COVER SHEET

TECHNICAL SPECIFICATION

FOR

DRIVES LAB ITEMS

CONTENTS

INTENT OF SPECIFICATION

1. The quotation will be made BY OEMS strictly in line with NIT and following conditions.
2. This requirement is for the drives laboratory being set up at ISG premises.
3. These specifications are made in order to cover the complete requirement of items to be used in the drives laboratory.
4. Vendor can quote for the items in his range and need not quote for all items in this tender.
5. Deviations if any shall be clearly mentioned in the format given in Section – VIII of this Specification only and nowhere else.
6. Tenderer shall make one copy of this specification duly signed and submitted along with the offer as a token of acceptance.
8. Price shall be provided separately for each item as per the price formats provided separately.
9. Un-priced price format shall be provided along with the techno-commercial offer.

SECTION – I

SITE DATA

1.0 **Site Data.**
1.1 Location: BHEL ISG BANGALORE
1.2 No data loss while operating: 0 Deg C to 45 Deg C.
1.3 Destruction proof while not operating: -40 Deg C to 70 Deg C
1.4 Max. Relative Humidity: 100 %
1.5 **Power supply available:** UPS supply 240vAC, 415 V 3 Phase unregulated

Scope of supply:

Sl. No.	Item Description	SPECIFICATION NO.	QTY	Approved vendor
A1	5 KW AC Drive 4 quadrant with Ethernet connection	IS-1-08-DL-001	2 SETS	ABB, SIEMENS
A2	5 KW Inverter duty AC Motors + base frame	IS-1-08-DL-002	2 SETS	ABB, SIEMENS, KIRLOSKAR
A3	Speed transducers + couplings	IS-1-08-DL-003	2 SETS	Hubner, ABB, SIEMENS
A4	Centrifuge switch + couplings	IS-1-08-DL-004	2 SETS	Hubner, ABB, SIEMENS
A5	Position transducer + couplings	IS-1-08-DL-005	2 SETS	Hubner, ABB, SIEMENS
A6	AC Motor mounted Mechanical brake disk	IS-1-08-DL-006	2 SETS	ABB, SIEMENS, KIRLOSKAR
A7	Fly wheel disks	IS-1-08-DL-007	2 SETS	ABB, SIEMENS, KIRLOSKAR
A8	Mechanical load belt & pulley type	IS-1-08-DL-008	2 SETS	ABB, SIEMENS, KIRLOSKAR
A9	Programming terminal (with Rockwell software)	IS-1-08-DL-009	1 SET	HP/WIPRO/ZENITH/HCL/SIEMENS/ RAIL/COMPAQ/IBM
A10	Data logger PC based with sensors for speed current torque, Voltage and position transducers, Rockwell software	IS-1-08-DL-010	1 NO.	HP/WIPRO/ZENITH/HCL/SIEMENS/ RAIL/COMPAQ/IBM
A11	Feeders	IS-1-08-DL-011	1 NO.	Electrichen power gears/ VV controls/ Venson/hi-power/ others
A12	Dust proof measures civil work	IS-1-08-DL-012	1 SET	Bangalore / Karnataka
A13				
A14	Ethernet switches	IS-1-08-DL-014	1 SET	CISCO/Equivalent
A15	Miscellaneous test instruments	IS-1-08-DL-015	1 SET	SHylendra/motwane/Conin
A16	Precision V source	IS-1-08-DL-016	2 NO	SHylendra/motwane/Conin
A17	HMI terminal	IS-1-08-DL-017	1 NO.	HP/WIPRO/ZENITH/HCL/SIEMENS/ RAIL/COMPAQ/IBM
B1	Software development stations	IS-1-08-DL-018	3 NO.S	HP/WIPRO/ZENITH/HCL/SIEMENS/ RAIL/COMPAQ/IBM

B2	Ethernet switches	IS-1-08-DL-019	1 SET	CISCO/Equivalent
B3	CPU modules with IOs and communication modules	IS-1-08-DL-020	1 SET	ABB/SIEMENS/RAIL
B4	Optic fiber cable, Ethernet cables	IS-1-08-DL-021	2 SET	CISCO/Equivalent
B5	Precision V-I source	IS-1-08-DL-022	1 SET	SHylendra/motwane/Conin
B6	Miscellaneous test instruments	IS-1-08-DL-023	1 SET	SHylendra/motwane/Conin
B7	Secondary injection kit, core identification kit, Hand held meter, buzzer	IS-1-08-DL-024	1 NO.	SHylendra/motwane/Conin
B8	Precision milli-volt source	IS-1-08-DL-025	1 NO.	SHylendra/motwane/Conin
B9	Thermocouple simulator	IS-1-08-DL-026	1 NO.	Imported
B10	RTD simulator	IS-1-08-DL-027	1 NO.	Imported
B11	Digital MultiMetre	IS-1-08-DL-028	5 NO.S	SHylendra/motwane/Conin
B12	GPS time synchronization source	IS-1-08-DL-029	1 NO.	Bangalore / Karnataka
B13	Sq. wave pulse generator	IS-1-08-DL-030	1NO.	Chennai/ Tamilnadu
B14	Sync. Modules	IS-1-08-DL-031	1 NO.	BHEL EDN / EQUIVALENT
B15	Tool kits for wiring	IS-1-08-DL-032	1 SET	UNIVERSAL TOOLS/ OTHERS
B16	Control desk with switches and meters	IS-1-08-DL-033	1 NO.	Electrichen power gears/ VV controls/ Venson/hi-power/ others
B17	Simulator software	IS-1-08-DL-034	1 SET	Bangalore / Karnataka
B18	Level 2 computer/server with OS and communication software	IS-1-08-DL-035	3 NO.S	HP/WIPRO/ZENITH/HCL/SIEMENS/ RAIL/COMPAQ/IBM
B19	Human machine interface along with development software	IS-1-08-DL-036	3 NO.S	HP/WIPRO/ZENITH/HCL/SIEMENS/ RAIL/COMPAQ/IBM
C1	Modules and storage system	IS-1-08-DL-037	1 NO.	GODREJ/EQUIVALENT
C2	Work bench with facilities	IS-1-08-DL-038	4 NO.S	GODREJ/EQUIVALENT
C3	UPS 12 KVA	IS-1-08-DL-039	1 NO.	HI-REL
C4	12 KVA 3 phase 415V/800V trafo	IS-1-08-DL-040	3 NO.	Bangalore / Karnataka
C5	Oscilloscope	IS-1-08-DL-041	6 NO.S	Bangalore / Karnataka
C6	12 Channel signal plotter	IS-1-08-DL-042	2 NO.S	Bangalore / Karnataka
C7	3 Phase Auto transformer 12 KVA, 415V/0-415V	IS-1-08-DL-043	3 NO.S	SHylendra/motwane/Conin

C8	Programmable interface card, Communication bus interface card	IS-1-08-DL-044	1 SET	ABB/SIEMENS/RAIL/EQUIVALENT
C9	HV test kit, LCR meter, harmonic analyses	IS-1-08-DL-045	1 NO.	SHylendra/motwane/Conin

SPECIFICATION : IS-1-08-DL-001

DESCRIPTION : 5 KW AC Drive 4 quadrant with Ethernet connection & profibus connection

QTY : 2 SETS

APPROVED MAKE: ABB/SIEMENS

DETAILED SPECS:

VVVF Drive Specification:

1) The digital VVVF drive shall be used for intended application (which requires accurate speed and torque control. The efficiency of the digital VVVF drive shall not be less than 97%. In the case of torque control, torque step rise time for open loop and closed loop control shall be less than 5 ms with nominal torque. In the case of speed control, for closed loop control, the static accuracy shall be in the range of 0.01 % of nominal speed and dynamic accuracy shall be in the range of 0.1-0.2% sec. with 100% torque step.

2) VVVF Convertor system for AC drive shall comprise of following main units

- Convertor transformer
- A.C Power circuit devices
- Thyristor bridge/ convertor AC to DC
- Inverter bridge for DC to AC

Prepared By:	Checked By:	Approved By:

- Regulation & control equipment
- Protection, indication & annunciation devices.
- Load side filter, step up transformer as required & input reactor.

3) The VVVF convertor panels shall be sheet steel enclosed of minimum thickness 2.5 mm, dust and vermin proof, free standing, floor mounted having panel illumination lamps, space heaters and sockets for soldering etc.

4) The control blocks shall be plug-in type with required/necessary test sockets. The layout of components shall be such designed that the testing operation & maintenance is convenient. The panels shall have enclosure with class of protection conforming to IP-41.

5) The protective features for the VVVF convertor shall include following:

- Electronic type AC surge suppressor with fuse monitoring device, AC incomer under voltage & over load.
- Phase sequence protection & monitoring
- Convertor transformer fault
- RC snubber across each thyristor device & input AC reactor at the converter input.
- Semi-conductor fuses with fuse monitoring device in series with each thyristor device.
- Air Flow/ pressure switch for forced air-cooling system.

6) The DC side of VVVF convertor shall have following features:

- Smoothening reactor.

- Indication measurement & feedback of current on DC side.

7) The digital drive regulation shall be considered ensuring precise control of speed and torque.

8) The control functions to be carried by the VVVF convertor include following, but shall not be limited to:

- Reference speed setter
- Ramp generator
- Speed feed back & controller
- Current feed back & controller
- Pulse transformer & trigger module
- Logic control & sequence module
- V/f control
- Slip compensation control
- Current limiter
- Counter current/ regenerative braking
- Regulated power supply for reference setting:

The variation of (+/-) 0.1% with the input variation of +10% -15% steady state regulation of (+/-) 0.25% against +3%, -6% input supply frequency variation and 100 to 200% load disturbances.

9) The control regulation equipment shall be compatible to PLC in the distribution hierarchical control.

10) The protections for the VVVF convertor are to be provided as per the clauses stipulated in IEEE-444 as suitable and required for each case and shall generally include the following.

- Over voltage & Under voltage on DC link
- Over current on DC link
- Transients and surges over voltage and loss of phase.
- Over speed monitor
- DC side short circuit

- DC side earth fault
- Control power supply failure
- Inversion fault, di/dt & dv/dt
- Ventilation failure
- Wrong phase sequence
- Motor stalling monitor
- Any other protection as required for particular application

11) In case of H.T motor and process drives display and data logging shall be considered by providing printer.

12) The indications shall be provided as listed but not limited to the following:

- Voltmeter and an ammeter for output and input side shall be provided.
- The frequency meter for output side to be provided
- Speed indicator of motor as required. Meter with selector switch for signal measurement at all important power points in regulation system.

13) The annunciation shall be provided as listed but not limited to the following:

- Main power ON
- Control supply ON
- DC convertor ON
- DC breaker/ contractor ON & tripped
- Earth fault
- Convertor transformer fault as applicable
- Incoming breaker trip
- Phase loss
- DC over voltage
- Microprocessor healthy

14) Following faults shall also be annunciated Convertor faults/ Inverter faults :

- Overload
- Over current
- AC fault
- DC fault
- Fuse failure
- Fan failure
- Surge suppressor failure

Motor faults:

- Over load
- Over current
- Over speed
- Over voltage
- Speed sensor fault

Alarms:

- Convertor overload
- Motor overload
- Earth fault]

Drive status:

- Readiness
- Field ON

15) The load side shall comprise of filter network, suitable step up power transformer and isolator and overload relay for each motor. A provision of by-pass to be made for running the drive in case of failure of VVVF convertor.

16) Drive should support direct interfacing of Encoder, Tacho & Brake.(drive should have Brake control logic & close loop control logic (positioning))

Constructional features

- Totally enclosed, sheet steel clad, dust & vermin proof and floor mounting type with IP 41 degree of enclosure. Rittal make panels of suitable size shall be supplied for Drive Panel.

- Panel front, rear and side door shall be using 2 mm thick sheet steel.
- Paint shade outside and inside - RAL 7035.
- Tinned copper earth bus size - 30x6 mm
- Earthing studs shall be provided externally at side of the panel.
- Front door shall be hinged type with concealed hinges.
- Door swing shall be 85 to 90 deg.
- Cable entry shall be from bottom.
- Panel shall be freestanding type and each panel shall have 4 nos. removable lifting hooks at top.
- Suitable cable clamping arrangement shall be provided.

- Cable termination on either side shall be done with pin/ U- type lugs.
- Gland plate 3 mm HRSS shall be provided.

- All door and cover plates for cut-outs shall be provided with suitable Neoprene/ Rubber gaskets to give the required degree of protection.
- Toughened glass, if provided, shall be 4 mm thick with rubber beading all around and clamps at back support.
- Foundation frame shall be made using MS channel size 75x40x6 mm thick painted black.
- Panel internal wiring shall run through PVC channels with covers.
- Door shall be provided with locking arrangements.
- 15 mm anti-vibration pad shall be provided.
- Panel to panel jointed sides will be with cork sheet beading between frames.
- Tolerance shall be $\pm$ 5 mm of panel dimension.
- Heat load data shall be provided by supplier of each panel.
- All cubicles, racks and modules to be provided with readily visible identification labels.
- Necessary 240 V AC power supply socket to be provided for connection of instruments during maintenance.
- Copper / Aluminum bus shall be provided for grounding purposes.
- All cables shall enter from bottom of panels and removable gland plates will be provided with each Cubicle.
- Panels shall be provided with internal illumination.
- 20% spare Terminals shall be provided.
- 200 mm empty space from bottom shall be provided in the panels.
- Clear, legible identification labels shall be provided for all compartment panels and control devices.
- To ensure good earth continuity all bolted joints shall be provided with tooth spring washers.
- Two separate earthing terminals shall be provided for earthing.
- Components and devices accessible from the front.
- Protection against accidental contact with live parts while maintaining a compartment and keeping others in service.

Internal wiring

- Shall be with 1100 V grade multi-stranded copper wires with PVC insulation.

Terminal blocks

- Shall be suitable for accommodating 2 No conductors of 2.5 sq.mm copper control.
- All TBs shall be either Phoenix or WAGO make.
- Separate sets of Terminal blocks for inputs and outputs.
  Digital Inputs & Outputs shall have fuses where there is a possibility of short circuit e.g. Lamp drives for Desks, contactor output etc.

  20% additional interposing relays (for 20% potential free DOs) shall be provided which shall be pre-wired to the up to TB. All spare contacts of the relays shall be pre-wired up to the TB.

Wiring Diagrams

In control schemes Wiring Diagrams - all the wires shall be designated with clearly defined external TB number, internal TB number card slots racks and ferrule nos.

- All wiring shall be accessible form the front and shall be done be 1.1 KV grade PVC insulated flexible copper wires.
- Not more than one wire shall be terminated in one terminal.
- Interlocked type identification ferrules shall be provided.
- Auxiliary wiring shall be properly marked as per IS 5578 (1984).
- All spare contacts of contactors / relays shall be wired up to terminal block.
- All control wiring shall be of 1.5 sq. mm. multi-stranded wire, P.T. wiring shall be of 1.5 sq. mm. multi-stranded duly colour coded and C.T. wiring shall be of 2.5 sq. mm. multi-stranded duly colour coded. The terminal blocks for the CT's & PT's shall be of disconnecting (CATD) type.

Specification of major components.

Contactors

- All Control contactors shall be AC 3 duty and Power contactor shall be AC 4 duty unless otherwise specified.
- Shall have at least 2NO+2NC auxiliary contacts with minimum rating of 32 A at 415 V.
- For reversible drives mechanically interlocked contactors shall be used.
- All coils shall be suitable for 110/ 220 VAC no economy resistor.
- Insulation of coil shall be class E or better.
- Shall pick up positively at voltage between 85% and 110% of the rated value.

Thermal overload relay

- Bimetallic Triple pole, ambient temperature compensated, inverse time lag, hand reset type.
- Shall conform to IEC - 292 -1.
- Shall have built in single-phase protection.
- Shall be provided with INO + 1NC auxiliary contacts.
- Manual reset push button shall be located on the compartment door.

Motor protection relay

- Protection against thermal overload, earth fault, phase unbalance and locked motor.
- Shall be manual or auto reset type as specified.
- Shall be provided with at least 1NO + 1NC auxiliary contacts.

Current transformers

- Bar type primaries and 5A (max) secondary
- Measuring CT accuracy class 1.0
- Protective CT accuracy class 10P 10.

Indicating instruments

- Flush mounting, square dial with provision for zero adjustment.
- Accuracy class 1
- Voltmeter and ammeter for incomers 144 x144mm.
- Size of ammeter for motor feeders 96 x 96 mm.
- All meters shall be taut band type (i.e 240 deg. Deflection)

Auxiliary relays

- Coil Voltage 110 V AC
- Rating of contacts shall be at least 10 A.
- All relays shall be provided with RC circuit/Snubber across the coil as these are driven by PLC.

Control transformers

- Epoxy moulded/ Wound dry type Control transformer shall be double wound dry type conforming to IS -2026 (1977) with tapping at + / - 2.5% and + / - 5% on the primary side. For control supply for each motor feeder module one No. 16A, DP MCB shall be used.
  Neutral shall be solidly earthed.

Drawings And Documents for Drive Panels (shall be decided after order finalization)

Following drawings and documents shall be submitted by the supplier in required 6 sets for Approval/ Information (drawing list shall be decided during DE):

	Description	**Drg. No.**
	DRIVE PANEL DRAWING	
1	GA with BOM for Drive Panel	
2	Control schematic - Drive Panel	
3	Terminal plan - Drive Panel	

SPECIFICATION : IS-1-08-DL-002

DESCRIPTION : 5 KW Inverter duty AC Motors + base frame

QTY : 2 SETS

APPROVED MAKE : ABB/SIEMENS/kirloskar/Crompton Greaves

DETAILED SPECS:

A. Constructional features

- Stator frame shall be fabricated steel.
- Laminated sheets of high grade low loss silicon steel shall be used for stator core.
- Casing feet shall be integral with motor frame.

- The degree of protection shall be IP 55 for motor and bearing and IP 55 for the terminal box.
- The motor shaft shall be of forged steel.
- Motor shall be fitted with antifriction bearings with regreasing facility.
- The pedestals shall be insulated against circulating currents.
- Arrow mark shall be provided on the non - driving end to indicate the direction of rotation.
- Motors shall be designed to keep torsional and rotational natural frequency at vibration of motor and driven equipment at least 25% above or below, preferably above the motor operating speed (to avoid resonance in vibration over the operating speed) range.
- The type of cooling for motors shall be TEFC.
- Max. Double amplitude vibration for LT motors shall be 40 microns for speed upto 1500 rpm and 15 microns for speed up to 3000 rpm.
- Noise level of motors shall not exceed 85 dB as per IS:12075.
- Greased ball, roller and/or sleeve bearing (SKF make preferred) shall be rated for minimum standard life of 40,000 hrs taking bearing and driven equipment load into account and shall be effectively sealed against dust ingress and shall be pressure grease gun lubricated.
- Motors shall have glossy, light gray finish no. 631 as per IS:5
- Motors shall be provided with separate terminal boxes for main, space heaters, embedded temp. detectors, bearing temperature indicators etc.
- Terminal box for main shall be mounted on right hand side as seen from driven end.
- Terminal boxes shall be confirming to IP:55 degree of protection with removable front cover. Space between and around terminals shall be adequate for easily connecting Al.
- Two grounding terminals one on either side at bottom suitable for connecting grounding conductor along with 2 nos. tapped, drilled holes with hexagonal heat bolts, plain washers, spring washers etc. for each earthing point.

B. Electrical design

- Motors shall be suitable for 3 phase, 3 wire,415 V, 50 Hz power supply having **Class `F'** insulation with temperature rise limited

to **Class `B'** insulation with IP 55 degree of protection. Motors shall be suitable for 50 kA for 1 second short circuit.

- **All motors shall be energy efficient**.
- Motors shall be capable of running continuously at full load at voltage variation of +/- 10% frequency variation of +/-5% and combined voltage and frequency variation of 10%.
- Type of starting for all motors shall be through inverters.
- Motors shall be suitable for continuous duty cycle and capable of starting & accelerating to full speed at full load at 80% nominal voltage at motor terminals.
- Direction of rotation for all motors shall be Bi-directional.
- Starting current for shall not exceed 600% of rated full load current and shall be capable of running satisfactorily at 75% nominal voltage for 5 minutes.
- Temperature rise over designed ambient temperature of 50^{o}C shall be 75^{o}C by thermometer method and 70^{o}C by resistance method .
- Routine test on every motor shall be done in presence of BSSL representative and test certificates for the same shall be furnished for BSSL approval.
- Motors shall be suitable for Auto bus transfer/Bus change over scheme.
- Motors driven by VVVF drive shall be Inverter duty motors.
- Size of main power cable for different ratings of motors are as follows :

	Rating	Al. Cable size
Above	upto	
	0.75 kW	2Cx6 sq.mm.
0.75 kW	5.5 kW	3Cx6 sq.mm.
5.5 kW	11 kW	3Cx10 sq.mm.

Cable boxes shall be suitable for glanding the cables as indicated above.

- The starting torque shall be as per the requirement of the specific application.
- Motors shall be suitable for 3 equally spread starts per hour under normal service conditions.
- Motors shall be suitable for DOL starting, The insulation of motors shall be designed conforming to IEC 34 - 15/ 1990.
- Motors shall be provided with suitable rated space heater.

- The design and performance shall conform to IS 325 - 1978.

C. Terminal box :

- The terminal box shall be phase segregated type.
- The terminal box shall suitable to withstand the system short circuit current for at least for 0.25 seconds.
- For motors with differential protection two numbers phase segregated terminal boxes shall be provided.
- Separate terminal boxes shall be provided for space heater, RTDs etc.
- The terminal box shall be reversible to suit cable entry from bottom or top.

D. Cooling

- Motors shall be of TEFC design and effective in both direction of rotation.

E. Quality of operation

- Motors shall be dynamically balanced with full key in the shaft and the load.
- The vibration levels shall be as per IS 12075 -, 1987.
- Continuous noise level shall not exceed 85 db at a distance of1 m from the motor body.

F. Duty Cycle for the motors

Application	**Duty Cycle**
Hydraulic system motors	S1
Booster Fan motors	S1
Induced Draft fan motors	S1
Hoisting operation motors	S3, 25% CDF, crane duty
Swivel motors	S1 (S3)
Inverter duty motors	S3, 25% CDF
Transfer cars motors	S1 (S4), crane duty

Forced draft Cooler motors S1

Cable reeling Drum motor S4, Stall torque motor

SPECIFICATION : IS-1-08-DL-003

DESCRIPTION : Speed transducer

QTY : 2 Set

APPROVED MAKE : Hubner, Leine and Linde,equivalent

TECHNICAL SPECIFICATIONS

Item Name: Speed transducer

Sl No.	Technical Specification	Description
1.	Speed Range	Up to 1015 RPM
2.	Enclosure	Cast Aluminium
3.	Grade Of Protection	IP-65
4.	Electrical circuits	1 Sets of 90 Deg phase shifted pulse trains, with marker pulse
5	Profibus interface	Optional to be quoted
6	Type of mounting	foot / flange mounting to be provided
7	Pulse per revolution	1000
5.	Shaft dia	11 mm
6.	Coupling	Suitable coupling for 11 mm
6.	Operating Voltage	5-24 VDC
7.	Paint Shade	To be specified

SPECIFICATION : IS-1-08-DL-004

DESCRIPTION : Centrifuge Switch with Couplings

QTY : 1 Set

APPROVED MAKE : Hubner, Leine and Linde,equivalent

TECHNICAL SPECIFICATIONS – DATA SHEET

Item Name: Centrifuge Switch with Couplings

Sl No.	Technical Specification	Description
1.	Speed Range	Up to 1015 RPM
2.	Enclosure	Cast Aluminium
3.	Grade Of Protection	IP-65
4.	Contact Arrangement	2 Sets of c/o contacts.
5.	Contact Rating	6 Amp res. @ 240 VAC
6.	Operating Voltage	5-24 VDC
7.	Paint Shade	176 as per IS-5

SPECIFICATION : IS-1-08-DL-005

DESCRIPTION : Position transducer

QTY : 2 Set

APPROVED MAKE : Hubner, Leine and Linde,equivalent

TECHNICAL SPECIFICATIONS

Item Name: Position transducer

Sl No.	Technical Specification	Description
1.	Supply Voltage	24V DC
2.	Max. Current Drawn	190mA
3.	Positions per revolution	8192
4.	No. of revolution	20
5	Output	Profibus /ISI (incremental serial interface)
6	Accuracy	+/- position
7	Max. cable length	350m
8.	Protection class	IP 64
9.	Type of construction	Heavy duty with extremely robust Aluminium housing
10.	Max. radial thrust/play	20N
11.	Max. axial thrust/play	10N
12.	Max. speed	4000 rpm
13.	Type of mounting	Foot/flange type
14.	vibration	≤ 100m/s^2
15.	shock	≤ 1000m/s^2

SPECIFICATION : IS-1-08-DL-006

DESCRIPTION : Mechanical Brake

QTY : 2 Set

APPROVED MAKE : reputed

TECHNICAL SPECIFICATIONS

Item Name: Mechanical Brake

Sl No.	Technical Specification	Description
1.	Mechanical Brake	To be mounted onto 5 KW AC Motor-Gen Assembly
2.		Disc operated

SPECIFICATION : IS-1-08-DL-007

DESCRIPTION : Fly Wheel Disc

QTY : 2 Set

APPROVED MAKE : Reputed

TECHNICAL SPECIFICATIONS

Item Name: Fly Wheel Disc

Sl No.	Technical Specification	Description
1.	Fly Wheel Disc	To be mounted along with belt and pulley arrangement onto 5 kw AC motor-generator assembly. Pulley with 4 Inch and 8 – inch wheels and V-belts.

SPECIFICATION : IS-1-08-DL-008

DESCRIPTION : Mechanical Load

QTY : 2 Set

APPROVED MAKE : Reputed

TECHNICAL SPECIFICATIONS

Item Name: Mechanical load

Sl No.	Technical Specification	Description
1.	Mechanical Load	To be mounted along with belt and pulley arrangement onto 5 KW AC motor-generator assembly.

SPECIFICATION : IS-1-08-DL-009

DESCRIPTION : Programming Terminal (with Rockwell Software)

QTY : 1 Set.

Software): RSview32 (5000 Tags) Minimum Specification for Programming Terminal (with Rockwell

SL NO	Description of item	Details
	OPERATOR STATION (PC)	
1.	Make	HP XW 4400/ Compaq/ IBM/Zenith /Equivalent
2.	Processor	Pentium dual core processor for sever grade PCs 'PIV' processor with I/O capability
3.	Speed	3.4 GHz
4.	Memory & Cache	1 GB RAM, 512KB cache, 2 MB L2 cache
5.	Hard Disk	80 GB HDD, Graphic acceleration card with 8 MB on-load RAM.
6.	Floppy Drive	1.44MB FDD
7.	Monitor	TFT monitor 19" with resolution 1280 x 1024
8.	CD/DVD Drive	52 x CD/DVD ROM (read/write)combo drive ie. It shall be possible to read and write CD and DVD
9.	Port	2 Nos. Serial port, 1 No. Parallel port, 4 No USB, 1 No keyboard connector VGA, mic in, line out, RJ-45
10.	Power Supply	Appox. 350W SMPS with line filter as required suitable for input power for 230V AC.
11.	Keyboard	Windows based multimedia keyboard, optical mouse and other standard accessories
12.	Expansion slots	For insertion of external card later
13.	Network Interface	Integrated Gigabit Ethernet
14.	Multimedia	8 MB V RAM with SVGA card
15.	Cables	System shall be complete with all required cables
16.	Operating System	Microsoft Window XP professional (Latest version)
17	Interface to Control Net/Profibus/Modbus/Fieldbus	1 Set

SPECIFICATION : IS-1-08-DL-010

DESCRIPTION : Data Logger Terminal

QTY : 1 Set.

Minimum Specification for DATA LOGGER TERMINAL:

PC as per specs listed below and data logger software.

SL NO	Description of item	Details
	OPERATOR STATION (PC)	
1.	Make	HP XW 4400/Compaq/IBM/Zenith/Equivalent
2.	Processor	Pentium dual core processor for sever grade PCs 'PIV' processor with I/O capability
3.	Speed	3.4 GHz
4.	Memory & Cache	1 GB RAM, 512KB cache, 2 MB L2 cache
5.	Hard Disk	80 GB HDD, Graphic acceleration card with 8 MB on-load RAM.
6.	Floppy Drive	1.44MB FDD
7.	Monitor	TFT monitor 19" with resolution 1280 x 1024
8.	CD/DVD Drive	52 x CD/DVD ROM (read/write)combo drive ie. It shall be possible to read and write CD and DVD
9.	Port	2 Nos. Serial port, 1 No. Parallel port, 4 No USB, 1 No keyboard connector VGA, mic in, line out, RJ-45
10.	Power Supply	Approx. 350W SMPS with line filter as required suitable for input power for 230V AC.
11.	Keyboard	Windows based multimedia keyboard, optical mouse and other standard accessories
12.	Expansion slots	For insertion of external card later
13.	Network Interface	Integrated Gigabit Ethernet
14.	Multimedia	8 MB V RAM with SVGA card
15.	Cables	System shall be complete with all required cables
16.	Operating System	Microsoft Window XP professional (Latest version)
17	Analog input 12 bit resolution	8 no.s .
18	Digital inputs	8 no.s
19	Digital outputs	4 no.s

SPECIFICATION : IS-1-08-DL-011

DESCRIPTION : Wall Mounted Feeder Panel in 2 sections.

QTY : 1 Set.

Make :epg / vvcontrols / venson /control InfoTech /others

SL NO	Description	Qty	Remarks
	SECTION – 1, 415 V		
1.	Incomer -64 Amp MCCB	01	1 Voltmeter
2.	Outgoing Feeder: (i) 64 Amp MCCB (ii) 32 Amp MCCB	 01 05	
	SECTION – 2, 220 V		
3.	Incomer -64 Amp MCCB	01	1 Voltmeter
4.	Outgoing Feeder:16Amp MCCB	10	
5.	Paint Shade		Siemens Grey, IS: 5 –1994

SPECIFICATION : IS-1-08-DL-012

DESCRIPTION :Dust Proof Measure Civil Work-Noise Reduction Material

QTY : 1 Set

APPROVED MAKE : Reputed

TECHNICAL SPECIFICATIONS – DATA SHEET

Item Name: Dust Proof Measure Civil Work- Noise Reduction Material

Sl No.	Description	Specification	Dimension	Remarks
1.	**Wall**	Constructed with Acoustical Layers Including Tec sound, Plywood, Glass Wool And Frame work. Final Finish To be Laminate or MDF.Total Thickness of the wall to be 4-5''.	8m x6m (approx.).	
2.	**Windows**	Shall be constructed with permanent acoustical Glass along with Wooden Frame work embedded in the wall	4mx2m	
3.	**Door**	Acoustic door Along with frame to achieve 20-25 db loss	3mx 2m	
4	**AC filters**			1 set

SPECIFICATION : IS-1-08-DL-014

DESCRIPTION : Ethernet switch and other items

QTY : 1 SET

Approved Make : D-Link/equivalent

BOM:

SL NO	ITEM	Make	Qty
1	10/100 Mbps, 24 port, Ethernet switch with one pair of 1000 Mbps optical port	D-Link /cisco/equi	1 No.
2	10/100 Mbps 8 port, Ethernet switch with one pair of 100 Mbps optical port	-Do-	6 Nos.
3	RJ 45 patch cards in jack panel (7 feet length)	Reputed	100 Nos.
4	Fibre patch chords	Reputed	16 Nos.
5	Cat-6 cable box (appox.305 Meters)	Reputed	3 Box
6	12 port LIU	Reputed	8 sets
7	1000 Mbps Fiber Optical cable (6 core, 62.5/125 Micron)	Reputed	120 Meters

TECHNICAL SPECIFICATIONS- DATA SHEET

Item Name: 8 Port Ethernet switch-

SL NO	TECHNICAL SPECIFICATION	DESCRIPTION
1.	Type	8 Port 10/100M TP +1 Module slot managed switch
2.	Mounting	19'' rack mountable width,1U height
3.	Power Supply	230 VAC,
4.	Power Consumption	20 Watts
5.	Ambient Temperature	0 to 50^0 C
6.	Humidity	5 to 90 %
7.	Dimensions	330 x 189 x 44 mm

Item Name: 24 Port Ethernet switch-

SL NO	TECHNICAL SPECIFICATION	DESCRIPTION
1.	Type	24 Port Layer 2 fast Ethernet stackable switch
2.	Mounting	19'' rack mountable width,1U height
3.	Power Supply	100-240 VAC,50/60 Hz with internal Universal Power Supply
4.	Power Consumption	29 Watts

5.	Operating Temperature	0 to 50^0 C
6.	Storage Temperature	-25 to 55^0 C
6.	Humidity	5 to 95 %, Non Condensing
7.	Dimensions	441 x 210 x 43 mm

SPECIFICATION : IS-1-08-DL-015

DESCRIPTION : Miscellaneous Test Instrument

QTY : 1 SET

Make :

BOM:

SL NO	ITEM	make	Qty
1	Megger (MIT 520)	Motwane/Fluke/sequiv	1 No.
2	Mega Ohm Meter	Motwane/Fluke/sequiv	1 No.
3	Analog Multimeter	Motwane/Fluke/sequiv	5 No.
4	Digital Micro Ohm Meter	Motwane/Fluke/sequiv	1 No.

DESCRIPTION : Miscellaneous Test Instruments – Analog Multimeter

QTY : 1 No..

Features:

1. Robust Center Pole meter Movement And Mirror are Enable accurate ratings to be taken, Avoiding parallax Errors.
2. Self Latching Meter movement reversal switch for making negative polarity measurements.
3. Fuse protection on all functions and ranges for increase instruments & user protection.
4. User re-stable overload cut out switch protects the instrument in the event of operator error.
5. Proven reliability of design & manufacturing.

TECHNICAL SPECIFICATIONS- DATA SHEET

Item Name : Analog Multimeter

SL NO	TECHNICAL SPECIFICATION	DESCRIPTION
1.	DC Voltage Range	100 mV- 1000V
2.	AC Voltage Range	3 V– 1000V
3.	DC Current Range	50 μA to 10 Amps
4.	AC Current Range	10 mAmps to 10Amps +5 AC
5.	Resistance Range	0 to 20 MOhms
6.	Insulation Resistance Range	Up to 200 MOhms
7.	AC Voltage Range	Up to 1000 Volts

8.	DC Voltage & Current Accuracy	+/- 1% of f.s.
9.	AC Voltage & Current Accuracy	+/- 2% of f.s. deflection at 50 Hz
10.	Resistance Accuracy	+/- 5% of rdg at centre Scale
11.	With Standard Accessories	

DESCRIPTION : Miscellaneous Test Instruments – Mega Ohm Meter

QTY : 1 No..

TECHNICAL SPECIFICATIONS- DATA SHEET

Item Name : Mega Ohm Meter

SL NO	TECHNICAL SPECIFICATION	DESCRIPTION
1.	Test Voltage	0-10 KV Continuously Variable
2.	IR Range	0- 250000 MOhms
3.	Accuracy	+/- 2% of f.s. or +/- 5% +1 Digit of rdg

DESCRIPTION : Miscellaneous Test Instruments – Digital MicroOhm Meter

QTY : 1 No..

TECHNICAL SPECIFICATIONS- DATA SHEET

Item Name : Digital MicroOhm Meter

SL NO	TECHNICAL SPECIFICATION	DESCRIPTION
1.	Test Current	5-100 Amps DC, Selectable
2.	Measurement Range	1 microOhm to 19.99 Ohms in Multiple Ranges
3.	Resolution	1 microOhm in lowest range
4.	Accuracy	Within +/- 0.25% +/- Isd

DESCRIPTION : Miscellaneous Test Instruments – Meggar

QTY : 1 No..

TECHNICAL SPECIFICATIONS- DATA SHEET

ITEM NAME: INSULATION TESTER (Meggar) -1000 volts…. Qty: 2 Nos.

SL NO	Technical specification	Description
1.	Type	Portable battery/mains operated (DC) electronic insulation tester
2.	Quantity	2 Nos.
3.	Power	Battery: 6 x 1.5 V cells
4.	Application	Measurement of insulation resistance of various de-energized electrical equipments and components.
5.	Display scale	Digital scale

6.	Scale length	More than 100mm
7.	Measurement range	Resistance :0. 1M ohm to 1000 Mega ohm either on multiple scales or provided with suitable range multiplier.
8.	Voltage range	1000volts DC either continuously variable or in steps of 500/1000V.
9.	Voltage stability	+/- 3% of rated output.
10.	Accuracy	+/- 2% of full scale or better
11.	Protection	Over –voltage and overload protection
12.	Salient features	Automatic discharge of capacitive voltage, guard terminal
13.	Accessories	Test leads, carrying case and manual
14.	Make	MEGGER, FLUKE, KYORITSE, CONIN-DIT 10.

NOTE: 1. Instrument shall be International standards and shall be accepted by all testing laboratories. Test certificates, manuals and calibration certificate have to be supplied along with each instrument.

SPECIFICATION : IS-1-08-DL-016

DESCRIPTION : Precision Voltage Source

QTY : 2 No.

SL NO	ITEM	Make	Qty
1	Accurate voltage source (Stability: 1 PPM) for Calibrating/Testing Panels with Signals up to 40 V DC.	Conin/Shylendra/Reputed	2 No.

Features:

1. AC and DC Voltage Outputs
2. Wide Multiple Ranges
3. Ease of Operation
4. High Stability
5. Front Panel Controls
6. Short Circuit and Over- Burden Protections
7. Direct Reading output Controls
8. Compact Size for ease of portability
9. Rapid warm up

TECHNICAL SPECIFICATIONS- DATA SHEET

Item Name: Precision V Source

SL NO	TECHNICAL SPECIFICATION	DESCRIPTION
1.	Power Input	240VAC, 50Hz
2.	Voltage	100mV to 1000V AC / DC (Multiple Steps)
3.	Accuracy	Within +/- 1% of the Setting 40-400Hz
4.	Frequency	40-400Hz (Cont. Variable or Variable in Steps)

SPECIFICATION : IS-1-08-DL-017

DESCRIPTION : HMI Terminal

QTY : 1 Set.

Minimum Specification for HMI Terminal:

SL NO	Description of item	Details
	OPERATOR STATION (PC)	
1.	Make	HP XW 4400/Compaq/IBM/Zenith/Equivalent
2.	Processor	Pentium dual core processor for sever grade PCs 'PIV' processor with I/O capability
3.	Speed	3.4 GHz
4.	Memory & Cache	1 GB RAM, 512KB cache, 2 MB L2 cache
5.	Hard Disk	80 GB HDD, Graphic acceleration card with 8 MB on-load RAM.
6.	Floppy Drive	1.44MB FDD
7.	Monitor	TFT monitor 19" with resolution 1280 x 1024
8.	CD/DVD Drive	52 x CD/DVD ROM (read/write)combo drive ie. It shall be possible to read and write CD and DVD
9.	Port	2 Nos. Serial port,1 No. Parallel port, 4 No USB,1 No keyboard connector VGA, mic in, line out, RJ-45
10.	Power Supply	Appox. 350W SMPS with line filter as required suitable for input power for 230V AC.
11.	Keyboard	Windows based multimedia keyboard, optical mouse and other standard accessories
12.	Expansion slots	For insertion of external card later
13.	Network Interface	Integrated Gigabit Ethernet
14.	Multimedia	8 MB V RAM with SVGA card
15.	Cables	System shall be complete with all required cables
16.	Operating System	Microsoft Window XP professional (Latest version)

SPECIFICATION : IS-1-08-DL-018

DESCRIPTION : Software Development Stations

QTY : 3 Set.

Minimum Specification for Software Development Stations:

SL NO	Description of item	Details
	OPERATOR STATION (PC)	
1.	Make	HP XW 4400/Compaq/IBM/Zenith/Equivalent
2.	Processor	Pentium dual core processor for sever grade PCs 'PIV' processor with I/O capability
3.	Speed	3.4 GHz
4.	Memory & Cache	1 GB RAM, 512KB cache, 2 MB L2 cache
5.	Hard Disk	80 GB HDD, Graphic acceleration card with 8 MB on-load RAM.
6.	Floppy Drive	1.44MB FDD
7.	Monitor	TFT monitor 19" with resolution 1280 x 1024
8.	CD/DVD Drive	52 x CD/DVD ROM (read/write)combo drive ie. It shall be possible to read and write CD and DVD
9.	Port	2 Nos. Serial port, 1 No. Parallel port, 4 No USB, 1 No keyboard connector VGA, mic in, line out, RJ-45
10.	Power Supply	Appox. 350W SMPS with line filter as required suitable for input power for 230V AC.
11.	Keyboard	Windows based multimedia keyboard, optical mouse and other standard accessories
12.	Expansion slots	For insertion of external card later
13.	Network Interface	Integrated Gigabit Ethernet
14.	Multimedia	8 MB V RAM with SVGA card
15.	Cables	System shall be complete with all required cables
16.	Operating System	Microsoft Window XP professional (Latest version)

SPECIFICATION : IS-1-08-DL-019

DESCRIPTION : Ethernet switch

QTY : 1 Set.

Approved Make : D-Link / equivalent

SL NO	ITEM	Make	Qty
1	10/100 Mbps, 24 port, Ethernet switch with one pair of 1000 Mbps optical port	D-Link /cisco/equi	1 No.
2	10/100 Mbps 8 port, Ethernet switch with one pair of 100 Mbps optical port	-Do-	6 Nos.
3	RJ 45 patch cards in jack panel (7 feet length)	Reputed	100 Nos.
4	Fibre patch chords	Reputed	16 Nos.
5	Cat-6 cable box (appox.305 Meters)	Reputed	3 Box
6	12 port LIU	Reputed	8 sets
7	1000 Mbps Fiber Optical cable (6 core, 62.5/125 Micron)	Reputed	120 Meters
8	UTP Fibre Converter MM with SC Port.	Reputed	4 Nos.

TECHNICAL SPECIFICATIONS- DATA SHEET

Item Name: 8/24 Port Ethernet switch-

SL NO	TECHNICAL SPECIFICATION	DESCRIPTION
1.	Type	8 Port 10/100M TP +1 Module slot managed switch 24 Port Layer 2 fast Ethernet stackable switch
2.	Mounting	19'' rack mountable width,1U height
3.	Power Supply	240 VAC,
4.	Power Consumption	20 Watts
5.	Ambient Temperature	0 to 50^0 C
6.	Storage Temperature	-25 to 55^0 C
7.	Humidity	5 to 90 %
8.	Dimensions	330 x 189 x 44 mm(8 Port), 441 x 210 x 43 mm(24 Port)

SPECIFICATION : IS-1-08-DL-020

DESCRIPTION : CPU modules with IOS and Communication facilities

QTY : 1 SETS

APPROVED MAKE : ABB/SIEMENS/RAIL

DETAILED SPECS:

TECHNICAL SPECIFICATION FOR PLCs

CONTENTS

SECTION – I
SITE DATA

1.0 **Site Data.**

1.1 Location : isg bangalore

1.2 No data loss while operating : 0 Deg C to 45 Deg C.

1.3 Destruction proof while not operating : -40 Deg C to 70 Deg C

1.4 Max. Relative Humidity : 100 %

1.5 **Power supply available**

One source of UPS supply 240vAC, 2 wire shall be provided for PLC.
All AC/ DC power requirement of the various cards, modules, interrogation supply, components & sub systems under the package shall be in supplier's scope.

SECTION – II

APPLICABLE STANDARDS

2.0 The PLC shall comply to the following specification and to the specific standards mentioned in the respective clauses -

IPSS:2-07-015-88	Modular programmable logic controllers.
IPSS:2-07-016-88	Specification for panels.
IPSS:2-07-030-88	Guidelines for application software documentation.
IPSS:2-07-036-93	Guide for supply of computer hardware manuals.
IS:10118 (Part 1 to 4)-1982	Code of practice for selection, installation and maintenance of switchgear and control gear.
IS:13947 (Part 1,5)-1993	LV switchgear & control gear.
IS:12021-1987	Specification for control transformers for switchgear and control gear for voltages not exceeding 1000 Volt AC.
IS:8623 (Part 1)-1993	Specification for low voltage switchgear & control gear assemblies.
IEC 1131-2	Specification for Programmable Controllers

If any part, whole or specific aspect of equipment is not being covered under the above standards, the supplier shall specifically bring out such aspects in the offer and decide during tender scrutiny / evaluation stage as to the specific standards which shall be applicable. Otherwise, the successful tenderer shall be liable to abide by the specific requirement of the purchaser at detailing stage without any additional cost to the Purchaser.

2.1 The equipment & system shall also conform to the latest Indian Electricity Rules as regards safety, earthing and other essential provisions specified therein for installation and operation.

2.2 All equipment & system shall also comply with the statutory requirement of the Government of India and the State Government in which the plant is located.

SECTION – III
SCOPE OF SUPPLY

3.1 The supplier shall be responsible for design, manufacture, assembly, testing at manufacturer's works, training, documentation, supply and delivery of system at site, other services and site assistance as mentioned in this enquiry.
The programmable logic controllers (PLC) shall be of rugged and modular construction, plug in type. PLC shall be suitable for reliable, failsafe operation in arduous steel plant environment where electromagnetic noise, high temperature, dust, humidity and mechanical shocks / vibrations are prevalent. It shall have field expandable design so as to accommodate incremental increase in memory and I/Os as required.

3.2 Main Equipment
Programmable logical controllers complete with Rack, Digital Input/Output cards, Analog cards, pulse counter cards, communication interface cards, Remote I/O racks, with necessary inter connection cable / connectors, Generation of all power supplies including field interrogation power supply, housed and wired in required number of control panels. Ethernet cards for connectivity to higher end system to be included.

*Please note that the Dual Hot redundant PLC shall have **Bumpless transfer** from working to standby and also dual redundancy in I/O communication and Ethernet communication*.
Please note that all the PLC and other cards provided shall be of the same type and from the same family.

Important Points :

Modbus / Profibus / TCP/IP communication to be available for any external electrical control system. This system shall be connected directly to dedicated PLC and not through PLC network.

Notes on items to be considered

1. PLC system

2. CPU Module (with or without redundant configuration)

3. Engineering pkg.

4. I/O series – Centralized / Expandable/ Remote (Hot swappable)

5. I/O connection - MPI bus/ Profibus /Optical module bus

6. Suitable Communication Processor (CP 485/ CP 443 – to be decided during detail engineering) for TCP/IP telegram message transfer between Level1 - Level2.

7. Modbus / Profibus / TCP/IP communication to be available for any external electrical control system. This system shall be connected directly to dedicated PLC and not through PLC network.

8. Min. Speed acceptable is 8 Mbps for Profibus wherever used.

9. All necessary repeater/ switches required for connectivity of RIOs, third party devices in all the units are in supplier's scope along with required cable.

10. All Engineering station (laptop) shall be suitable for adaptor/ node level communication apart from network connectivity. Supplier to confirm uploading and downloading application software facility in CPU through engineering station.

11. Drives shall be connected through communication link with PLC for necessary data transfer.

3.2.1 Configuration of PLC

2.0 PLC with non-redundant CPU and power supply, one power supply for interrogation, three communication and all necessary cards/connectors to meet the system configuration & specification.

a) Remote I/O rack with one power supply, one communication and all necessary cards/connectors to meet the system configuration & specification.

b) PLC programming software with license , CD etc .This shall include all software required to interface with HMI stations , Input/Outputs ,drives, third party devices as mentioned below. It shall comply with IEC 1131-3– 1 set

c) HMI development with runtime software with 10,000 tags –1 no:

d) The following I/O, relay and third party interface count to be considered for each set of PLC.

3.2.1.1 PLC Configuration
Location: ISG LAB

Location	DI (24V dc)	DO (24V dc)	AI (mA)	AI (RTD)	AI - pulse	AI (thermo couple)	Drive i/f	Third party i/f	AO (mA/V)	Relays for DO
PLC A 1/2	32	32	8	0	2	-	3	2	8	8

3.2.2For BHEL ISG

1 PLC programming package with license (as above)+ 1HMI software (runtime + development) with license for 10,000 tags (as above) + 1 no: emulator to check both PLC, HMI and interface between the PLC& HMI developed. To be provided 2 weeks after issue of LOI with all manuals.

3.3 Third party interface

Design, testing and establishing communication with third party devices provided by customer. Please note the following regarding these interfaces

- Communication between PLC and external electrical control system (on Modbus / Profibus / TCP/IP), third party PLCs are to be established for signal/data exchange by the supplier. Communication shall be through standard protocol. **Corresponding protocol with compatible communication module shall be supplied by the supplier.** Communication module shall have the facility (selectable) to act like Master or Slave.
- The supplier will be provided with the details of the devices procured by the customer after order placement.
- The supplier will consider all hardware & software on PLC side and communication cables (approx 50m of communication cable can be considered for each device). Any software development/protocol development/driver development for third party device communication is also in the supplier's scope. Any standard software required shall also be considered. Please note that the communication cables shall be shielded type only.
- The supplier will provide all details and documentation regarding communication interface at different stages to BHEL.
- The supplier will demonstrate the interfaces functioning during inspection of PLC system at Supplier's works. Else it shall be demonstrated during integrated testing at BHEL, Bangalore/Supplier's works along with the application software developed by BHEL Bangalore.
- The supplier is responsible for demonstrating the interface at site to the customer's satisfaction. This shall include connection details on the third party device. Any co-ordination work required at will be done by BHEL and

any manual labour required will be provided**.** Suitable mandays including travel ,lodging /boarding charges shall be considered by supplier for this purpose. Please note that three separate visits have to be considered for this purpose and it is not to be linked with any other services offered at site.

- Interface Test

  Interface test will be carried out at supplier's works where general procedure for message transmission (communication set-up, etc between level-1 and level-2 automation) is to be demonstrated. Also correctness of exchange of the messages at protocol as well as application level is to be proved.

- The following third party devices to be considered for interface purpose with PLC:

DRI Injection
Carbon injection
Electrode regulation
Temperature measurement
Lance manipulator
O2 side blowing system
Weighing System
Customer PLC
Pre-heater

3.4 The supplier is responsible for the following additional services required at site :

a) Initial site service when requested by BHEL.
   1) Installing and powering up PLC system
   2) Establishing redundancies
   3) Random I/O checking and proving the redundant I/O functioning
   4) Loading of PLC software to both PLCs from Engineering terminal, I/O and program monitoring, forcing of I/Os etc to be demonstrated
   5) HMI Diagnostics pages developed to be loaded and demonstrated
   6) Please consider suitable mandays including your travel expense and boarding/lodging in pricing.

3.5 Documentation as indicated in the respective section

3.6 weeks training for 3 Nos. of BHEL/Customer engineers at your training institute.

3.7 Inspection & testing at factory

3.8 Supplier shall quote for any additional hardware /software such as communication software, cable, connectors etc required for successful

operation of the system as per Configuration Diagram enclosed and it shall be clearly indicated in un-priced BOM (Computers and Ethernet switch need not be considered in your scope). The supplier shall also include any cable, connector, card etc.(on PLC-HMI side) for communication to third party devices as mentioned in the scope.

3.9 The application software development is in BHEL scope The supplier shall furnish all clarifications and extend all co-operation in preparing the application software.

SECTION – IV
TECHNICAL SPECIFICATION

4. BASIC PARAMETERS

4.1 Memory

Type memory	CMOS/ RAM (min. 16 MB) with Ni/Cd or Li backup battery for a min. period of 24 hours/FEPROM
Memory size for user programmer	Ensure that 50% spare space will be available. **It shall be possible to add memory incrementally if required later**
Interrogation voltage	24 V DC
For inputs galvanic isolation	Opto coupler
Output rating –continuous	2A
Inrush	1400 VA for 50 msec

4.2 Special functions/ Design criteria required for PLCs

4.2.1 Alpha Numeric report/ message generation for printer/ TFT display shall be possible.
4.2.2. Laptop based programming unit shall be possible. (laptop not in your scope)
4.2.3 Dynamic mimic generation.
4.2.4. Facility to start and stop drives through key board.
4.2.5 PLC in hot standby configuration with redundant CPU memory.
4.2.6 **CPU load not to exceed 50%. (to be proved at site)**
4.2.7 **Memory utilization not to exceed 50%. (to be proved at site)**
4.2.8 **Communication bus bandwidth utilization less than 50%. (to be proved at site)**
4.2.9 Spare I/Os installed and wired to terminal strip.
4.2.10 **Space and provision in I/O rack and wiring to terminals shall be provided for adding extra 15% of total I/O count**
4.2.11 Power supply distribution by MCB.
4.2.12 ALL I/O shall be connected through LED indication & fused terminals.

4.2.13 **Communication link between remote I/O and PLCs shall be redundant.**

4.2.14 All HMI packages shall be of minimum 10,000 tags (1 development version and others run time version). HMI tag if exceed the minimum 10000 tags, then actual requirement shall be supplied by the supplier without any cost.

4.2.15 On-line replacement of modules shall be possible

4.3 Constructional Features

4.3.1 All plug in modules to be mounted in suitable racks.
An extractor / handle to pull module out of rack.
Provision to guard against incorrect insertion and test points to check necessary signal.
Extender module for testing of plug in modules shall be provided.

4.3.2 -Suitable cable clamping arrangement shall be provided

4.3.3 -Cable termination shall be done with pin/U type lugs.

4.3.4 *Metallic parts of all components shall be effectively earthed using green coloured insulated copper wire or other approved means. -*

4.4 Internal Wiring

4.4.1 Shall be with 1100 V grade multi stranded copper wires with PVC insulation.

4.4.2 *Segregation of wiring shall be done for different voltage levels.*

4.4.3 *Cross ferruling system shall be followed for internal wiring. Ferrules shall be interlocked type.*

4.4.4 Wiring

DESCRIPTION	***WIRING COLOUR CODE***
230V ac Phase (UPS & Non-UPS supply)	Red
230V ac Neutral (UPS & Non-UPS supply)	Black
24V DC , +VE	Blue
24V DC , -VE	White
SYSTEM GROUND	Green with White band
SAFETY GROUND (Electronic)	Green
DIGITAL INPUTS	Yellow
DIGITAL OUTPUTS	Blue
ANALOG INPUT / OUTPUT	Red
Relay Contact	Grey

4.5 Terminal Blocks

4.5.1 Shall be suitable for accommodating 2 Nos conductors of 2.5 sq mm copper controls.
4.5.2 Make shall be Phoenix/ WAGO
4.5.3 All TBs shall be fuse TBs with fuse failure LED indication.
4.5.4 Separate sets of terminal blocks for inputs and outputs. Digital inputs & outputs shall have fuses where there is a possibility of short circuit e.g., lamp drives for desks, contactor output etc.,
4.5.5 20% additional interposing relays (for 20% potential free DOs) shall be provided which shall be pre-wired to the TB. All spare contacts of the relays shall be pre-wired up to the TB.
4.5.6 *Terminal blocks shall be properly arranged to facilitate easy termination of cables. They shall have minimum clearance of 300 mm. to cable gland plates and of 150 mm. to adjacent terminal rows, panel sides & other equipment.*

4.6 Wiring Diagrams

In control schemes wiring diagrams, all the wires shall be designated with clearly defined external TB number, internal TB number card slots racks and ferrule Nos.

4.7 Technical specification of system components and auxiliaries

4.7.1 Processing Unit

The CPU will be 32 bit or more microprocessor. It will be modular construction and will be plug-in type. It will be able to perform logic processing, timing counting, latching, comparing, retrieve, storage and arithmetic functions.
For the PLCs with dual CPU configuration in hot standby mode one CPU shall have provision of switching over instantaneously in case of failure, without any loss of system performance to another processor working simultaneously in hot standby mode (bumpless transfer). Both CPUs in master mode shall allow changeover form either to the other.

Any of the CPUs in hot stand-by mode can be master / slave depending on the choice of the user. There shall not be any designated slot for master /slave CPU. The changeover and selection shall be bumpless.

4.7.2 Memory Module

Shall be modular and plug in type. It will be nonvolatile.
Battery back up will be provided for RAM. The battery shall be Lithium/ Ni Cd type with backup for at lest 24 hours.

4.7.3 Input Module (Hot plug-in/ plug-out type)

Modular, plug in type. Input modules shall house LEDs for status indication of each input. Digital inputs shall be 24 VDC. Analog inputs shall be PT100/ 4.20 mA/ k type thermocouple.

4.7.4 Output Module (Hot plug-in/ Plug-out type)

Modules plug in type. Output modules shall house LEDs for status indication of each output. The output contact shall be 24 V DC, 2 A, suitable for driving 170 Amps contactor (relayed out-puts could be used). All individual outputs shall short circuit fuse protection with fuse failure indication. Analog outputs shall be 4-20 ma/$\pm$10 V.

4.7.5 Timers and Counters

- OFF delay and ON delay through software. Time delay will be from 1200 msec. to few hours.
- Timing accuracy will be +/- 0.1% of set value.
- Counter shall be suitable for down, up and up/down counting with range 0000 - 9999

4.7.6 Power Supply Unit

- Shall have following protections.
- Thermostat protection against over temperature.
- Electronic over, current protection.
- Surge voltage protection.
- Distribution of DC voltages to CPU, I/O modules shall be through single pole MCBs.
- Possibility of have Alarm contacts for failure.

Distributed (PLC + RIO panel) power supply unit of 24V DC, 40 Amps rating shall be supplied with PLC and 30 Amps for auxiliary PLC for I/O integration.

4.7.7 Engineering Station

Network level communication from Engineering Station required for program editing/ hardcopy generation of program for each plant unit. From the Engineering station it shall be possible for programming in the form of ladder diagram, statements or functional blocks with conversion from one form to another. Shall include for visual verification of programmer. Able to enter, add, alter and delete logic and data, monitor logic, set points, set timers, search contacts, coils, flags. Program writing or editing shall be editing shall be possible on-line without CPU going in to stop mode. *Programming shall be IEC-1131 compliant. In online mode, the status & logic continuity shall be high lighted. Forcing of I/Os, mode changing of processors, I/O data table*

view, editing, online program change shall be possible. All the above operations shall be possible both in direct connections with PLC system as well as a node data highway.

4.7.8 HMI

Each drive can be controlled through HMI. Hence HMI shall be capable of following

Displaying Status information of all drives/systems etc.

Command execution for start/stop, setting of parameters for the system

Report generation

Data logging

Dynamic graphic display of mimic

System overview

Real time / historical trending etc.,

Alarms

Event logging of commands, parameter change etc executed from HMI

4.7.9 Approved Makes

Panel- Rittal
MCB – Havells /Indo Kupp /MDS/ S&S/ Schneider/ Standard
Lamps –Osram / Philips
5A/15A Piano switch –Anchor/Ellora/Precision
Switch socket outlet-Alstom /Anchor/BCH/CGL/ Essen
Power supply –Cossel/ Pheonix
Terminal blocks –Phoenix/WAGO

SECTION V
INSPECTION & TESTING

1.0 Test & inspection shall be as per BHEL/customer approved procedure. BHEL Quality Assurance Plan as per Annexure–I, and Inspection Test schedule as per Annexure-II are enclosed for reference. Supplier shall submit the test & Inspection procedure along with QAP immediately along with the offer.

Supplier shall produce during inspection:

a) Raw material inspection certificate.
b) In House test reports (Type test certificate shall be produced for exactly the same rating/specifications)
c) Statutory certificates as required.

- All Inspection & Testing shall be carried out based on the following documents:-

(a) Relevant Standards
(b) Specifications
(c) Approved Drawings.
(d) Data sheets.
(e) Approved supplier QAP

- Supplier shall furnish all type and routine test certificates along with the inspection call. Manufacturer's test certificates shall incorporate Model No, Sl No etc.

- Supplier shall submit Total BOM along with Inspection call.

- Inspection call shall be given at least 3 weeks in advance with all test reports.

- Supplier shall carryout/demonstrate various routine tests and any other test specified by Customer at suppliers works at no extra cost.

- Test inspection procedure specified hereunder is subject to change during detailed engineering and is only for reference.

- Equipment's Model version should be the latest available in the market.
- All reports / certificates shall bear company seal and signature of supplier / manufacturer.

2.0 Testing shall be carried out strictly as per Quality Assurance Plan, which is approved by Customer

SL. NO	TEST DESCRIPTION	TEST INSPECTION METHOD	ROUTINE TEST (See Note)
1	Visual inspection & dimensional Check.	As per GA drawing	BC
2	Insulation resistance test & HV test	IR measurement with suitable megger before and after HV test. High voltage shall be applied for 1 minute at 1.0 KV with all electronic cards pulled out.	BC
3	Temperature test (aging) for CPU and		A

	other modules		
4	Mechanical vibration test for CPU and other modules		A
5	Functional test for modules and CPU& HMI	As per detailed control scheme and as per manufacturer's practice/approved FAT	BC
6	Noise immunity test for CPU and other modules		A
7	Integrated functional test	As per detailed control scheme and as per manufacturer's practice/approved FAT	BC

Note:-
A -Manufacturer's Test certificate to be furnished
B -Test to be conducted in presence of BHEL's representative & report to be submitted
C -Test to be conducted in the presence of customer / consultant or his authorized representative

SECTION VI
DOCUMENTATION

The following documents shall be submitted by the supplier for approval :

Sl no	Title	No: of copies	Date of first submission
1	Overall system configuration diagram	7 sets	1 week after receipt of LOI
2	Datasheet which includes technical leaflets of modules	7 sets	1 week after receipt of LOI
3	Catalogues + hardware and software manuals for PLC system in CD	7 sets+ 2 CDs	1 week after receipt of LOI
4	OGA ,BOM , Power Distribution SLD for Panel ,QAP, Foundation plan	7 sets	1 week after receipt of LOI
5	UPS power requirement for PLC	7 sets	1 week after receipt of LOI
6	Earthing requirements for PLC panel	7 sets	1 week after receipt of LOI

Sl no	Title	No: of copies	Date of first submission
7	PLC I/O address to be added based on I/O list prepared by BHEL	7 sets	1 week after receipt of LOI
8	PLC Wiring Diagram with ferruling principle	7 sets	3 weeks after receipt of LOI
9	PLC Nest Loading /Module Loading Diagram / IO diagram & Terminal Plan in BHEL format	7 sets	3 weeks after receipt of LOI .Based on BHEL Format which will be provided.
10	Software / design philosophy / connection details for third party interface	7 sets	3 weeks after receipt of LOI
11	Project specific FAT procedures	7 sets	3 weeks after receipt of LOI
12	Internal Test Certificates	1 Original + 2 copies	Along with inspection notice
13	O&M manual –All final approved documents and hardcopy of manuals	7 sets + 2 sets of CDs +RFT	

1) Please note that initially one set of documents to be provided for BHEL approval and then after BHEL approval only the documents shall be multiplied.
2) Resubmission of any document incorporating comments shall be made within 3 days and the number of copies shall be as above.
3) All documents to be submitted in BHEL approved template, a soft copy of which shall be provided.

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4) **If any additional document is required during detailed engineering it shall be included.**
5) All drawings provided by the contractor shall be on standard size A4/A3 sheets, in the form of black or blue lines on a white background.
6) **Approval of drawings shall not relieve the supplier of his responsibility in terms of the contract**
7) Final payment is subjected to furnishing the complete documentation in required volumes in required number of sets.

SECTION – VII
INFORMATION REQUIRED FROM SUPPLIER

Please check with list below to ensure all the details required below are enclosed. Else your offer may be rejected

S.N.	Description
1	Please mark point wise confirmation for each clause for all sections in a copy of this enqui

	brought out with clause number in a separate sheet. If no deviations are brought out it is a
2	Detailed configuration diagram
3	OGA of panel
4	The following details of CPU offered with **details marked clearly in your standard techn** -CPU scan time (in ms/K Byte of binary instruction) – Memory (in MB) available for User program and User tags separately –Type of memory and backup –On line replacement of I/O modules For dual redundant processors -CPU switchover time (in ms) –**Principle of hot standby redundancy** indicating exactly when cross loading takes place –Mark up in standard technical literature that the switchover is bumpless – On-line editing and transfer to secondary processor – How switchover affects HMI (Ethernet connectivity) and I/O connectivity. Any programmi
5	CD containing literature (catalogues + manuals) of all the cards, HMI, PLC programming p
6	Design principle for third party interface
7	Confirmation that ladder logic, structured text, FB, SFC are all supported
8	Catalogue with rating for 24V dc interposing relay offered for Digital Output
9	List of recommended 2 years spares & commissioning spares

Form No:IS-QEI-4-410/002

INDUSTRIAL SYSTEMS GROUP	ENQUIRY / JOB NO. I/O PO NO. & DATE SUB-SUPPLIER	IS-BG4-06/01	**QUALITY ASSURANCE PLAN** **FOR** **EQUIPMENT**	CUSTOMER PROJECT PACKAGE NO. CUSTOMER REF. NO. & DA

INSTRUCTIONS FOR FILLING UP :

1. QAP shall be submitted for each of the equipment separately with break-up of assembly / sub-assembly & part / component or for group of equipment having same specification.
2. Use numerical codes as indicated for extent of inspection & tests and submission of test certificates & documents.Additional codes & description for extent of inspection & tests may be added as applicable for the plant and equipment.
3. Separate identification number with quantity for equipment shall be indicated wherever equipment having same specifications belonging to different facilities are grouped together.
4. Weight in tonnes (T) must be indicated under column 5 for each item.Estimated weights may be indicated wherever actual weights are not available.(Wherever applicable).

ABBREVIATIONS USED :
MFR : MANUFACTURER, CUST : EPI

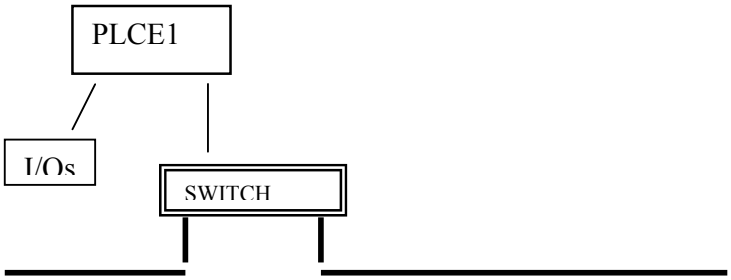
CODES FOR EXTENT OF INSPECTION , TESTS , TEST CERTIFICATES & DOCUMENTS

Code	Description	Code	Description	Code	Descr
1.	Visual	12.	Routine Test as per IS/Other Standard defined.	23.	Short time
2.	Dimensional	13.	Type Tests as per IS /Other Standard defined	24.	Operational
3.	Fitment & Alignment	14.	Impulse Test	25.	Overspeed
4.	Physical Test (Sample)	15.	Partial Discharge Test	26.	Flame Proo
5.	Chemical Test (Sample)	16.	Heat Run Test/Temp.Rise Test	27.	Clearance a
6.	Ultrasonic Test	17.	Enclosure Protection Test	28.	V
7.	Magnetic Particle Test (MPI)	18.	Calibration	29.	Correctness
8.	Radiography Test	19.	Noise & Vibration		
9.	Dye Penetration Test	20.	Test Certificates for Bought out components / Equipment		
10.	Measurement of IR Value Before HV TestAfter HV Test	21.	Tank Pressure Test		
11.	High Voltage Test / Dielectric Test	22.	Paint Shade Verification Including Thickness		

EQUIPMENT DETAILS							INSPECTION AND TESTS					
Sl. No.	Description (With equipment heading , place of use and brief specifications)	Identification No.	Quantity		Manufacturer's name & Address	Expected Schedule of Inspection	Raw Material and In process Stage Inspection			Final Inspection and Test By		
			No./ M	T			MFR	BHEL	CUS	MFR	BHEL	CUST
1	2	3	4	5	6	7	8	9		11	12	
	PLC system		1 Lot		-		1,2,12			1,2,3	1,2,3	
							3			10,11	10,11	
										12,20,24	12,20,24	

BHEL	SUB-SUPPLIER:	(QAP NO TO BE ALLOTI
NAME : V..SUBRAHMANYAM	NAME : -	QAP NO.
SIGNATURE :	SIGNATURE : -	SHE

CONFIGURATION DIAGRAM FOR PLC



I/O

ETHERNET TCP/IP
FIBER OPTIC CABLE

SPECIFICATION : IS-1-08-DL-021

DESCRIPTION : Optic Fibre Cable, Ethernet Cable

QTY : 2 SETS

APPROVED MAKE : D-Link /cisco/equivalent

SL NO	ITEM	Make	Qty
1	6 core Multimode 62.5/125µm outdoor armoured Fibre Optic Cable	D-Link /cisco/equivalent	200
2	CAT-6 UTP Cable	D-Link /cisco/equivalent	1 Set

SPECIFICATION : IS-1-08-DL-022

DESCRIPTION :Precision V-I Source

QTY : 1 Set.

APPROVED MAKE: motwane/conin/shylendra

Features:

1. AC Current and Voltage Outputs
2. Wide Multiple Ranges
3. Ease of Operation
4. High Stability
5. Front Panel Controls
6. Short Circuit and Over- Burden Protections
7. Direct Reading output Controls
8. Compact Size for ease of portability
9. Rapid warm up

TECHNICAL SPECIFICATIONS- DATA SHEET

Item Name: Precision V-I Source

SL NO	TECHNICAL SPECIFICATION	DESCRIPTION
1.	Power Input	240VAC, 50Hz
2.	Current	0-50 Amps, AC (Multiple steps from 100mV to 50A)
3.	Voltage	100mV to 1000V AC (Multiple Steps)
4.	Accuracy	Within +/- 1% of the Setting 40-400Hz
5.	Frequency	40-400Hz (Cont. Variable or Variable in Steps)

SPECIFICATION : IS-1-08-DL-023

DESCRIPTION : Miscellaneous test instruments -Digital Frequency Meter

QTY : 1 Set.

SL NO	ITEM	Make	Qty
1	AC Milli Ammeter	Fluke/motwane/reputed	2 Nos.
2	Digital Timer	Fluke/motwane/reputed	2 Nos.
3	Digital Frequency Meter	Fluke/motwane/reputed	1 No.
4	Power Factor Meter	Fluke/motwane/reputed	1 No.
5	Frequency Counter	Fluke/motwane/reputed	1 No.
6.	Digital Tachometer	Fluke/motwane/reputed	2 Nos.
7.	Digital Sound Level Meter	Fluke/motwane/reputed	1 No.
8.	Portable Vibration meter	Fluke/motwane/reputed	1 No.
9.	Vibration Analyser	Fluke/motwane/reputed	1 No.

Features:

1.Measurement of Continuous Frequency Changes.
2.RMS Response (Differential System) with Minimiumk waveform Effect.
3.Anti-Shock Structure.

TECHNICAL SPECIFICATIONS- DATA SHEET

Item Name: Digital Frequency Meter

SL NO	TECHNICAL SPECIFICATION	DESCRIPTION
1.	Measurement Range	45-65 Hz.
2.	Accuracy	Class: 0.2
3	Range of voltages	50-300
4	Range of frequency	1-500

DESCRIPTION : Miscellaneous test instruments -Frequency Counter

QTY : 1 Nos.

TECHNICAL SPECIFICATIONS- DATA SHEET

Item Name: Frequency Counter

SL NO	TECHNICAL SPECIFICATION	DESCRIPTION
1.	Frequency Range	0.1 Hz To 1000 MHz.
2.	Accuracy	+/- Time Base (Error x Frequency + LSD)

DESCRIPTION : Miscellaneous test instruments –Portable PF meter

TECHNICAL SPECIFICATIONS- DATA SHEET
Item Name: PF Meter

SL NO	TECHNICAL SPECIFICATION	DESCRIPTION
1.	Make	Conin/Motwane/Equivalent
2.	Model	-
3	Type	Digital
4.	True power	upto 320 kw
5	App. Power	Upto 400 KVA
6	AC voltage	750 V
7	AC Current	400 Amps
8	Resolution	0.01
9.	Accuracy	+/- 2 %
10	Standard Accessories	

DESCRIPTION : Miscellaneous test instruments –Digital Timer

TECHNICAL SPECIFICATIONS- DATA SHEET
Item Name: Digital Timer

SL NO	TECHNICAL SPECIFICATION	DESCRIPTION
1.	Make	Conin/Motwane/Equivalent
2.	Model	-
3	Type	Digital
4.	Range	1m sec to 99.9 sec
5	Accuracy	Value +/- 0.05% +/- resolution
6	Power	230 V AC+/- 15%, 50HZ+/-5%,15VA

DESCRIPTION : Miscellaneous test instruments –AC Milli Ammeter

TECHNICAL SPECIFICATIONS- DATA SHEET
Item Name: AC Milli Ammeter

SL NO	TECHNICAL SPECIFICATION	DESCRIPTION
1.	Current Range	0.15-30 Amps
2.	Voltage	750V AC
3..	Accuracy	0.5% of F.S

DESCRIPTION : Miscellaneous test instruments –Digital Tachometer

TECHNICAL SPECIFICATIONS- DATA SHEET

Item Name: Digital Tachometer

SL NO	TECHNICAL SPECIFICATION	DESCRIPTION
1.	Contact	Non Contact Type
2.	Range	6.0 – 99999.9 RPM
3.	With Standard Accessories	

DESCRIPTION : Miscellaneous test instruments –Digital Sound Level Meter

Features:

1. A,C Frequency Weightings.
2. FAST, CLOW Time Weighting.
3. MAX Hold Function.
4. AC, DC Output.

TECHNICAL SPECIFICATIONS- DATA SHEET

Item Name: Digital Sound Level Meter

SL NO	TECHNICAL SPECIFICATION	DESCRIPTION
1.	Range	30-130 db
2.	Display	Large & Clear

DESCRIPTION : Miscellaneous test instruments –Portable Vibration Meter

TECHNICAL SPECIFICATIONS- DATA SHEET

Item Name: Portable Vibration Meter

SL NO	TECHNICAL SPECIFICATION	DESCRIPTION
1.	Acceleration	19.99 m/sec (HI) 199.9 M/sec (LO)
2.	Displacement	199.9 micron (HI) 1999.9 micron (LO)
3.	With Standard Accessories	

DESCRIPTION : Miscellaneous test instruments –Vibration Analyzer

TECHNICAL SPECIFICATIONS- DATA SHEET

Item Name: Vibration Analyzer

SL NO	TECHNICAL SPECIFICATION	DESCRIPTION
1.	Acceleration	5Ranges with Full Scale 0.01,0.1,1.0,10.0 & 100.0 m/sec^2
2.	Velocity	5Ranges with Full Scale 0.1,1.0,10.0,100.0 & 1000.0 mm/sec
3.	Displacement	5Ranges with Full Scale 1.0,10.0,100.0,1000.0 & 10000.0 micros
4.	Frequency Range	Max. 1 Hz to 1000 Hz, Built-in High Pass Filter

		with Cut off at 1 KHz/10 KHz and Low Pass filter with Cut off at 1KHz/10 KHz
5.	Power	20/240 V, 40-60 Hz AC Mains Supply

SPECIFICATION : IS-1-08-DL-024

DESCRIPTION : Secondary Injection Test Kit

QTY : 1 Set.

TECHNICAL SPECIFICATIONS- DATA SHEET
Item Name: Secondary Injection Test Kit

SL NO	TECHNICAL SPECIFICATION	DESCRIPTION
1.	Make	Conin
2.	Output Current	0-100 Amps.
3.	Input Supply	0-230/240 Volts,50 Hz Single Phase AC
4.	AC Voltage Output	0-250 Volts Continuously Variable, 100VA
5.	Metering Accuracy	+/- 1.5 %
6.	Measurement Method	AC True RMS
7.	Voltmeter Range	0-250 Volts
8.	Accuracy	+/- 1.5 %
9.	Complete with Standard Accessories with Built in Timer	

Note: The Complete unit will be fabricated on Angle Iron Structure and Housed in Sheet Metal case with Carrying handles for easy Portability with Enclosure.

DESCRIPTION : Cable Core Identification Kit

QTY : 1 Nos.

Features:

2. Identifies up to 19 Cable Cores.
3. Minimum Of Controls & large LCD Simplify accurate usage.
4. Safety Circuits enable the Display to be connected to 240 Volts Without Damage.
5. Only One Person Required for Operation.
6. Supplied as Complete Kit with Carrying Case and Send Unit.

TECHNICAL SPECIFICATIONS- DATA SHEET
Item Name: Cable Core Identification Kit

SL NO	TECHNICAL SPECIFICATION	DESCRIPTION
1.	No. Of Cores	19 nos.
2.	Supply Battery	9 Volts PP3, No Battery Required for Sender Unit
3.	Max. Loop Resistance Complete with Standard Accessories.	500 Ohms

DESCRIPTION : Hand Held Meter

QTY : 1 No..

APPROVED MAKE: conin/equivalent

TECHNICAL SPECIFICATIONS- DATA SHEET

Item Name: Hand Held Meter

SL NO	TECHNICAL SPECIFICATION	DESCRIPTION
1.	DC Current Range	Up to 10 Amps
2.	DC Current Accuracy	1.2% + 2 DC
3.	AC Current Range	Up to 10 Amps
4.	AC Current Accuracy	1.2% +5 AC
5.	DC Voltage Range	Up to 1000 Volts
6.	DC Voltage Accuracy	0.3% +1 DC
7.	AC Voltage Range	Up to 1000 Volts
8.	AC Voltage Accuracy	0.5% +2 AC

SPECIFICATION : IS-1-08-DL-025

DESCRIPTION :Precision Millivolt Source

QTY : 1 No..

APPROVED MAKE: conin/shylendra/reputed

Features:

1. AC Current and Voltage Outputs
2. Wide Multiple Ranges
3. Ease of Operation
4. High Stability
5. Front Panel Controls
6. Short Circuit and Over- Burden Protections
7. Direct Reading output Controls
8. Compact Size for ease of portability
9. Rapid warm up

TECHNICAL SPECIFICATIONS- DATA SHEET

Item Name: Precision MilliVolt Source

SL NO	TECHNICAL SPECIFICATION	DESCRIPTION
1.	Power Input	240VAC, 50Hz
2.	Current	0-50 Amps, AC (Multiple steps from 100mV to 50A)
3.	Voltage	100mV to 1000V AC (Multiple Steps)
4.	Accuracy	Within +/- 1% of the Setting 40-400Hz
5.	Frequency	40-400Hz (Cont. Variable or Variable in Steps)

SPECIFICATION : IS-1-08-DL-026

DESCRIPTION : Thermocouple Simulator

QTY : 1 No.

APPROVED MAKE : reputed

TECHNICAL SPECIFICATIONS- DATA SHEET

Item Name: Thermocouple Simulator

SL NO	TECHNICAL SPECIFICATION	DESCRIPTION
1.	Type of thermo-couples	SS Head, Mineral Insulated (i.e. extruded MgO), Ni-Cr-Ni extension type (K type).
2.	Calibration Stability	1 PPM stability for calibrating / testing Thermocouple (all Type) interface.
3.	Temperature Range	0-600 DEG. C

SPECIFICATION : IS-1-08-DL-027

DESCRIPTION : RTD Simulator

QTY : 1 No.

APPROVED MAKE : reputed

TECHNICAL SPECIFICATIONS- DATA SHEET

Item Name: RTD Simulator

SL NO	TECHNICAL SPECIFICATION	DESCRIPTION
1.	Type of Temperature sensor to be simulated	Pt 100
2.	Calibrating Stability	1 PPM stability for calibrating / testing RTD (all Type) interface
3.	Accuracy of sensor being simulated	CLASS B

SPECIFICATION : IS-1-08-DL-028

DESCRIPTION : Digital Multimeter

QTY : 5 Nos.

APPROVED MAKE : motwane/fluke/reputed

TECHNICAL SPECIFICATIONS- DATA SHEET

ITEM NAME: PORTABLEN DIGITAL MULTIMETER

SL NO	TECHNICAL SPECIFICATION	DESCRIPTION
1.	Type	Portable digital
2.	Quantity	5 Nos.
3.	Power	Battery operated
4.	Measuring Ranges AC and DC	Voltage: 400mV-1000V Current: 2mA-10A Resistance: 400-50 M ohm Capacitance: 10nF-200mF Frequency: 2KHz- 20KHz
5.	Accuracy	Current: AC: +/- 1.5%, DC: +/- 1% Voltage: AC: +/- 1.5%, DC: +/- 1% Resistance: +/- 1%
6.	Display	3 ½ digit –LCD
7.	Additional Function	Continuity check –beep, Diode test, Hold display features
8.	*Features	Heavy duty shock, dust proof, overload protection, auto/manual polarity, low battery, over range indication on board, function of data holding, auto power off, manual circuit discharge, hazardous voltage warning
9.	Accessories	Test leads and carrying case
10.	Probable makes	YOKOGAWA, MOTWANE, FLUKE

NOTE: 1. Measuring leads and any other accessories has to supply along with each instrument, its cost Inclusive with instruments.

SPECIFICATION : IS-1-08-DL-029

DESCRIPTION : GPS Time Synchronization Source

QTY : 1 Set.

APPROVED MAKE: reputed

Features:

1. 12 Channel GPS Receiver with TRAIM
2. Accurate to 30 Nanoseconds RMS to UTC (USNO).
3. Frequency Accuracy to 1x10-12 (Long Term).
4. IRIG B Time Code Output.
5. IPPS Selectable Pulse Rates & Alarm Outputs
6. Ethernet Network Port (10/100 Base T).
7. SNMP with Enterprise MIB.
8. Telnet & Serial Port (RS232-422) for Monitoring & control.
9. Vacuum Fluorescent Display & Keypad.
10. Network time Server option Supports NTP.
11. Expansion Model option with 4 Configurable Outputs.
12. Programmable Pulse Output option.
13. Time interval/even Timing option.
14. Frequency Measurement option.
15. Remote Software Upgrades.

TECHNICAL SPECIFICATIONS- DATA SHEET
Item Name: GPS Time Synchronization Source

SL NO	TECHNICAL SPECIFICATION	DESCRIPTION
	GPS Receiver	
1	Receiver Input	1575.42 MHz L1 C/A Code. Coarse Acquisition
2.	Position Accuracy	Typical 10 m RMS tracking 4 Satellites
3.	Tracking	12 Parallel channels. Multi Satellite ensembling with TRAIM
4.	Acquisition Time	<20 min. (Typically)
5.	1 PPS Output Accuracy	UTC (USNO)+/- 30 nS RMS 100 nS Peak (without S/A 99 %)
6.	Frequency output Accuracy	$1x10^{-12}$ @ 1 Day
7.	Frequency/Timing Allan Deviation Stability	$1x10^{-9}$ @ 1 Sec

		$3x10^{-10}$ @ 10 Sec $3x10^{-10}$ @ 100 Sec $2 x10^{-10}$ @ 1000 Sec $1x10^{-12}$ @ 1 Day
8.	Stability When not Tracking Satellites	$2x10^{-6}$ (0^0 C to 50^0 C) Typical
9.	Code Out Of Time Code Generator	IRIG B
	OSCILLATOR	
10.	Standard Oscillator	VCTCXO
11.	Optional Oscillator	OCXO
	STANDARD INPUT/OUTPUT SIGNALS	
12.	8 standard I/Os: (i) 2 For Control & Monitoring (ii) 6 For Signals	Serial & Ethernet Port 1PPS Out, Time code out, Rate Out, Open Collector Alarm Out, Optional Time Internal/Event Timing Input, Optional Frequency measure input (all With BNC female Connector). I/Os are Configurable via the keypad /Display RS 232/422, and standard Network Port.
13.	RS 232/422	User Selectable up to 19200 bps, Connector: Male 9 Pin D Subminiature.
14.	Network Interface	Standard 10/100 Base T RJ-45 eight Pin Connector. Protocol: Telnet & SNMP for the user Interface, FTP (for firmware upgrades). And optional NTP and SNTP server
15.	1 PPS	Pulse Width: 20 μS (+/- 1μS) on the rising edge on Time, TTL Levels into 50 Ohms, BNC Female Connector.
16.	Code Out	Default IRIG B AM Format: AM or DC Code IRIG B AM Code: 3Vp-p into 50 Ohm +/- 10%, Ratio (AM): 3:1. DC Code: TTL into 50 Ohm. Connector: BNC Female
17.	Rate Out	Default: 10 MPPS, Rate: 1PPS, 10 PPS, 100 PPS, 1kPPS, 10k PPS, 100 kPPS, 1 MPPS, 5 MPPS & 10 MPPS. Duty Cycle: 50% & 60/40 % Amplitude: TTL Levels into 50

		Ohms. Connector: BNC Female
18.	Alarm	Open Collector. Max. 25 Volts/50 mA Connector: BNC Female
	MECHANICAL/ENVIRONMENTAL: Time and Frequency System	
19.	Power	Voltage: 90-260 VAC Frequency: 47-63 Hz
20.	Connector	IEC 320
21.	Size	1U: 1.75''x17.1''x15.35'' (4.44 cm x 43.4 cm x 38.9 cm) Standard 19'' (48.26 cm) EIA rack system, Hardware Included
22.	Operating Temperature	0^0 C to $+50^0$ C ($+32^0$ F to $+122^0$ F)
23.	Storage Temperature	-55^0 C to $+85^0$ C (-67^0 F to $+185^0$ F)
24.	Humidity	95%, Non Condensing
25.	Display	Graphics (120 x 60) Vacuum Fluorescent Display. One line for Time & Day of Year (TOD). Two-Line Alpha- numeric Display for status messages & user Input. Keypad: Includes Numeric 0-9, Left, Right, Up, Down, CLR, Enter, Time Key, status Key & Menu Key.
	MECHANICAL/ENVIRONMENTAL: Antena	
26.	**Size**	3'' Dia x 3'' Height (7.62cm x 7.62 cm)
27.	**Input**	BNC Female to GPS Receiver. TNC on Antenna
28.	**Power**	+12 VDC
29.	**Operating Temperature**	-55^0 C to $+85^0$ C (-67^0 F to $+185^0$ F)
30.	Storage Temperature	-55^0 C to $+85^0$ C (-67^0 F to $+185^0$ F)
31.	Humidity	95%, Non Condensing
32.	Certification	UL, FCC, CE & C-UL

SPECIFICATION : IS-1-08-DL-030

DESCRIPTION : Square Wave Pulse Generator

QTY : 1 No.

APPROVED MAKE : reputed

TECHNICAL SPECIFICATIONS- DATA SHEET

Item Name: Square Wave Pulse Generator

SL NO	TECHNICAL SPECIFICATION	DESCRIPTION
1.	Frequency Range	0 to 2 GHz
2.	Output Amplitude	0 to 10 V Peak to Peak
3.	Accuracy	0 to 0.001Hz

SPECIFICATION : IS-1-08-DL-031

DESCRIPTION : Synchronizing Module

QTY : 1 No.

APPROVED MAKE: BHEL-EDN

TECHNICAL SPECIFICATIONS- DATA SHEET

Item Name: Synchronizing Module

SL NO	TECHNICAL SPECIFICATION	DESCRIPTION
1.	Input Signal	3 –Phase, 415V
2.	Output Signal	3-Phase ,25 to 40V
3.	Phase shift between Primary and secondary	-120 to + 120 Deg.

SPECIFICATION : IS-1-08-DL-032

DESCRIPTION : Tool Kit for Wiring

QTY : 3 Sets

APPROVED MAKE : Taparia/equivalent

SL NO	ITEM	Make	Qty
1	Spanner Set	Reputed	2Sets
2	Screw Driver Set	Reputed	2Sets
3	Crimping Tool (Up to 25 Sq. mm)	Reputed	2 Nos.
4	Temperature Control Soldering Iron	Reputed	2 Sets
5	Wire Stripper	Reputed	2 Sets
6	Cutting Plier	Reputed	2 Nos.
7	Nose Plier	Reputed	2 Nos.
8.	Tweezer	Reputed	2 Nos.
9.	Precision Cutter	Reputed	2 Nos.
10.	Hydraulic Crimping Tool	Reputed	2 Nos.
11.	Desoldering Gun	Reputed	2 Nos.
12.	Patch Chord 2 Meter long	Reputed	10 Sets
13.	Patch Chord 1Meter long	Reputed	10 Sets
14.	Crocodile Clips	Reputed	10 Sets

SPECIFICATION : IS-1-08-DL-033

DESCRIPTION : Control Desk

QTY : 1 No.

APPROVED MAKE : EPG/VVCONTROLS/VENSON/OTHERS

TECHNICAL SPECIFICATIONS- DATA SHEET
Item Name: Control Desk

SL NO	TECHNICAL SPECIFICATION	DESCRIPTION
1.	Dimension	1m(Wide) x 600mm(depth) x 700mm (height)
2.	No. Of Illumination Push Buttons	8 Nos.
2.	No. Of Selector Switches	3 Nos.
3.	No. Of Meters	3 Nos.
4.	Top Surface	Made Of Stainless Steel.

SPECIFICATION : IS-1-08-DL-034

DESCRIPTION : Simulator Software

QTY : 1 No.

APPROVED MAKE : matlab/equivalent

TECHNICAL SPECIFICATIONS- DATA SHEET

Item Name: Simulator Software

SL NO	DESCRIPTION/Modules	QTY.	Remarks
1.	MATLAB	1 No.	
2.	Robust Control toolbox	1 No.	
3.	Fuzzy Logic Toolbox	1 No.	
4.	Control System Toolbox	1 No.	
5.	Sim power Systems	1 No.	
6.	Simulink	1 No.	

SPECIFICATION : IS-1-08-DL-035

DESCRIPTION : Level two Computer/Server with OS & Communication Software

QTY : 3 Sets

Minimum Specification for Level two Computer/Server with OS & Communication Software :

SL NO	Description of item	Details
	OPERATOR STATION (PC)	
1.	Make	HP XW 4400/Compaq/IBM/Zenith/Equivalent
2.	Processor	Pentium dual core processor for sever grade PCs 'PIV' processor with I/O capability
3.	Speed	3.4 GHz
4.	Memory & Cache	1 GB RAM, 512KB cache, 2 MB L2 cache
5.	Hard Disk	80 GB HDD, Graphic acceleration card with 8 MB on-load RAM.
6.	Floppy Drive	1.44MB FDD
7.	Monitor	TFT monitor 19" with resolution 1280 x 1024
8.	CD / DVD Drive	52 x CD/DVD ROM (read/write) combo drive i.e. It shall be possible to read and write CD and DVD
9.	Port	2 Nos. Serial port, 1 No. Parallel port, 4 No USB,1 No keyboard connector VGA, mic in, line out, RJ-45
10.	Power Supply	Approx. 350W SMPS with line filter as required suitable for input power for 230V AC.
11.	Keyboard	Windows based multimedia keyboard, optical mouse and other standard accessories
12.	Expansion slots	For insertion of external card later
13.	Network Interface	Integrated Gigabit Ethernet
14.	Multimedia	8 MB V RAM with SVGA card
15.	Cables	System shall be complete with all required cables
16.	Operating System	Microsoft Window XP professional (Latest version)

SPECIFICATION : IS-1-08-DL-036

DESCRIPTION : HMI along with Development Software

QTY : 3 sets

Minimum Specification for HMI along with Development Software:

SL NO	Description of item	Details
	OPERATOR STATION (PC)	
1.	Make	HP XW 4400/Compaq/IBM/Zenith/Equivalent
2.	Processor	Pentium dual core processor for sever grade PCs 'PIV' processor with I/O capability
3.	Speed	3.4 GHz
4.	Memory & Cache	1 GB RAM, 512KB cache, 2 MB L2 cache
5.	Hard Disk	80 GB HDD, Graphic acceleration card with 8 MB on-load RAM.
6.	Floppy Drive	1.44MB FDD
7.	Monitor	TFT monitor 19" with resolution 1280 x 1024
8.	CD/DVD Drive	52 x CD/DVD ROM (read/write)combo drive i.e. It shall be possible to read and write CD and DVD
9.	Port	2 Nos. Serial port,1 No. Parallel port, 4 No USB,1 No keyboard connector VGA, mic in, line out, RJ-45
10.	Power Supply	Approx. 350W SMPS with line filter as required suitable for input power for 230V AC.
11.	Keyboard	Windows based multimedia keyboard, optical mouse and other standard accessories
12.	Expansion slots	For insertion of external card later
13.	Network Interface	Integrated Gigabit Ethernet
14.	Multimedia	8 MB V RAM with SVGA card
15.	Cables	System shall be complete with all required cables
16.	Operating System	Microsoft Window XP professional (Latest version)

SPECIFICATION : IS-1-08-DL-037

DESCRIPTION : Modules & Storage System

QTY : 1 set

Approved make : godrej/equivalent

Technical Specifications-Data Sheet

Item Name: Modules & Storage System

SL NO	Description of item	Details
1.	4-Tier System with automatic storage & retrieval facilities and with computerized information System.	1 set

SPECIFICATION : IS-1-08-DL-038

DESCRIPTION : Work Bench

QTY : 4 sets

Approved make : Reputed

Technical Specifications-Data Sheet

Item Name: Work Bench

SL NO	Description of item	Qty.	Remarks
1.	Workbenches, 2.0 x 0. 8 m, with a rigid steel structure, even surface, hard-wood plate of min. 50 mm thickness, air-dried, hard-wood block, specially treated, provided with toothed profile, water resistant, edges with steel to resist clipping and general wear and tear. They shall be furnished with min. 4 drawers and compartments with doors, both fitted with locks.	4 sets.	
2.	Workbenches Should have a top mounted instrument and current supplying board. The board shall be dust & vermin proof. It shall be completely equipped, wired and painted and shall have rated insulation level in accordance with the applicable IEC/ VDE standards.	4 sets.	

SPECIFICATION : IS-1-08-DL-039

DESCRIPTION : UPS

QTY : 1 SET

TECHNICAL SPECIFICATION
FOR
UNITERRUPTED POWER SUPPLY (UPS)

CONTENTS

ENCLOSED:

a. QAP no. IS-1-05-2012/QAP4

PREPARED BY	**CHECKED BY**	**APPROVED BY**
(JK)	**(AVR)**	**(AVR)**

S E C T I O N - I
GENERAL SPECIFICATION

1.O SITE CONDITIONS:

1.1 Maximum and Minimum Ambient Temperature
a) Outdoor: 50 ^{0}C
b) Indoor: 48 ^{0}C and 4 ^{0}C
However for the purpose of equipment design consider 55 deg C ambient (for Derating if required))

1.2 Relative Humidity
a) Outdoor: 90 %
b) Indoor: 27 %
However for the purpose of equipment design consider 100% max relative humidity (for derating if required).

1.3 Location: Indoor: Equipment shall be located indoor in hot, humid, tropical and dusty atmosphere in adverse industrial environment.

NOTE:
a. Maximum ambient temperature and relative humidity do not occur simultaneously.
b. Indoor means inside the motor/control room
c. Outdoors means outside the motor/control room.

1.5 Environmental conditions

All equipment and accessories shall be suitable for conductive dusty laden corrosive atmosphere normally experienced in steel plants and all equipments and accessories shall be designed to resist vermin fungus dew etc. However for the purpose of equipment design consider 55 deg C ambient (for Derating if required) (**UPS to be located in Air conditioned room**)

1.6 Power supply available

1.6.1 Main power supply

- Voltage: 415 V, +/- 10 %
- Phase: 3 phase, 4 wire solidly grounded system
- Frequency: 50 Hz +3%, - 6 %

- Neutral: Solidly grounded.

- System Fault Level: 50 kA (RMS) for 1 second.

- Rated Insulation Voltage: 2.5 kV for 1 minute.

SECTION - II

APPLICABLE STANDARDS

The equipment shall confirm to latest Indian Electricity rules as regards to safety, earthing and other essential provisions specified therein of Electrical equipments.

The equipment shall also confirm to the following standards.

IS/IPSS Code & year	**Title**
IEC 144 and IEEE-444	UPS design and manufacture
Applicable standard :	IEC – 60146-4 (1986-09), IEC - 60146-5 (1988-11)
IS: 8623 (Part1-3)-1993	Low voltage Switchgear and control gear assemblies
IS: 10118 Part (1-4)-1982	Code of practice for selection, Installation and Maintenance of Switch gear and control gear.
IS: 13947 (Part 1-5)-1993	Low Voltage Switchgear and control gear.
IS: 4237 -1982.	General requirements for control gear and switchgear for voltages not exceeding 1000V AC or 1200 V DC.
IS: 2147 - 1962	Degrees protection provided by enclosures for low voltage switchgear and control gear.
IS: 5082 – 1981.	Wrought aluminum and aluminum alloys, bars, rods, Tubes and sections for electrical purposes.
IS: 2551 – 1982	Danger notice plates
IS: 5 –1994	Painting.
IS: 11182 Part (1 & 2)-1984, Part 3,5,6 and 7 1986,1993,1996	Guide for evaluation of insulation system of electrical equipment.

SCOPE OF SUPPLY AND SERVICES

Sl no	**Item Description**	**Quantiity**
1	**12 KVA Hot standby mode Redundant UPS system**	1 set

	With sealed maintenance free battery – 60 minutes backup. Degree of protection shall be IP21.and painted with Shade No.631(light grey) of IS 5 : 1994	
2	*Spares:* ***a. Supply of Erection and Commissioning spares and any special tools and tackles shall be included.*** ***b. 2-years normal spares to be recommended along with price valid till the tenure of the contract.***	1 LOT

SECTION-III

TECHNICAL SPECIFICATION

3.0. UNINTERRUPTED POWER SUPPLY SYSTEM (UPS)

a. The UPS shall be complete with battery bank rack & interconnecting cables. The Battery shall be suitably located in a separate adjacent room. UPS shall also conform to the latest Indian Electricity Rules as regards safety, earthing and other essential provisions specified therein for installation and operation.

b. Under normal conditions, 12KVA UPS systems shall supply regulated AC power continuously to critical loads. The rectifier battery charger shall convert the normal AC incoming power to DC power for the inverter and for float charge of the storage battery..

c. If AC incoming power supply fail or deviate from specified tolerances, the storage battery shall supply DC power to the inverter of working UPS system up to specified time of 60 minutes and ensure continuous AC Power supply to critical loads. The output of UPS shall be 125% for I5 minutes of the rating of the UPS.

d. When UPS systems develop fault, **static by pass transfer switch** shall automatically transfer the critical loads from inverter output to by pass AC incoming power supply. The static by pass transfer switch shall automatically re-transfer the load back to UPS, when it starts functioning in normal condition and stabilizes.. Manual by-pass transfer switch shall also be provided for test / repair / maintenance of the UPS system.

e. The battery reserve time capability shall not be available if it is taken out of service for maintenance. However, UPS system shall continue to function as before and meet all performance criteria as specified.

3.1 Technical Parameter

3.1.1 Input power supply conditions shall be as below:

Voltage	: 415 V + 10%, -15%, 3 phase 4 wire AC
Frequency	: 50 Hz + 3%, -6%
Power factor	: 0.8 lagging (minimum)

3.1.2 The UPS System shall be designed to function under the following design conditions:-

Applicable standard :	IEC – 60146-4 (1986-09), IEC - 60146-5 (1988-11)
Design ambient temperature :	50^0C
Acoustic noise :	55 dB at 1 M

Degree of enclosure : IP 41

3.1.3 UPS output shall meet the following requirements:

OUTPUT REQUIREMENTS OF UPS

Voltage	AC 415 V, 3 phase 4 wire suitable for required nos. of 220 V single phase outgoing feeders.
Frequency	50 Hz
Power rating	12 KVA, at 0.8 P.F
Voltage regulation	+ 1 % nominal for any of following conditions : 1. No load to full load 2. 1.0 - 0.8 lagging power factor 3. Min to max DC input voltage 4. 0-550 C ambient temperature.
Voltage transient response	10% maximum deviation (average over half-cycle for 100% load application or removal.)
Voltage adjustability	+ 5 %
Voltage unbalance	5 % maximum line to line or line to neutral, with 100 % load unbalance
Phase separation	1200 + 5% with 100 % load unbalance
Voltage wave form	5% total harmonic distortion (THD) maximum with loads containing up to at least 25 % third and 10 % fifth harmonic current
Frequency stability	+ 0.1 % free running
Frequency slew rate	1.0 Hz / second (maximum)
Frequency adjustability	+ 2 Hz
Overload capacity	100 % continuous 125 %for 15 minutes 150 % for 30 secs. 750 % for 10 milliseconds
Battery recharge time	8-10 hours

3.14 Storage battery

Voltage	As required by the inverter
Protection time	60 Minutes
Type	Sealed maintenance free, inverter grade lead acid, and battery to be provided in separate cubicle.

General technical requirements of UPS

a. Complete operation and control of UPS system shall be microprocessor based with fault diagnostic and data logging features
b. Touch membrane switches **along with LCD display on the front side** of UPS panels shall be provided to facilitate UPS operation in desired mode locally and for display of all input, output and battery parameters.

c. LED based block mimic diagram shall be provided on the UPS panels indicating the complete status of the system including the power route to the UPS, output and other system elements which are in energized state of operation.

d. Provision of contacts shall be kept in the UPS panel for annunciation of abnormal operation/ alarm condition in any other operator panel/ annunciation panel.

UPS system shall also have RS-232 serial communication port interface capacity for alarm and status monitoring at supervisory control station.

Protection Indication and Annunciation

a. The protection of the UPS system are to be provided as suitable and required for rectifier and inverter unit and shall generally include the following:

b. Rectifier

- Current limiting to maximum value.
- Reduced setting of current limiting value when cooling system failure occurs
- Current limiting during boost charging & float charging
- Control power supply failure
- Any other protection as required for particular application.

- Inverter Unit

- High or low output voltage
- High or low link voltage
- Over current on rectifier output
- Over current on inverter output
- Low battery voltage
- Cooling fan failure
- Auxiliary supply failure
- Control & regulation failure
- Any other protection as required for particular application

i. The following meters shall be provided:-

c. Output voltage
d. Output frequency
e. Ammeters
f. Ammeters for battery charging/discharging

The annunciation /alarms shall be provided as listed but need not be limited to:

i. Main power off

ii. Control supply off
iii. Earth fault
iv. Load on AC mains/battery
v. Battery run out warning
vi. Cooling fan failure

1. The following indication are to be provided for the rectifier unit:-

a. Rectifier on
b. Cooling fan failure
c. Battery on float charge
d. Battery on boost charge
e. Charging failure
f. AC mains failure due to fuse blown
g. Over current
h. High battery voltage
i. Low battery voltage
j. Battery on load timer

SECTION - IV

4.0 **Tests:**

The supplier shall perform the following tests
The supplier shall give three weeks notice to enable to witness all routine tests

4.1 **Routine Tests:**

4.1.1 Physical **Inspection:**
i) Check for overall and mounting dimension, painting with respect to approved OGA drawings.
4.1.2 Checking of protective measures and earthing in line with relevant standards.
4.1.3 Insulation resistance measurement and HV test in line with relevant standards.
i. **Functional test:** Factory test shall be carried out at manufacturers works. Routine test shall be carried out as per the Indian standards and type test certificates for similar equipment shall be submitted before taking up the routine test. Routine test shall be carried out in the presence of the purchaser unless the purchaser waives of the inspection in writing.
ii. The following routing tests shall be carried out.
b. Assembly inspection/painting check
c. H.V test on main circuits.
d. H.V test on auxiliary circuit
e. Protective device co-ordination
f. Functional tests including inverter settings and inverter efficiency
g. Current limiting test
h. Supply variation

i. Insulation resistance measurement
j. Spike buster test
k. Ripple voltage
l. Tests on control circuits
m. Over load capacity tests
n. Steady state regulation at no load, 50% and 100% of load
o. Harmonic distortion test
p. Acoustic noise test
q. Battery operation

Any other test not specifically mentioned but required as per relevant IEC standard shall also be carried out and test certificate for the same furnished by the Tendered

Tests to be carried out at manufactures works shall be as mentioned below. For the test designated by symbol "A", valid test certificates shall be provided. Tests designated by symbol "B" shall be carried out in presence of the Purchaser or his authorized representatives.

The following tests shall be performed on UPS unit:

a)	Assembly inspection	-	B
b)	Continuity test	-	A
c)	Insulation resistance test	-	B
d)	High voltage test	-	B
e)	Voltage test on light load	B	A
f)	Current test	B	-
g)	Power loss calculation	to be furnished at the time of inspection	
h)	Checking properties of trigger equipment and incorporated stabilization means	B	A
I)	Temperature rise test	B	-
j)	Load test - Symmetrical loading - Unsymmetrical loading	B	-
k)	Operational/ functional tests as per stage III tests including switchover to battery by supply failure test	B	-

l)	Test for load transfer to bypass	B	-
Tests to be conducted on battery shall generally be but not limited to the following			
a)	Visual inspection	-	B
b)	Insulation test	-	B

SECTION - V

DRAWING AND DOCUMENTATION

The schedule for the submission of drawings and documents are as follows:

SL. NO	DESCRIPTION	FROM	QTY	TIME SCHEDULE	REMARKS
1.	Block diagram for approval	Ammonia prints	8	In 1 weeks from LOI	For Approval
2.	PCB modules diagrams with the BOM of the components used in each module.	Do	8	Do	For information
3.	Single line diagram for approval	Do	8	Do	For information
4.	Certified OGA, GA, bill of material for cucibles & battery for approval	Do	8	Do	For information
5.	Approved OGA and GA	RTF + Ammonia prints	2 8	Along with inspection call	For Approval
6.	Certified Schematics for approval	Ammonia prints	8		For Approval
7.	Approved schematics	RTF + Ammonia prints	2 8	Along with inspection call	For information
8.	Certified wiring & terminal diagrams	do	do		For information
9.	Bill of material	do	do	Along with inspection call	For information
10.	Test certificates (Internal)	do	do		For approval
11.	Final test certificates, O & M Manual & catalogues	do	do	Along with dispatch	For documentation

Notes on Drawings and Documentation

a. The drawings shall furnished after placement of the order by the supplier for our approval, as per the title block format of BHEL (TITLE FORMAT will be furnished along-with purchase order).
b. All documents to be furnished by the suppler shall be duly certified and signed by the competent authority and all revisions shall be duly recorded.
c. All drawings shall be mentioned in metric system & shall generally be of A3 size.
d. Title and written notation shall be in English.
e. Test certificates and documents of operation and maintenance manual shall be strictly in A4 size 297 x 210 mm only. All copies of test certificates as stipulated shall be on good quality of paper having good and legible printing.
f. The drawing shall be prepared in INK. The schematic diagram, wiring diagram, Bill of Material, OGA GA etc.
g. Manufacturer shall duly sign all documents.

TECHNICAL PARTICULARS OF UPS & BATTERY

(To be filled by the Tendered & submitted along with offer)

b. Make of UPS with model
c. Standards followed
d. Dimension of UPS
e. Output rating (Capacity)
f. Input voltage with its Variation limit
g. Input frequency with its variation limit
h. Output voltage with its variation limit
i. Output frequency with its variation limit
j. No. of phases in input
k. No. of phases in output
l. Output voltage waveform
m. Total harmonic distortion
n. Inverter type
o. Overload capacity
p. Audible noise
q. Indication lamps with potential free contacts for Mains ON, Inverter healthy, overload. On battery, low battery voltage. Inverter trip. Bypass OK, Load on inverter, load on bypass.
r. Provision of input and output voltmeters, Ammeters, DC Voltmeter
s. Provision of Static by pass switch
t. Provision of manual by pass switch
u. Provision of isolating transformer at output, converter transformer

v. Provision of 3 phase rectifier
w. Provision of input switch, output switch, battery isolator
x. Protection for DC input under voltage, over temperature, fan failure, overload and short circuit with potential free contacts for alarms & interlocks
y. Provision of redundant converter, inverter, charger etc in hot stand by mode

25.0 Enclosure sheet steel protection class

26.0 Battery type & capacity in AH
27.0 Make of Battery and its model no.
28.0 Battery bank voltage
29.0 Voltage of each battery
30.0 Whether battery charger provided?
31.0 Battery charger DC ripple value
32.0 Whether Literature for UPS and Battery bank enclosed?

LIST OF ACCEPTABLE MAKES

Sl. No.	ITEM	RECOMMENDED SUPPLIERS
1.	Moulded case circuit breaker (MCCB)	ABB/ALSTOM/L&T/SCHNEIDER (CGL/MERLINGERIN)
2.	Semiconductor fuse	EE/HIRECT
3.	SMF Battery lead acid type	AMCO/CHLORIDE (EXIDE)/SABNIFE(HBNIFE POWER SYSTEM)/STANDARD
4.	Battery charger	AEL/APLAB/CALDYNE/CHABI ELECTRICALS/NELCO/SABNIFE

SECTION - VI: INFORMATION TO BE FURNISHED along with offer

b. Unpriced copy of the price bid to be furnished along with technical bid
c. Tentative OGA and SLD and BOM
d. Details of Battery and battery stand
e. Clause wise confirmation/clarification for technical specification
f. Deviation format duly filled.
g. List of commissioning spares quoted and recommendation for 2 years normal spares.

SPECIFICATION : IS-1-08-DL-040

DESCRIPTION : HV Transformer

QTY : 1 SET

APPROVED MAKE: reputed

TECHNICAL SPECIFICATIONS - DATA SHEET

Item Name – HV Transformer

Sl.No.	Technical Specifications	Description
1	Input	415 VAC 3 Phase, 50 Hz
2.	Output	0-800 VAC 3 Phase
3.	Current	30 Amps
4.	Max. Ambient Temperature	45^0 C

SPECIFICATION : IS-1-08-DL-041

DESCRIPTION : OSCILLOSCOPE

QTY : 6 SETS

APPROVED MAKE: BPL/reputed

DETAILED SPECS:

TECHNICAL SPECIFICATION FOR DIGITAL STORAGE OSCILLOSCOPE - 100MHz: QTY_1No

Features:

. Easy to read color or monLCD
. Dual channel Band width: 10 MHz to 100 MHz
. Rise time: 1.8 ns-14ns
. Vertical sensivity 2 mv-5v/div
. Real time sampling 1 Gsa/s or 250 MS a/s per channel, Equilant Sampling 50 Gsa/s

- Advanced triggering on edge, video, pulse
- Sweep time: 1ns- 50s/Div
- Storage of 10 wave form and setups, save, Recall
- 18 Automatic Measurements
- Frequency counter
- Auto Calibration, Auto setups
- Memory depth 4k points per channel (CH1 OR CH2)
- Cursor Measurements-Auto measure, Track or manual
- Math +,-X,FET (Hanning Blacking, Rectangle)
- Built-in USB device interface, and RS232 interface
- Trigger hold off
- Main time base, Delayed Scan Function, X-Y, Roll
- Exclusive Feature: Digital Filters, LPF, HPF, BPF, Pass/Fail Test, Auto-cal

SL	TYPE	DESCRIPTION

NO		
1)	Operating modes	Channel I & II alternate or chopped (approx, 0-100MHz), X-Y operation(ratio 1:1 input via CH II),add/sub CH I+CH II, invert CH II
2)	Real time sample	1 Gs/s-
a	Band width:	100 MHz
B	Rise time:	3.5 ns (approx)
C	Equilant sample rate	50 Gs/s
D	Accuracy:	+0.01%
e	Input impedance	1Mohm/13pf,50 ohms
f	Rise time	3.5 ns
g	Time base range	2 ns/div -50s/div
h	X Y operation Band width	100 MHz
3)	Phase difference	+ or -3 degree
a	Display	Color LCD VGA/Mono LCD
b	Real time sample rate	250Ms/s
c	Equivalent sample rate	50 GS/s
	COMMON SPECIFICATIONS:	
4)	Number of Channel	2 Inputs Channels Ext. Trig. Input
a	Memory	4K per channel
b	Vertical sensitivity	2m V/div
c	Vertical Resolution	8 bit
d	Input Coupling	DC, AC,GND
e	Trigger Type	Edge, TV, Pulse
f	Trigger Mode	Auto, Normal, Single
5)	Ext I/p Impedance, Max. input Voltage	1M ohms///3pf 400 V(DC +AC Peak)
a	Trigger coupling	DC, AC, LF Rej, HF Rej.
b	Horizontal Accuracy	+0.01%
	Math	+, -, x, +, fft.
	FFT - Window - sample	Hanning, Hamming, Backman, Rectangular 1024 points
	Auto Measurement	Vpp, Vmax, Vmin, Vbase, Vamp, Vms, Vavg, Vpre, Freq, period, Rise, Fall, +Width, -Width, +Duty,- Duty, Delay A, Delay B.
	Cursor Measurement Out put	Manual, Track, Auto measure
	Storage	10 Waveform, 10setups
	I/O	USB device and REST 232
	Probe Compensation Output	3 V p-p, 1KHz
	power	10 V-240 V AC, <50VA Max.
	Net Weight	4.5 Kgs
	Size	300(L) x 312(W) x 145(H)

	Accessories(Included)	Probe x 2(1x10x)Power cord.CD for S/Wand user manual and USB data cable
	Operating Conditions	0-40 Deg C.<90RH

SPECIFICATION : IS-1-08-DL-042

DESCRIPTION : 12 Channel Signal Plotter

QTY : 2 sets

Make : reputed

Features:

1. 12 Channel Continuous trace
2. Each Channel has own circuit, no scanning relays used.
3. Input can be zoomed, zoned & auto-ranged.
4. Easy to install, operate, upgrade & maintained.

Technical Specifications-Data Sheet

Item Name: 12 Channel Signal Plotter

SL NO	Description of item	Details
1.	No. Of inputs	12
2.	Power Supply	100 to 300 VAC
3.	Display	TFT LCD Display
4.	Chart Width	180 mm
5.	Printing	6 Colours ink-jet printing
6.	Language	Multi Language
7.	Weight	Light
8.	Interface	RS 485 Communication
9.	Isolation Resistance	200 MΩ min.
10.	Type of Input	Direct Voltage, Direct Current, RTD, Thermocouple

SPECIFICATION : IS-1-08-DL-043

DESCRIPTION : Auto Transformer

QTY : 1 SET

APPROVED MAKE: reputed

TECHNICAL SPECIFICATIONS - DATA SHEET

Item Name – Auto Transformer

Sl.No.	Technical Specifications	Description
1	Input	415 VAC 3 Phase, 50 Hz
2.	Output	0-500 VAC 3 Phase
3.	Current	30 Amps
4.	Max. Ambient Temperature	45^0 C

SPECIFICATION: IS-1-08-DL-044

DESCRIPTION :Programmable Interface Card, Communication Bus Interface Card

QTY : 1 SET

APPROVED MAKE : ALTERA/ EQUIVALENT

TECHNICAL SPECIFICATIONS - DATA SHEET

Item Name – Programmable Interface Card, Communication Bus Interface Card

Sl.No.	Technical Specifications	Description
1	FPGA Hardware	1 SET
2.	FPGA Software	1 SET

Features:

1. On-board memory, Flash ROM/ RAM etc.
2. Profibus interface.
3. Ethernet interface.
4. RS232 interface.
5. 64 Nos. 24V DI
6. 64 Nos. 24V DO.
7. 8 Nos. 14 bit AI.
8. 8 Nos. 12/14 bit AO.
9. 2 Nos. incremental encoder interface.

SPECIFICATION : IS-1-08-DL-045

DESCRIPTION : HV Testing Kit

QTY : 1 No.

APPROVED MAKE : conin/Equiv.

TECHNICAL SPECIFICATIONS - DATA SHEET

Item Name – HV Testing Kit

Sl.No.	Technical Specifications	Description
1	Input	230 VAC Single Phase, 50 Hz
2.	Output	0-25 KV
3.	Capacity	25 KVA
4.	DC Test Voltage	0-25 KV at 40 mA DC
5.	AC Test Voltage	0-25 KV at 1000 mA AC

DESCRIPTION : LCR Meter

QTY : 1 No.

APPROVED MAKE : Motwane/ fluke/Equiv.

Features:

5. Auto Computing
6. Auto Ranging

TECHNICAL SPECIFICATIONS – DATA SHEET

Item Name –LCR Meter

Sl.No.	Technical Specifications	Description
1.	Display	240x120 Dot Matrix LCD Display
2.	Measurement Accuracy	0.1%
3.	Memory Capacity	For Save/recall 100 Sets
4.	Measurement Range,L	0.1μH to 9999 H
5.	Measurement Range,C	0.1 pF to 9999 μF
6.	Measurement Range,R	0.001 Ohm to 100MOhm
7.	Measurement Range,Q	0-99

DESCRIPTION : Harmonic Analyzer

QTY : 1 No.

APPROVED MAKE : reputed

Minimum Features:

1. 110V AC input.
2. Compute FFT.
3. Up to 100th harmonic

Price Format for drives lab equipments:

Sl No	Description	Qty.	Unit Price	Total Price	Remarks
A1	5 KW AC Drive 4 quadrant with Ethernet connection	2 SETS			A1 TO A8 IS ONE SYSTEM AND TO BE QUOTED AS SUCH
A2	5 KW, 415V Inverter duty AC Motor+ Base frame	2 SETS			
A3	Speed transducers + couplings	2 SETS			
A4	Centrifuge switch + couplings	2 SETS			
A5	Position transducer + couplings	2 SETS			
A6	AC Motor mounted Mechanical brake disk	2 SETS			
A7	Fly wheel disks	2 SETS			
A8	Mechanical load belt & pulley type	2 SETS			
A9	Programming terminal (with Rockwell software)	1 SET			
A10	Data logger PC based with sensors for speed current torque, Voltage and position transducers, Rockwell software	1 NO.			
A11	Feeders	1 NO.			
A12	Dust proof measures civil work	1 SET			
A14	Ethernet switches	1 SET			
A15	Miscellaneous test instruments	1 SET			
A16	Precision V source	2 NO			
A17	HMI terminal	1 NO.			
B1	Software development stations	3 NO.S			
B2	Ethernet switches	1 SET			
B3	CPU modules with IOs and communication modules	1 SET			
B4	Optic fiber cable, Ethernet cables	2 SET			
B5	Precision V-I source	1 SET			
B6	Miscellaneous test instruments	1 SET			

Sl No	Description	Qty.	Unit Price	Total Price	Remarks
B7	Secondary injection kit, core identification kit, Hand held meter, buzzer	1 NO.			
B8	Precision milli-volt source	1 NO.			
B9	Thermocouple simulator	1 NO.			
B10	RTD simulator	1 NO.			
B11	Digital MultiMetre	5 NO.S			
B12	GPS time synchronization source	1 NO.			
B13	Sq. wave pulse generator	1NO.			
B14	Sync. Modules	1 NO.			
B15	Tool kits for wiring	1 SET			
B16	Control desk with switches and meters	1 NO.			
B17	Simulator software	1 SET			
B18	Level 2 computer/server with OS and communication software	3 NO.S			
B19	Human machine interface along with development software	3 NO.S			
C1	Modules and storage system	1 NO.			
C2	Work bench with facilities	4 NO.S			
C3	UPS 12 KVA	1 NO.			
C4	12 KVA 3 phase 415V/800V HV Transformer	3 NO.			
C5	Oscilloscope	6 NO.S			
C6	12 Channel signal plotter	2 NO.S			
C7	3 Phase Auto transformer 12 KVA, 415V/0-415V	3 NO.S			
C8	Programmable interface card, Communication bus interface card	1 SET			
C9	HV test kit, LCR meter, harmonic analyses	1 NO.			