnest Money Deposit. Should the supplier fail to deliver the systems within the period prescribed for such delivery/completion or at any time repudiates the contract before the expiry of such period, the competent authority or the purchaser may without prejudice to his right to recover the damages for breach of the contract/order. If for any reasons the contractor is unable to adhere to the contract delivery dates, he may seek extension in delivery/completion dates well in time by sending a request in writing in this regard to the under signed officer issuing the contract/supply order. The purchaser reserves the right to allow the extension of delivery period subject to such conditions as he may think fit. However, the decision of the purchaser shall be final and binding.

11. DOCUMENTATION:

The supplier will provide drawings, manuals, installation, operation and maintenance, trouble- shooting, circuit diagram etc. The supplier will also supply detailed circuit diagram and installation configuration of the equipment including Do's and Don'ts in **English**.

12. DISPUTES:

In case of any dispute the decision of the Director General, National Institute of Solar Energy (NISE), (an Autonomous Institute under the Ministry of New and Renewable Energy), Gwal Pahari, Gurgaon-Faridabad Road, Gurgaon (Pin-122003), will be final and binding on both the parties. Further dispute, if any will be settled in the Court of Law at New Delhi jurisdiction only.

13. COMPETENCE:

The supplier should have sufficient experience in making of SCADA systems. Catalogues and company profiles should be enclosed along with the Technical bid.

14. VALIDITY:

Tenders should be valid for 30 days from the date of opening.

15. SUBMISSION OF TENDERS

Sealed tenders are to be submitted in two parts i.e. **Part-I containing Technical competence/literature along with Demand Draft for EMD, and Part-II containing only commercial invoice in a separate sealed envelope, super-scribed as commercial bid.** Both the technical and commercial bids should be kept in a large size sealed envelope super-scribed as tender for **"SUPPLY, INSTALLATION AND COMMISSIONING OF SCADA BASED CONTROL SYSTEM FOR CST TEST FACILITY"** due for on 6th December, 2016 and addressed to:

Director General

National Institute of Solar Energy (NISE)
Gwal Pahari, Gurgaon-Faridabad Road
Distt. Gurgaon (Pin-122003), Haryana.

"SUPPLY, INSTALLATION AND COMMISSIONING OF SCADA BASED CONTROL SYSTEM FOR CONCENTRATED SOLAR THERMAL (CST) TEST FACILITY"

(S.K Singh)
Director General

Annexure A.

Details of hardware's Specification in existing CST test facility

The I/O signals of temperature, pressure and flow transmitters in test facility which operated by PLC system is detailed below.

Sensors	Output Signal
Expansion Tank Pressure Sensor	4-20 mA
Expansion Tank Outlet Pressure Sensor	4-20 mA
Solar Field Inlet Pressure Sensor	4-20 mA
Solar Field Outlet Pressure Sensor	4-20 mA
Heat Exchanger Hot water Inlet Pressure Sensor	4-20 mA
Heat Exchanger Hot water Outlet Pressure Sensor	4-20 mA
Expansion Tank Outlet Pressure Sensor	4-20 mA
Solar Field Outlet Temperature Sensor	Resistance
Solar Field Inlet Temperature Sensor	Resistance
Calorimeter Temperature Sensor	Resistance
Heat Exchanger Hot water Inlet Temperature Sensor	Resistance
Heat Exchanger Hot water Outlet Temperature Sensor	Resistance
Heat Exchanger Cold water Inlet Temperature Sensor	Resistance
Heat Exchanger Cold water Outlet Temperature Sensor	Resistance
Solar Field Inlet Flow Sensor	4-20 mA
Solar Field Bypass Flow Sensor	4-20 mA
Cooling Tower Outlet Flow Sensor	4-20 mA
Control/Indicators at Control Panel	
Solar Circulation Pump Run F/B	Potential Free Contact
Solar Circulation Pump Trip F/B	Potential Free Contact

Raw Water Pump Run F/B	Potential Free Contact
Raw Water Pump Trip F/B	Potential Free Contact
Make Up Water Pump Run F/B	Potential Free Contact
Make Up Water Pump Trip F/B	Potential Free Contact
Cooling Water Pump Run F/B	Potential Free Contact
Cooling Water Pump Trip F/B	Potential Free Contact
Solar Circulation Pump Start/ Stop	Potential Free Contact
Raw Water Pump Start/Stop	Potential Free Contact
Make UP water Pump Start/Stop	Potential Free Contact
Cooling Water Pump Start/Stop	Potential Free Contact
Expansion Tank Level Low	Potential Free Contact
Pumps and Heater	Input
Solar Circulation Pump	415 V AC 3 Phase
Raw Water Pump	415 V AC 3 Phase
Make Up Water Pump	415 V AC 3 Phase
Cooling Water Pump	415 V AC 3 Phase
Heater 24 kW	415 V AC 3 Phase
Cooling tower fan	415 V Ac 3 Phase

- Data from sensors are logged in a data logger connected through PLC.
- Solar circulation pump is controls through VFD for controlling different mass flow rate.
- Heater is controlled by Thyristor Power Regulator for temperature control

Annexure B

Detail Technical Specification for SCADA system.

S. No.	Particulars	Details
1.0	HARDWARE SPECIFICATION:	
1.1	COTROLLER CPU:	<p>a) Single stand-alone System CPU on different back plane/chassis. The processor should have a real-time clock. All below data should be consider as minimum requirement.</p> <p>b) I/O Discrete points: >128</p> <p>c) Analog I/O: >64</p> <p>d) Internal coils: 512</p> <p>e) Timer / Counter: >10</p> <p>f) User Memory: > 15k</p> <p>g) Selectable Scan time up to 500 msec. for inputs</p> <p>h) PID Controller with minimum possible scan time shall be implemented.</p> <p>i) The processor shall have capability to implement all the control functions required to implement the logic functions for the close loop controlling functions.</p> <p>j) Watchdog timer shall be a software device. Watchdog timer shall continuously monitor the healthiness of processors. Any hardware or software problem in the processor system, which shall include, CPU, Memory, power supply, communication interface etc. shall cause the watch dog timer to report processor failure</p> <p>k) Option for Third party communication through mod-bus protocol should be provided.</p>
1.2	INPUT/OUTPUTS:	<p>I/O modules as per logic and requirement as per functional isolation. I/Os for annunciation (fault) to be calculated additionally as per requirement of system and diagnosis to give total I/O count for process requirement.</p> <ul style="list-style-type: none"> • I/O status: Required. • State of output on system fault: De-energized. • Dedicated I/O modules: I/O modules should be provided as required. <p>Vendor shall provide removable wiring i.e. on removable fused terminal block/fixed terminal block so that the removal of I/O mo</p>

			for repair/replacement does not cause disturbance to wiring.
1.3	DIGITAL INPUT MODULES:	<ul style="list-style-type: none"> • Input interrogation voltage: 24V DC. • Minimum 4 & maximum 32 nos. of inputs per module shall be provided & shall withstand inrush current of 10 times the rated load. • I/O isolation type: Optical • Status LED on module: Needed for all channels. 	
1.4	DIGITAL OUTPUT MODULES:	<ul style="list-style-type: none"> • No. of outputs/module: Min 4 output/module & max 32 output/modules. • Output voltage: 24 Volt DC for SOV & LED Status Lamps. • Output type: PLC output cards should drive the Solenoid • Valves & Electrical motor interface through interposing • Relay and Status LED lamps directly. • Current rating per O/P: 200 mA per channel minimum. • Module shall withstand inrush current of 10 times the rated load • Max. Current ratings: As per requirement • I/O isolation type: Optical • Status LED on module: Needed for each channel. 	
1.5	ANALOG INPUT MODULE:	<ul style="list-style-type: none"> • Input (isolated): 4-20mA from transmitter/converter (With 2 wire inputs). • Polarity Protection required by fused terminal blocks • No. of Inputs/Module: Min 4 input/module & max 16 Input/module • Input update rate: 100 msec (Max.) • Resolution: 8 bits min. • Diagnostic LED status: Manufacturer's standard 	
1.6	ANALOG OUTPUT MODULE:	<ul style="list-style-type: none"> • No. of Output/Module: Min 4 output/module & max 12 output/module • Output type: 4-20mA • Load Impedance for current Output: 500 ohms • Resolution: 8 Bit min. 	
1.7	SPARE PHILOSOPHY:	Installed engineering spares of approx. 20% shall be provided in each sub-system for each type of module to enhance the system functional requirements with wiring	
2.0	MAN - MACHINE INTERFACE:		
2.1	SCADA console	SCADA console shall be based on the Windows and object technology and provided with the following features. Object database technology (i.e., Objectivity). OPC (OLE for process	

			Control) connectivity with other applications. TCP/IP Connectivity. CD/DVD R/RW drives in Engineering work station.
		2.1.1	<p>SCADA console should have the following</p> <p>a) 19" high-resolution colour LCDs capable of producing alphanumeric and graphic type displays.</p> <p>b). Independent electronics and interface to PLC.</p> <p>c). An optical Trackball / Mouse</p> <p>d). A detachable Alphanumeric keyboard for engineering work station use.</p> <p>e) One alarm horn and One silencing (ACK) button.</p> <p>f) Capability to perform screen-print on a colour Laser printer.</p> <p>(g) CD/DVD ROM drives in all Operating work station.</p>
		2.1.2	All SCADA screens shall be well arranged and tags shall be provided to identify each equipments/instruments with P&I Diagram.
		2.1.3	Pop Up windows shall be provided for any input to be entered
		2.1.4	All necessary interlocks & ranges of the instruments shall be indicated in one of the screen
		2.1.5	Password Protected Log-In shall be provided
	2.2	DATA LOGGING & REPORT GENERATION & TRENDS	
		2.2.1	Capability to store instantaneous values for all necessary variables minimum (7) days and with a sampling rate of (1) minute.
		2.2.2	All values shall be stored in engineering units.
		2.2.1	Report Generation shall be possible for the stored data for required interval of time.
		2.2.3	Trend/Graph Generation shall be possible for selected variables E.g. considering time as x axis and values as y axis.
	3.0	EQUIPMENT ASSEMBLY	
		3.1	Single cabinet shall be provided to accommodate both PLC & VFD system. However they both shall have separate mounting plates. Necessary isolation shall be taken to prevent hazard to PLC system through VFD system.
		3.2	Double Door cabinet shall be provided and shall be either front or rear accessible.
		3.3	Necessary Filters/Fans/Lights & Locks shall be provided inside the cabinets

	3.4		Thickness of the Cabinet and Mounting Plate shall be selected as per optimum requirement which can withstand weight of the component mounted.
	3.5		All lamps/switches/Pushbuttons shall be labelled properly to identify the function of the same.
	3.6	CABINET WIRING:	<p>a) All wiring, internal and external to the cabinets, shall be of general-purpose type.</p> <p>b) All wiring shall be housed in covered non-flammable plastic raceways so arranged for easy maintenance. Raceways shall have 10% spare capacity.</p> <p>c) All terminals shall be of screw type. Self-insulating crimping wire lugs shall be used for all terminations on terminal blocks. Whereas forked tongue type lugs shall be used for termination on screwed terminals such as on relays, push buttons, lamp, etc. Size of the terminals shall be 2.5 sq.mm or of suitable size to accept the wire gauge of the wire terminated. Terminal block shall be rated for minimum 600V.AO/DO signals' terminals will have FUSED TBS on +ve terminals only for safety purpose.</p> <p>d) Generally no more than two wires shall be terminated on a single terminal. Where ever required duplication of signals double decker terminals shall be used for looping if necessary. Use of shorting links for looping shall be avoided.</p> <p>e) Wire colour code for panel wiring shall be as follows. (As per IEC60364)</p> <p>Power supply Phase - Red</p> <p>Power Supply neutral - Black</p> <p>Ground - Yellow-Green/Green</p> <p>PLC Wiring - Blue/Orange/White/Grey</p> <p>f) All electrical terminals and equipment on the panel and other accessories shall be identified with appropriate tag, cable marker etc.</p> <p>g) All terminals in a terminal strip shall be identified by their individual numbers located integral with the terminal itself. Each group of terminal strip shall have maximum 200 terminals. Maximum number of terminals in one side of a cabinet shall be 400.</p> <p>h) Wiring at terminals shall be identified by the terminal numbers and termination services at the</p>
	3.7	POWER SUPPLY	
		3.7.1	a) Power supply shall be packaged properly, so that heat

			<p>generated by it can be removed in order to prevent overheating, hence fan shall be provided in the control panel.</p> <p>b) 24VDC power supply shall be used with 30% spare capacity. Hookup for 2-wire transmitters, LED status, Lamps etc.</p> <p>c) BUYER will provide 415 V AC, $\pm 10\%$, 50HZ, $\pm 3\text{Hz}$ UPS. It shall be contractor's responsibility to provide power distribution network required for the system and instruments on the PLC cubicle for CPU, I/O rack. For panel light, services plug (230 VOLT NON UPS AC) etc. system should be devised with sufficient current and should be with separate MCB & fuses where ever necessary</p>
		3.7.2	Power supply details shall be given subsequently
		3.7.3	Power Supplies shall be rated sufficiently to supply power to fully loaded cabinets and/or the field transmitters.
		3.7.4	The failed power supply shall be removable without interrupting power to the system or affecting control.
		3.7.5	Redundant power supply should be provided
4.0	Other Accessories		Other essential hardware's shall be included like VFD and valves etc ., to achieve the proposed control logic

Proposed Control Logic for Automatic Operation of Test Facility

It is proposed that operation of test facility should be automatic for testing of solar thermal technologies. Once that SCADA system starts the system, the safety logic and control logic will control all the equipments of the system and thus different test sequences will be done automatically based in desired value T_m .

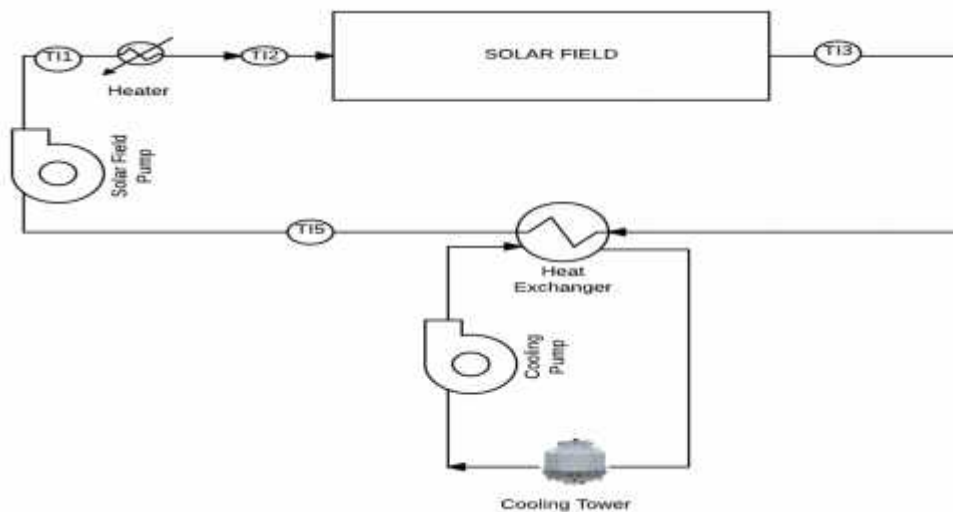


Fig: Reference diagram for control Logic

TI2 = Solar Field Outlet Temperature Sensor

TI3 = Solar Field Inlet Temperature Sensor

TI5 = Heat Exchanger Hot water Inlet Temperature Sensor

Only, TI2 and TI3 are input to be given by the operator for the desired value of $T_m (= \frac{TI2+TI3}{2})$ and all other operations will be done by the control logic. The control logic will have to fulfil the following conditions for automatic operation of the system.

Action 1: Solar Field Pump should regulate its flow so as to maintain TI3 reaches its desired value.

How to achieve Action 1: At starting solar field pump should start with maximum flow rate and once the flow is stabled, pump should gradually decrease its flow so that TI3 reaches its given value.

Action 2: Cooling Water Pump (CWP) should regulate its flow so as to maintain TI2 equals the desired value of TI2. It should turn off when TI3 is less than the desired value of TI2 and it

How to achieve Action 2: Flow in CWP should be increased when TI2 is more than desired value of TI2 and should be decreased when TI2 is less than desired value of TI2.

APPROVED MAKE OF COMPONENTS

1	MPDC/PCC/MCP	Panel Manufacturers having CPRI test certificate of Similar panel
2	Switch Gear/ Control Gear/ Overload Relay	Siemens / L & T / Schneider / equip
3	MCB/MCB DB	Standard / L&T(Hager) / Siemens / GE / Schneider / Havells / Legrand
4	PLC	Siemens/ ABB/ Schneider/Rockwell
5	Light fittings	Philips / GE / Crompton / Bajaj / Wipro/ Phoenix (Halonix)
6	Power Cables	CCI / Havell's / Gloster / Industrial/ Asian / NICCO / Universal / RPG / Torrent/ Polycarb. (Must conform to IS 7098 Part-I or IS 6474 or IS 6380)
7	Wiring Cables	Havells / Finolex / Plaza / Polycarb/ KEI. (Must conform to IS 694)

8	Cable Glands	Comet / Electromac/Siemens / Braco
9	Cable Lugs	Dowell/ Johnson
10	Metal Socket outlets	Best & Crompton / CGL / Havells / Anchor
11	Contactors/Fuses/isolators	Siemens / GE Power / BCH / L& T/ ABB / TC
12	Indicating meters	MECO/ AE
13	CTs	AE / Kappa/ Siemens/ L&T/Equiv.
14	Indic lamps/Push buttons	Siemens/ Schneider/ L& T
15	Terminal blocks	Elemex / Connectwell / WAGO
16	MCCB	GE/Schneider/L& T/Siemens/ ABB
17	Relays	GE/ Schneider/ ABB/ L&T
18	Meters	MECO/ IMP/Equip
19	Start/Stop push button with contact elements	Siemens/ Schneider/Equiv.

Any other items not included above shall be supplied by contractor after obtaining the approval for make, from our Engineer / Consultant.