

Enclosure to tender:

Annexure – S
(Sub Annexure from S1 to S6)

Electrical Installations for 1500 hp Engine Test Cell TC-10

1. Scope: Design, Supply, Installation and Testing of Electrical Paneling, Wiring, Fixtures and Fittings on Turn Key Basis for the electrical equipments in Engine Test Cell at BEML Engine Division, Mysuru.

2. Preface: The new Engine test facility proposed for installation in TC-10 will have several Electrical accessories broadly as mentioned below:

Table -1: Broad list of equipments in the proposed Engine Test Cell.

Sl. No	Location	Equipment	
1	Test Cell Console Room		
		1	Dyno Controller & Display Panel
		2	Computer
		3	UPS
		4	Voltage Stabilizer
		5	Air conditioner - 2 TR capacity - Split type - 2 Nos
		6	Lighting
		7	Sockets & Switches for other gadgets
2	Engine Test Cell		
		1	Dynamometer
		2	Fuel Measuring Unit (SFC)
		3	Fuel meter (Flow measurement)
		4	Fuel Conditioner
		5	Blowby meter
		6	Smoke Meter
		7	Air mass flow meter
		8	Coolant Conditioner for H.T circuit (High Tempr.)
		9	Coolant Conditioner for L.T circuit (Low Tempr.)
		10	Roof Exhaust Fan – 2 Nos
		11	Lube oil conditioner
		12	CCTV Cameras
		13	Several portable instruments like accelerometer, Torsional vibration meter.
		14	Lighting
3	Periphery of the		Cooling Tower Pumps

	Cell		
			Cooling tower fan
			Hoist 5 T SWL- 1 No
			Engine Cranker
			Diesel tank auto level controller
			Combustion Air Handling Unit
			Lighting
			Sockets & Switches for other gadgets
			Fire extinguishing system

To cater the Electrical supply of required ratings, power distribution boards, Electrical panels, Single phase and 3 phase supply points, Fixtures Etc., are to be installed. These requirements are part of the scope of the tender. The scope of supply and services is detailed below:

3. Please refer the enclosed General Lay out drawing of the Engine Test Cell. (See Annexure L) and Schematic Line Diagram of Power Supply and Cable Route. (See Annexure S-1).

At present Electrical Power supply is available at Main Receiving Station / Substation of capacity 2 X 800 KVA 11KV / 433V, which is located at approx. 200 M distance from proposed Engine Testing Cell TC-10. The existing nearby PDB-8 / LT panel is located about 30 m (cable length distance) from the proposed Power Distribution Board (PDB-12) in the same location and another nearby PDB-11 is at located at Compressor House at about 100 M (cable length distance) PI refer the Electrical line diagram for reference.

4. Detailed scope for the Tender: The firm should carry out the Design, Supply, Installation and Testing of following scope of work at Engine Test Cell at BEML Engine Divn. Mysuru.

Table -2 (To be filled by the firm and submitted along with Technical Bid)

Sl no.	Item Description with Specification	Qty.	Firms Offer	Firms Compliance (Accepted / Not accepted)
	Work at Compressor House			
4.1	<u>Replace existing old electrical panel with new one:</u> Complete work includes removal of existing electrical panel, removal of electrical cable connections at incomer & outgoing cables, refix new electrical panel (PDB-11), reconnect all the electrical connections, testing and energizing. Supply of any miscellaneous hardware items, fabricating any C channel structure to fix panel on floor, Cable Extension Box with busbars extension, to connect new cables etc. as required at site.	01 job		

4.2	<p><u>Supply & Fixing Power Distribution Board (PDB-11):</u> Design, Manufacture, Supply & Fix, new Power Distribution Board as per the specification & scope of supply detailed in Annexure EA-2. Complete work includes supply & fabricating MS angle iron stand for to erect new PDB on floor / on cable trench</p> <p>(See Annexure S-2 & Drawing for new PDB scope of supply)</p> <p>Note: If SFU is found obsolete/ not readily available in the market, MCCB/ MCB of suitable capacity, range and type as required with all accessories and protection O/C, S/C, E/L releases to be supplied.</p>	01 no.		
4.3	<p><u>Incoming Cabling from compressor house to PDB-12 :</u></p> <p>Supply and Laying of 3 Runs of 150 sq.mm 3.5 core 1.1KV XLPE Aluminum Armored UG Cable from PDB11 to PDB12. Approximate cable length -100 Mtr. For each run.</p> <p>Includes supply of 300 M cable, Excavation, Laying of cable in excavated earth trench, concrete floor / road cutting, supply & laying concrete / spun /hume pipe to cross the road, crossing Storm Water Drain Trench, supply & cable termination at both sides, supply of any hardware items like bolt nuts washers, cable glands, cable lugs, etc. as required at site and make good of concrete road cutting / concrete floor as guided by engineer in charge civil dept.</p> <p>Includes supply of CABLE ADAPTER BOX / Cable Extension Box to accommodate Extended bus-bars & cable connection</p> <p>"Complete work including Earth work excavation, Floor Cutting, Concrete Road Cutting, Supply & laying Concrete pipe / Spun Pipe / Hume pipe of required size & length for cable road crossing, including refilling the required quantity of earth back after cable/pipe laying, disposing the excess earth/concrete debris off the premises, making good the Floor & Road cutting portion with minimum 150mm thick, Plain Cement Concrete of ratio 1 : 1.5 : 3, above well consolidated sub-base / soling surface including finishing the concreted surface even & smooth, curing etc., complete all as specified &</p>	300 M		

	<p>directed by Engineer In-charge."</p> <p>New UG cables to be laid underground after preparing trench by Concrete Floor cutting / Road cutting to Minimum width of 2ft. , minimum depth 2ft below ground level.</p> <p>Approx. concrete road & floor cutting length = 50 M</p> <p>including all related civil works for underground pipe laying, overhead pipe laying / cable tray laying, Wall Cutting, Cement Grouting / foundation for fixing Panels etc.</p> <p>(See Annexure S-1 for Cable Route Diagram)</p>			
	Work at old electrical panel (PDB-8) at Engine Testing Dept. Building			
4.4	<p><u>Incoming Cabling from PDB-8 to PDB-12:</u></p> <p>Supply and Laying of 3 Runs of 150 sq.mm 3.5 core 1.1KV XLPE AluminiumArmoured UG Cable from old electrical panel PDB-8 to new electrical panel PDB-12.</p> <p>Approximate cable length of 20 Mtr.for each run. Includes supply of 60 M cable, Laying of cable in existing cable trench, supply &fixing cable termination at both sides, supply of any hardware items like bolt nuts washers, cable glands, cable lugs, etc.</p> <p>Includes CABLE ADAPTER BOX / Cable Extension Box to accommodate Extended busbars & cable connection to old panel PDB-8 as reqd. at site.</p> <p>(See Annexure S-1 for Cable Route Diagram)</p>	60 M		
4.5	<p><u>Supply & Fixing Power Distribution Board (PDB-12):</u></p> <p>Design, Manufacture, Supply & Fix new Power Distribution Board as per the specification & scope of supply detailed in Annexure S-2.</p> <p>Complete work includes supply & fabricating MS angle iron stand for to erect new PDB on floor / on cable trench</p> <p>(See Annexure S-2 & Drawing for new PDB scope of supply)</p>	01 no.		

	Note: If SFU is found obsolete/ not readily available in the market, MCCB/ MCB of suitable capacity, range and type as required with all accessories and protection O/C, S/C, E/L releases to be supplied.			
	Outgoing Cabling from PDB-12: (See Annexure S-1 Drawing for Cable Route Diagram & position of electrical panels)			
4.6	Cable to new cooling tower electrical panel : Supply and Laying of single run 185 sq. mm 3.5 core 1.1 KV XLPE AluminiumArmoured UG Cable from PDB-12 to nearby cooling tower electrical panel, in existing cable trench. Approximate cable length 10 Mtr. Includes supply and fixing cable termination at both sides of cable using cable gland, lugs, bolt nuts etc. as required at site	10 M		
4.7	Cable to new CAHU Electrical Panel : Supply and Laying of single run 185 sq. mm 3.5 core 1.1 KV XLPE AluminiumArmoured UG Cable from PDB-12 to CAHU electrical panel at TC-12 in existing cable trench. Approximate cable length 50 Mtr. Includes supply and fixing cable termination at both sides of cable using cable gland, lugs, bolt nuts etc. as required at site	50 M		
4.8	Cable to 5T MH Crane : Supply and Laying of single run 35 sq. mm 3.5 core 1.1 KV XLPE AluminiumArmoured UG Cable from PDB-12 to nearby main switch of 5T capacity MH Crane in existing cable trench / wall. Approximate cable length 20 Mtr. Includes supply and fixing cable termination at both sides of cable using cable gland, lugs, bolt nuts etc. as required at site	20 M		
4.9	Cable to PP-20 at Test Cell TC-10 : Supply and Laying of single run 35 sq. mm 3.5 core 1.1 KV XLPE AluminiumArmoured UG Cable from PDB-12 to PP-20 power panel at TC-10 in existing cable trench. Approximate cable length 80 Mtr. Includes supply and fixing cable termination at both sides of cable using cable gland, lugs, bolt nuts etc. as required at site	80 M		

4.10	Cable to PP-21 at Test Cell TC-12 : Supply and Laying of single run 50 sq. mm 3.5 core 1.1 KV XLPE AluminiumArmoured UG Cable from PDB-12 to PP-21 power panel at TC-12 in existing cable trench. Approximate cable length 70 Mtr. Includes supply and fixing cable termination at both sides of cable using cable gland, lugs, S.S. bolt nuts washers etc. as required at site	70 M		
4.10A	<u>Cable to Fire Extinguishing System :</u> Supply and Laying of single run 50 sq. mm 3.5 core 1.1 KV XLPE AluminiumArmoured UG Cable from PDB-12 to New Fire Extinguisher System Control Panel located beside existing Auto Fire System (OR between PDB 6 & PDB 7) in existing cable trench. Approximate cable length 80 Mtr. Includes supply and fixing cable termination at both sides of cable using cable gland, lugs, bolt nuts washers etc. as required at site	80 M		
	<u>Copper Plate Earthing</u>			
4.11	SITC of Cu Plate/Chemical Earthing : Copper plate electrode of size 300 x 300 x 3 mm Depth : 8 ft minimum Copper Flat / Earth Lead : 25 x 3 mm inside earth pit Earth Pit Testing Chamber Supply and Commissioning of Two nos. of Earthing Station, with Copper Plate Earthing as per IS specifications, Complete work as required at site & confirm to IE rules / IS standard OR code of practice for Earthing <ol style="list-style-type: none"> SITC of Cu plate Earthing – 2 Nos. connected to PDB -11 at Compressor house. SITC of Cu plate Earthing – 2 Nos. connected to PDB -12 at Testing dept. SITC of Chemical Earthing – 2 Nos connected to cooling tower electrical panel. 	6 nos.		
4.12	Supply Laying Fixing Termination of Cu Earth Flat : (for outside earth pit connection) Bare Copper flat earth lead of size 25 x 3 mm to be run from individual earth pit to PDB- 11,12 & new cooling tower panel, Interconnection of earth pits. Supply, laying & fixing of Copper Earth Flat from Earthing Station to Power Distribution Board, pump	120 M		

	panel. Including PVC sleeve, Clamps, SS nut bolt washers etc. as required at site.			
	<u>New Cooling Tower Electrical Panel :</u> <u>(See Annexure S1 Drawing for cable route & position of electrical panels)</u>			
4.13	<p>Design, Manufacture, Supply, Testing and Commissioning of Cooling Tower Electrical panel :</p> <p>Supply and Installation of floor mounted type Motor Control Centre (MCC Panel) for PUMPS & FANS of cooling tower</p> <p>Specification & scope of supply is as detailed in Annexure S-3 and in consultation with Cooling Tower Design.</p> <p>Complete work includes supply of MS C channels / L angles, hardware items etc. to Mount panel on concrete floor / on cable trench at suitable height, easy for cable connections, etc. as required at site. (SEE ANNEXURE S-3 & Drawing)</p> <p>Note: If SFU is found obsolete/ not readily available in the market, MCCB/ MCB of suitable capacity, range and type as required with all accessories and protection O/C, S/C, E/L releases to be supplied.</p>	01 no.		
4.14	<p><u>Cabling for cooling tower pumps & fans :</u></p> <p>Supply, Laying, Fixing and cable termination of Multicore flexible sheathed copper cable of required size & core, suitable for</p> <p>a)Power supply cable suitable for no. of pumps & its capacity, no. of fans & its capacity,</p> <p>b)control wiring for Remote Operation,</p> <p>c)Sensor wiring for Liquid Level Controller</p> <p>d)2 runs of bare copper wire for earthing of motors, to be run along with power supply cable(double earthing)</p> <p>complete scope as required at site, in consultation with cooling tower design.</p> <p>Includes supply and fixing suitable size cable tray, Rigid Metal Conduit / Flexible metal / PVC conduit etc.</p> <p>(SEE ANNEXURE S-4 for Approx. / minimum cable size & length)</p>	01 set		

4.15	<p><u>Auxiliary Remote Control Panel :</u></p> <p>Supply, Fixing, wiring & testing of Wired Remote Operation Panel OR Wireless Remote system – for to operate cooling tower pumps & fans independently from inside testing corridor. Similar to existing cooling tower remote operation panel.</p> <p>Complete work includes miscellaneous items if any, control wiring in conduit, running multicore control cable, etc. (SEE ANNEXURE S-5 & Drawing for remote panel scope of supply & diagram)</p>	01 set		
	<p><u>Power Panel (PP-20 & PP-21) in test cell corridor :</u> <u>(See Annexure S1 Drawing for cable route & position of electrical panels)</u></p>			
4.16	<p>Design, Manufacture, Supply, Installation, Testing and Commissioning of Power Panel (PCC Panel)</p> <p>Specification & scope of supply as detailed in Annexure S-6 The Approximate size / dimension and color required, as similar to existing PP in testing corridor. (SEE ANNEXURE S-6 & Drawing)</p> <p>Includes supply of miscellaneous items like MS C channel / L angle Iron stand to mount panel on concrete floor and Wooden Box to cover cabling box. Etc. as required at site.</p> <p>Note: If SFU is found obsolete/ not readily available in the market, MCCB/ MCB of suitable capacity, range and type as required with all accessories and protection O/C, S/C, E/L releases to be supplied.</p>	02 nos.		
	<p><u>Test Cell Lighting (for both TC-10 & TC-12) :</u></p>			
4.17	<p>Supply and Fixing 100W 230V AC 50Hz LED Bay Lighting Fixture. --- Approx. 05 nos. of fittings in each test cell Light fittings of make: Philips / Crompton Greaves / Havells are acceptable.</p> <p><u>Flame Proof Light Fittings suitable for Diesel & water vapour / exhaust smoke environment</u></p> <p>Complete work includes supply of any miscellaneous hardware items required to fix light</p>	10 nos.		

	<p>fittings as required at site and convenient to Engine Test cell Operators.</p> <p>The Illumination level inside test cell shall be around 350 Lux minimum & uniform. The minimum wattage of LED bay light is 100W x 5 nos. Either no. of fittings OR Wattage may be changed accordingly.</p>			
4.18	<p>Supply and Wiring for Lighting DB & light fittings :</p> <p>For both Test cell TC-10 and TC-12 Includes</p> <p>a)supply& fixing Lighting DB with MCB</p> <p>b)Supply& wiring using 2.5 sq. mm. (Flame Retardant) FR insulated multistrand copper wire, and metal conduit etc.</p> <p>c)single circuit means 1 phase red color, 1 neutral black color + 1 earthing green color wire – all run in same conduit.</p> <p>complete work as required at site and confirm to IE Rules / code of practice for industrial wiring.</p>	01 set		
	<u>Single phase and Three phase power points :</u>			
4.19	<p><u>Supply, Fixing and Wiring for 3ph power sockets :</u></p> <p>(Industrial Metal Clad Power sockets 3ph 415V 32Amp with MCBs and Plugs)</p> <p>a)4 nos. /points --inside Engine Test cell</p> <p>b)2 nos. / points -- Insidetesting console corridor. – Total 6points in each Test Cell</p> <p>c)FR insulated multistrand copper wire of 4 sq.mm</p> <p>d)single circuit means 3 phase red / yellow / blue color, 1 neutral black color + 1 earthing green color wire – all run in same conduit.</p> <p>Complete work includes materials & labours as required at site, wiring in Metal conduit suitable for & confirm to code of practice for Industrial wiring/ IE rules.</p>	12 nos.		
4.20	<p><u>Supply, Fixing and Wiring for 1ph power sockets :</u></p> <p>Industrial Metal Clad Power Sockets 1ph 250V 20Amp with MCBs and Plugs)</p> <p>a)4nos. / points -- inside Engine Test cell</p> <p>b)2 nos. / points -- inside console corridor. – Total 6 points in each Test Cell</p> <p>c)FR insulated multistrand copper wire of 4 sq.mm</p> <p>d)single circuit means 1 phase red color, 1 neutral black color + 1 earthing green color wire – all run in same conduit.</p>	12 nos.		

	Complete work includes materials &labours as required at site, wiring in Metal Conduit suitable for & confirm to code of practice for Industrial wiring/ IE rules.			
	Electrical work pertaining to 5 Ton Wire Rope Hoist :			
4.21	<p>Electrical work of SITC of 5 Ton Electric Wire Rope Hoist Includes,</p> <p>i) Festoon Cabling System for span of 20 Mtr. Approx.</p> <p>ii) Supply and Installation of control panel, crane pendent and complete wiring.</p> <p>iii)Supply & fixing 63A TPN switch on wall</p> <p>Firm should furnish GA Drawing, Circuit Diagram, Bill of Materials, Spares list etc. for BEML approval before manufacturing.</p>	01 no.		
4.22	<p>Supply & Fixing Wiring for Roof Extractors:</p> <p>wiring work – running from PP to Roof extractors – wiring in 1 inch metal conduit pipe & using 6 sq mm multi strand single core copper cable – suitable for 3ph 415V 10hp motor & double Earthing using bare copper wire to the roof extractor motor.</p> <p>Alternately – Two runs of 6 sqmm 4 core copper armoured UG cable with necessary cable glands, copper lugs, double earth copper wire running along with UG cable.</p> <p>Complete work as required at site and confirm to IE rules / IS standard OR code of practice for industrial wiring.</p>	01 set		
	Body Earthing of Electrical Apparatus :			
4.23	Establishing Earthing Connection using 2 Run of 8 SWG Bare Copper Wire from - Earth Bus located at Service pit to each Power Panel kept inside testing corridor. -- Qty = 40 Mtr. Approximately.	40 M		
	Replacing Existing 25hp capacity Electric motor of the exhaust blower with 45 KW / 60 hp Electric motor.			
4.24	Supply, Fixing, wiring and testing of 60 hp IE3 Energy Efficient 3ph Induction motor : to replace existing 25hp motor	01 no.		

	<p>3ph ind. Motor 4 pole TEFC 45 KW / 60 hp, Duty:S1, 1480 RPM, Class F, IP 55, Frame size: 225 M Horizontal Foot Mounting (B3 Mtg.) make: Siemens / ABB / Crompton / NGEF are acceptable.</p> <p>Motor should be with IE3 name plate. Firm to submit Test and Guarantee Certificate along with supply of motor.</p> <p>(Cable & Starter is in BEML scope. Existing old 125hp motor starter & UG cables to be used)</p> <p>Supply & fabricating new motor base plate, suitable to fix new 60hp motor in place of existing 25hp motor</p> <p>supply & fixing 6 nos. of new V Belts, of size C3510.C136 make: Ecodrive OR EQVLT. Is in firm's scope.</p> <p>Supply, Fabricating and Fixing belt guard etc. as reqd. at site is in firm's scope. (existing damaged belt guard to be replaced with new mesh guard)</p> <p>supply & replacing the motor side pulley, to increase the exhaust conveyor blower speed, to match the exhaust flow rate as per site requirement is in Firm's Scope.</p>			
4.25	<p><u>Supply and Commissioning of 2TR Split AC :</u></p> <p>Supply and fixing of 2TR capacity 5 star rated Split Air Conditioner along with required accessories, Remote, Voltage Stabilizer etc. make: Voltas / Carrier / Blue Star</p>	02 set		
4.26	<p><u>Supply and Fixing Wiring for AC points :</u></p> <p>Supply & fixing wiring for 1ph 230V 32A AC power points, in 1inch Metal Conduit pipe with FR insulated, 3 run of 4 sq mm copper multi strand copper wires (3run for each circuit for PNE) And cable termination at Power Panel (PP-21) at one side and another side connected to 32A 1ph 230V Metal Clad Plug & Socket DB.</p> <p>Complete work with wiring materials, Metal Cladplug & socket board, Plug etc. as required at site. Wiring in Surface or concealed wiring as required.</p>	01 set		
4.27	<p><u>Supply and Commissioning of UPS :</u></p> <p>a. 1 KVA UPS, Single phase input, Single</p>	1No each		

	<p>phase output, 230 V, 50 Hz to be connected to Auto fire system panel.</p> <p>b. 6 KVA UPS, 3 Phase input, Single phase or 3 phase output suitable to connect Dynamo meter control and CC TV control system as required at site.</p>			
4.28	<p><u>Supply, fixing and wiring – UPS DB :</u></p> <p>Factory made 4 way VTPN UPS distribution board includes MCB, Copper wire, termination Etc., as required at site (Test cell corridor).</p>	1 No.		

5. The following makes of the items are to be used.

- 1) **Electrical Cables** : of make Finolex / Polycab / Unistar / Havells / V-Guard are acceptable.
- 2) **Switch Fuse Units / MCB / MCCB** : L&T, Siemens, BCH, Havells is acceptable.
- 3) Complete work as required at site and as instructed by Engineer In-charge and to comply with Electrical Inspectorate Approval and Industrial safety norms.
- 4) Copper cables to connect Equipments/Accessories from nearby power source includes suitable plug, socket, pin top, conduit etc as required at site is in firm's scope.

SUB-ANNEXURES

Annexure S-1: Power Supply Schematic Line Diagram, Indicates Cable Route and position of Power Distribution Boards (PDB), Cooling Tower Electrical Panel, Power Panel (PP) etc.
(PI refer Drawing pertaining to Annexe-S1 Enclosed)

Annexure S-2 : Technical Specification, Scope of Supply & Minimum BOQ for PDB-11 and PDB-12. **(PI refer Drawing pertaining to Annexe-S2 Enclosed)**

Design, Fabricate, Assemble, Supply, Installation, Testing and Commissioning of LT Power Distribution Board with L&T make SFUs, Metering, Bus Coupling, Bus bars etc. suitable & similar to Existing PDB at Engine Division, BEML Ltd., Mysore Complex.

Note: If SFU is found obsolete/ not readily available in the market, MCCB/ MCB of suitable capacity, range and type as required with all accessories and protection O/C, S/C, E/L releases to be supplied.

Approx, Minimum Bill of Materials for LT panel (PDB)					
SI No.	Item Description	Specification	Make	Qty.	Remarks
		INCOMER SECTION 1 & 2			
01	INCOMER SFU	Switch Fuse Unit, 630A, TPN, 415V AC	L&T	2 nos.	Incomer 1 & 2
02	HRC FUSES	DIN Type HRC Fuse 630A	L&T	6 nos.	For incomer SFU

		METERING SECTION 1& 2				
03	INDICATORS	R,Y,B, Indicating Lamps, LED type, 230V AC	Reputed	6 nos.	For incomer 1 & 2	
04	FUSE FITTINGS	6A 500V AC with NS type fuses	Reputed	6 nos.	For incomer 1 & 2	
05	DIGITAL MFM METER	Multi Function Meter – Aux. 230V AC – suitable for to read & record Amps, Volts, KW, KVA, KVAR, KWH	VEGA L&T	2 nos.	For incomer 1 & 2	
06	AMMETER	Analog Ammeter, Aux. supply 230V AC, 5A size: 96X96mm	L&T	2 nos.	For incomer 1 & 2	
07	VOLTMETER	Analog Voltmeter, Aux. supply 230V AC, 0-500V size: 96X96mm	L&T	2 nos.	For incomer 1 & 2	
08	CT	Current Transformer 630/5A, CL-1, 15VA, Resin Cast type	KALPA	6 nos.	For incomer 1 & 2	
		BUSCOUPLER SECTION				
09	COUPLER SFU	Switch Fuse Unit, 630A, TPN / FP, 415V AC, fitted with Castle Interlocking	L&T	1 no.	For coupling incomer 1 OR 2	
		OUTGOING SECTION 1 & 2				
10	400A SFU	Switch Fuse Unit, 400A, TPN, 415V AC	L&T	4 nos.	To be distributed in section1 & 2	
11	250A SFU	Switch Fuse Unit, 250A, TPN,415V AC	L&T	4 nos.	To be distributed in Section 1 & 2	
12	125A SFU	Switch Fuse Unit, 125A, TPN, 415V AC	L&T	3 no.	To be arranged in section 1 or 2	
		ENCLOSURE				
13	PANEL	Approx. size: 3000(W) X 2075(H) X 800(D) Single Front Compartmentalized Type, Rear Cable Alley, Bottom Gland Plate, duly pre-treated for 7 day tank treated, powder coated with Color Shade RAL 7035	Reputed	1 no.		
		BUSBARS				
14	MAIN BUSBAR	1RX80X10 for Phase and 1RX80X06 for Neutral, 630A Aluminum Main Bus bars	STD	As reqd.		
15	SFU TAPPING BUSBARS	2RX40X10 for Phase and 1RX40X10 for Neutral,630A Tapping Busbars, 2RX30X10 for Phase and 1RX30X10 for Neutral, 400A Aluminum Tapping Bus bars 2RX25X10 for Phase and 1RX25X10 for Neutral, 250A Aluminum Tapping bus bars 1RX25X10 for Phase and 1RX25X06 for Neutral, 125A Aluminum SFU	STD	As reqd.		

		Tapping				
16	EARTH BUS	1RX40X10 mm Aluminum Main Bus bar	STD	As reqd.		
Miscellaneous items like Hardware, Shrouding, DIN Rails, CTTB, Control TBs, RYBN Sleeve, Name Plate, Lugs, Power Cables, Control Cables, PVC Duct, Toggle Switches, Castle Interlocking, are as required and all of Reputed make.						

Note: 1. The LT Power Distribution Board to be confirm to Latest IS Standards.

2. Firm to Furnish Bill of Materials (BoQ) and Drawings for BEML Approval, prior to mfg.

3. Firm to Offer for Pre-Dispatch Inspection at their works. BEML will decide the place of inspection.

4. The PDB to be complete in all nature and free from all defects. All Switchgears , Meters & Accessories to be Guaranteed for a period of at least 24 months from the date of supply and Set of Instruction manuals, Guarantee Cards, Bill of Materials, Drawings, Metering Circuit Diagram to be submitted along with Delivery of item.

Note: If SFU is found obsolete/ not readily available in the market, MCCB/ MCB of suitable capacity, range and type as required with all accessories and protection O/C, S/C, E/L releases to be supplied.

Annexure S-3 : Technical Specification, Scope of Supply & Minimum BOQ for Cooling tower panel (**PI refer Drawing pertaining to Annexe-S3 Enclosed**)

Motor Control Centre (MCC Panel) for PUMPS -- COOLING TOWER ELECTRICAL PANEL

Supply and Installation of floor mounted type Motor Control Centre (MCC Panel) for PUMPS consisting of the following.

i) one no. of 400 Amp Incoming SFU (Switch Fuse Unit)

ii) Metering Circuit with Digital Meters, like Mains ON R Y B LED indicator lamps, Analog Voltmeter with Selector Switch, Analog Ammeter with Selector Switch, Digital Multifunction Meter for V/A/VAR/KW/KVA/ KWH/Power Factor measurement etc. & 3nos. of 400/5A Class 1 CTs for current measurement.

iii) Digital Temperature Controller - 2nos. -- each one for Hot water tank & Cold water tank.

iv) Motor Control Centre – MCCs consisting of

a) 3 nos. of 25 HP Star/Delta Starter – for 3 nos. hot water pumps (CWP-1, CWP-2, CWP-3)

b) 3 nos. of 25 HP Star/Delta Starter – for 3 nos. cold water pump. (HWP-1, HWP-2, HWP-3)

c) 2 nos. 10 HP DOL Starters - for 2nos. of cooling tower fans (FAN-1, FAN-2)

d) 1no. of 25 HP Star/Delta Starter – spare (OR for booster pump in future use)

e)2 nos. of 10 HP DOL Starter – spare (OR for additional water circulation pump for balancing water level via water level controller in future use)

f)2nos. of Water Level Controllers - each one for cold water tank & hot water tank.

g)glass relays and Terminal Boards – for Local / Remote operation of pumps & fans.

h)Auto / Manual Selection Switches for hot water pumps.

i)Local / Remote operation selector switches for cold water & hot water pumps.

Note 1: All the pump starters are to be provided with suitable rating MCCB / MCB, MPCB / Bimetal Over Load Relays for short circuit & thermal protection. All pump starters should have ON – OFF push button With run / stop / trip indicators. L & T/ BCH/SIEMENS/ Reputed make controls.

Note 2: the ratings mentioned above are approximate. However MCC panel to be designed in consultation with cooling tower design. All electrical accessories Ratings & Protection to be suitable for Type 2 coordination.

Note3: If SFU is found obsolete/ not readily available in the market, MCCB/ MCB of suitable capacity, range and type as required with all accessories and protection O/C, S/C, E/L releases to be supplied.

Firm to submit the GA Drawing, Circuit Diagram and Bill of Materials (BoQ) of cooling tower panel for BEML Approval before taking up to production.

Firm to offer Pre-dispatch inspection. BEML will decide the place of inspection.

Annexure S-4 : Cabling for cooling tower pumps, fans, remote panel, liquid level controller etc.

Approx, Minimum Bill of Materials for Cabling of Cooling Tower Pumps & fans etc.					
SI No.	Item Description	Specification	Make	Qty.	Remarks
01	Cold Water Pumps Power Cabling	Multicore Multistrand Flexible Sheathed Copper Cable 1100 volts PVC Insulated, Minimum 4 core 6 sq.mm double run with double earthing bare copper wire for earthing OR EQVLT.	Polycab / Havells	Approx. 1 coil of 100 Mtr.	To connect 3 nos. 25hp of cold water pumps from cooling tower electrical panel
02	Hot Water Pumps Power Cabling	Multicore Multistrand Flexible Sheathed Copper Cable 1100 volts PVC Insulated, Minimum 4 core 6 sq.mm double run with double earthing bare copper wire for earthing OR EQVLT.	Polycab / Havells	Approx. 1 coil of 100 Mtr.	To connect 3 nos. 25hp of hot water pumps from cooling tower electrical panel
03	Cooling Tower Fans Power	Multicore Multistrand Flexible Sheathed Copper Cable 1100 volts	Polycab /	Approx. 1 coil of	To connect 2nos. of 10

	Cabling	PVC Insulated, Minimum 4 core 4 sq.mm double run with double earthing bare copper wire for earthing	Havells	100 Mtr.	hp fan motors from cooling tower electrical panel	
04	Control / Signal Cabling for water level controller	Multicore Multistrand Flexible Sheathed Copper Cable 1100 volts PVC Insulated, Minimum 6 core 1.5 sq.mm	Polycab / Havells	Approx. 1 coil of 100 Mtr.	For to connect water level controller sensors	
05	Control Cabling for Auxiliary Remote Panel	Multicore Multistrand Flexible Sheathed Copper Cable 1100 volts PVC Insulated, Minimum 24 core 1.5 sq.mm	Polycab / Havells	Approx. 1 coil of 100 Mtr.	From Main panel to Remote panel at testcell corridor	
06	Cable Tray / Metal Conduit	G.I. perforated cable tray of suitable size & length for laying cables from main panel to individual pumps, fans, sensors as required at site.	Reputed make	Approx. 8"-10 M 4"-10M 2"-10M	from main panel to pump deck thru wall, lawn, trench etc.	
07	Cable Termination	Termination of cables in pump motor TB, Fan motor TB, etc. using copper lugs, cable gland, coloured sleeves etc.	Reputed make	01 lot		
Miscellaneous hardware items like cable tray support clamps, Metal Conduit pipe clamps, supporting angle iron stand / bracket, Junction Box, Insulated sleeves, Wooden guttas etc. as required.						

Annexure S-5 :Auxiliary panel / Wired Remote panel Diagram – for to control cooling tower (**PI refer Drawing pertaining to Annexe-S5 Enclosed**)

Annexure S-6 : Scope of Supply & Minimum BOQ for Power Panel (PP-20 & PP-21)

(To be placed either inside TC-10 & TC-12 OR PP-20 inside testing corridor & PP-21 inside TC-12)

Note: If SFU is found obsolete/ not readily available in the market, MCCB/ MCB of suitable capacity, range and type as required with all accessories and protection O/C, S/C, E/L releases to be supplied.

Power Control Centre (PCC Panel) -- Power Panel - 2nos. - one for TC10 & another for TC12
Supply and Installation of floor mounted type Power Control Centre (PCC Panel) for Electrical Accessories inside Test Cell, consisting of the following. (**PI refer Drawing pertaining to Annexe-S6 Enclosed**)

i) One no. incoming 160 Amp SFU (TPN Switch Fuse Unit)

ii) Metering Circuit with Indicator Lamps, Analog & Digital Meters, like Mains ON R Y B LED indicator lamps, Analog Voltmeter with Selector Switch, Analog Ammeter with Selector Switch,

Digital LED OR LCD type Multifunction Meter for V/A/VAR/KW/KVA/ KWH/Power Factor measurement etc. & 3nos. of 150/5A Class 1 CTs for current measurement.

iii) 1no. outgoing 63Amp TPN SFU with 10 HP DOL Starter (built inside the switch box)
-- one starter for one Roof Extractor / Blower Fan -1

iv) 1nos. outgoing 63Amp TPN SFU with 10 HP DOL Starter (built inside the switch box)
-- one starter for one Roof Extractor / Blower Fan - 2.

v) 1no. outgoing 63 Amp TPN SFU for Engine Cranker

vi) 1 no. outgoing 32 Amp TPN SFU for 3ph power points inside & outside test cell.

vii) 1 no. outgoing 32 Amp TPN SFU for 1ph power points inside & outside test cell.

viii) 1 no. outgoing 32 Amp TPN SFU for Test Cell Lighting.

ix) 1 no. 32 Amp TPN SFU for Dynamometer Control Panel.

Note: All the starters are to be provided with suitable rating MCB / Fuse and Bimetal OLRs for short circuit & thermal protection. All starters should have ON – OFF push button With run / stop / trip indicators. L & T/ BCH/SIEMENS/ Reputed make controls.

The Approximate dimension of existing PCC is L=920 mm, H=220 mm, W=400 mm.

The size of Aluminium Main Busbars, Tapping Busbars / Bus links, to be appropriate as per standard electrical design.

The thickness of Fabricated sheet metal to be appropriate as per standard electrical design.

Note 1: the ratings mentioned above are approximate. However PCC panel to be designed suitable for Type 2 coordination & protection scheme. The ratings of all individual components are suitable accordingly.

Note 2: the firm should furnish GA Diagram, Single Line Diagram, Dimensional details, BoQ of materials, Live parts clearances, size of busbars, thickness of sheet metals used etc. for BEML Approval before taking manufacture of the item.

Note 3: Firm to offer pre-dispatch inspection. BEML will decide the place of inspection.

Note 4: If SFU is found obsolete/ not readily available in the market, MCCB/ MCB of suitable capacity, range and type as required with all accessories and protection O/C, S/C, E/L releases to be supplied.