





ISG - BANGALORE 	Indent Specifications For Various Test/ Measuring Instruments and other Items like Large Video Screen and LCD Projector	SPECIFICATION NO. IS-1-08-2005/ 030
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**TECHNICAL SPECIFICATIONS
FOR
Various Test/ Measuring Instruments and other Items like Large Video Screen and
LCD Projector**

**PROJECT: BHEL Bhopal LEM and IMM test bed
Modernization and Up-gradation Project**

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SECTION I GENERAL SPECIFICATION

1.0 SITE CONDITIONS:

- 1 Project site : BHEL- BHOPAL, MADHYA PRADESH
- 2 Altitude : Less than 1000 meters
- 3 Air Temperature :-
 - 3.1 Air Amb. Temperature Max for Design : 50⁰ C
 - 3.2 Air Amb. Temperature Min. : 4⁰C
- 4 Relative Humidity :-
 - 4.1 Relative humidity (max) : 95 %, Non Condensing
 - 4.2 Relative humidity (min) : 27 %
 - 4.3 Relative humidity for design : 100 %
- 5.0 Location : Indoor

Note: Maximum temperature & maximum relative humidity do not occur simultaneously.

The Equipment shall confirm to the IEC Rules 1956 and statutory requirements in Orissa State as regards safety, earthing and other essential provision specified therein for installation and operation of electrical plant and equipment.

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SECTION II - SCOPE OF SUPPLY

Sl. No.	Description	Qty	Approved Make
1.	Megger 10KV	5 Nos.	Fluke/ Yokogawa / Tinsley
2.	Megger 5KV	2 Nos.	Fluke/ Yokogawa / Tinsley
3.	LCR Meter	2 Nos.	Tinsley / Fluke
4.	Micro Ohm meter	6 Nos.	Tinsley / Microdyne /Megger/ GE Energy services
5.	Hand megger	14 Nos.	Fluke /Megger
6.	Digital Multimeter	14 Nos.	Fluke/ Yokogawa / Megger
7.	Analog Voltmeter	2 Nos.	Fluke / Yokogawa / AE
8.	Clamp meter	4 Nos.	Fluke/Yokogawa / Megger/ Motwane
9.	Tan Delta equipment	4 set	Tettex /Reputed subject to User's acceptance
10.	Temperature data logger (RTD) with ambient temperature feature	2 set	Yokogawa/ Fluke/ Conin
11.	Phase Sequence Indicator	3 Nos.	Gossen Metrawatt/ Conin / Megger / EIC/ Kyoristu
12.	Hand held Infrared Thermometer	8 Nos.	Extech/ Conin/ Fluke/ Reputed subject to User's acceptance
13.	Laser Beam Tachometer	8 Nos.	Extech/ Mycrodyne/ Lutron
14.	Digital Pulse Encoder with coupling	14 Nos.	Hubner/ Leine & Linde/ Kubler/ CST
15.	Large Video Screen with accessories	3 Set	Panasonic/ Mitsubishi/Toshiba/ Reputed subject to user's acceptance
16.	LCD Projector and Accessories	2 Set	SHARP / NEC / EPSON / SONY / MITSUBUSHI
17.	Noise Analyzer	5 Set	Yokogawa /Kusam Mecro / Lutron
18.	HV AC Test Kit	2 set	Motwane/ RE Electronics/ WS Test System/ Ajit Electronics/ Megger/ Tesla Bhopal/ Tinsley

Note:

- a) The above equipments are meant use in the Induction Machine Test Bed of Large Electrical Machines (LEM) and IMM at BHEL-Bhopal.
- b) The vendor may quote as many items as in his range of manufacturing/ supply. In case of sufficient offer not received within approved make the purchaser may accept other reputed make based on following criteria;

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- 1) The proven performance in similar application (Documentary evidence to be given)
- 2) Already supplied to BHEL for similar application (PO copy to be given)

c) The vendor must furnish point wise compliance for our specification for each equipment being quoted by him and any deviation must be specifically brought to notice of purchaser. The purchaser shall reserve the right to accept any deviation based on requirement and merit.

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SECTION III - DETAILED TECHNICAL SPECIFICATION

1. Megger 10 KV

Sl. No.	Specifications	Description
1	Rated Voltage	500 to 10 KV
2	Output Voltage	Rated Voltage X (1 ± 5%) (Load>=20 MΩ)
3	Top Value of Measuring Range	1000 G Ω
4	Accuracy	± 5% RDG; ±10% RDG
5	Range (Accuracy ± 5% rdg)	0.5 MΩ ~ 2 GΩ 0.025 GΩ ~ 100 GΩ; 0.05 GΩ ~ 200 GΩ
6	Range (Accuracy ± 10% rdg)	0.2 MΩ ~ 0.5 MΩ; 2 GΩ ~ 10 GΩ 0.01 GΩ ~ .025 GΩ; 100 GΩ ~ 500 GΩ 0.02 GΩ ~ 0.05 GΩ; 200 GΩ ~ 1000 GΩ
7	Output Short Circuit Current	More than 5 mA
8	Absorption & Polarization Index and Largest Accuracy	Range 1 ~ 19.99; The largest Accuracy: ±(5% RDG+1d)
9	Voltage Self-leakage time	<=30s (0.1 μF)
10	Anti-disturbance Ability	2 mA AC50Hz
11	Output Voltage Display Accuracy	2 % RDG + 1d
12	Power Supply Li Ion Battery	14.4V 2.1Ah, Charging via AC 220 V ±10 %, 50 Hz
13	Weight	~6 Kgs

Features:

- 1.0 Display should be analog as well as digital (3 ½ digit) simultaneously.
- 2.0 Should have provision of displaying output voltage & ambient temperature.
- 3.0 Complete protective function to aid safety operation.
- 4.0 RS 232 interface
- 5.0 Battery Check function.
- 6.0 EMI/EMC compatible.

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2. Megger 5 KV

Sl. No.	Specifications	Description
1	Rated Voltage	500 to 5KV
2	Output Voltage	Rated Voltage X (1 ± 5%) (Load>=20 MΩ)
3	Top Value of Measuring Range	1000 G Ω
4	Accuracy	± 5% RDG; ±10% RDG
5	Range (Accuracy ± 5% rdg)	0.5 MΩ ~ 2 GΩ 0.025 GΩ ~ 100 GΩ; 0.05 GΩ ~ 200 GΩ
6	Range (Accuracy ± 10% rdg)	0.2 M Ω ~ 0.5 MΩ; 2 GΩ ~ 10 GΩ 0.01 GΩ ~ .025 GΩ; 100 GΩ ~ 500 GΩ 0.02 GΩ ~ 0.05 GΩ; 200 GΩ ~ 1000 GΩ
7	Output Short Circuit Current	More than 5 mA
8	Absorption & Polarization Index and Largest Accuracy	Range 1 ~ 19.99; The largest Accuracy: ±(5% RDG+1d)
9	Voltage Self-leakage time	<=30s (0.1 μF)
10	Anti-disturbance Ability	2 mA AC50Hz
11	Output Voltage Display Accuracy	2 % RDG + 1d
12	Power Supply Li Ion Battery	14.4V 2.1Ah, Charging via AC 220 V ±10 %, 50 Hz
13	Weight	~6 Kgs

Features:

- 1.0 Display should be analog as well as digital (3 ½ digit) simultaneously.
- 2.0 Should have provision of displaying output voltage & ambient temperature.
- 3.0 Complete protective function to aid safety operation.
- 4.0 RS 232 interface
- 5.0 Battery Check function.
- 6.0 EMI/EMC compatible.

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3. LCR Meter

- Measures 14 Impedance Parameters (2 simultaneously)
- 0.05% Basic Measurement Accuracy
- 289,900 Programmable Frequencies from 10Hz to 2MHz
- AC Test Voltage Programmable from 20mV to 5V
- DC Bias Voltage, 2V Internal or 0 to 200V External
- Fast Measurement Speeds up to 40/Second
- Automatic Open/Short Zeroing Eliminates Connection Errors
- High Resolution LCD with 7 Digit Display
- 14 Hi/Lo Sorting Bins for Pass/Fail Testing
- RS-232, IEEE-488, Printer, and PLC Interfaces all Standard
- Results Displayed as Deviation or %Deviation from a Nominal Value
- Internal Storage and Recall of Test Setups
- Constant Voltage Maintained to the Device Under Test
- Ability to Automatically Perform 6 Unique Tests in Sequence
- Keypad Lockout Prevents Changes to the Test Setup
- On site calibration with NIST Traceable Cal Kit
- Programmable Average and Delay Times

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4. Micro Ohmmeter

RANGE	SPAN-OHMS	RESOLUTION	ACCURACY	TEST CURRENT
1	0-1900.0	100 m Ω	0.05 % of reading \pm 2 digits	1 mA
2	0-199.99	10 m Ω	0.05 % of reading \pm 2 digits	1 mA
3	0-19.999	1 m Ω	0.05 % of reading \pm 2 digits	1 mA
4	0-1.9999	100 m Ω	0.05 % of reading \pm 2 digits	10 mA
5	0-199.99	10 μ Ω	0.05 % of reading \pm 2 digits	300 mA
6	0-19.999	1 μ Ω	0.1 % of reading \pm 2 digits	3.3 A
7	0-1.9999	0.1 μ Ω	0.1 % of reading \pm 2 digits	3.3 A
Measurement Range		1 μ Ω to 1900 Ω in seven ranges		
Method		Four Terminal D.C.		
Display		4 1+2 Digits (1.9999 Full Scale)		
Power Requirements		115/230 Volts 50-60 Hz		
Dimensions		460 X 440 X 150 mm		
Interface		RS 232		
Approx Weight		Less than 12 Kg		

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5. Hand megger

Sl No.	Specifications	Description
1	Rated Voltage	100 / 250 / 500 / 1000 V
2	Output Voltage	Rated Voltage X (1 ± 5%)
3	Top Value of Measuring Range	2000 M Ω
4	Accuracy	± 5% RDG; ±10% RDG
5	Range (Accuracy ± 5% rdg)	0.5 MΩ ~ 100 MΩ 100 MΩ ~ 500 MΩ; 500 GΩ ~ 2 GΩ
6	Output Short Circuit Current	More than 2 mA
7	Absorptance & Polarization Index And Largest Accuracy	Range 1 ~ 19.99; The largest Accuracy: ±(5% RDG+1d)
8	Voltage Self-leakage time	<=30s (0.1 μF)
9	Anti-disturbance Ability	2 mA AC50Hz
10	Output Voltage Display Accuracy	2 % RDG + 1d
11	Weight	~11 Kg

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6. Digital Multimeter

SI No.	Specifications	Description
1	Voltage DC Range	Maximum Voltage :1000 V Accuracy : $\pm(0.05+1)$ Maximum resolution: 10 μ V
2	Voltage AC Range	Maximum Voltage: 2500 V Accuracy : $\pm(0.7\%+2)$ True RMS AC Bandwidth :20 KHz with low passfilter; 3 db @ 1 KHz Maximum resolution: 0.1mV
3	Current DC Range	Maximum Amps :10A (20A for 30 sec max) Amps Accuracy : $\pm(0.2\% +2)$ Maximum Resolution : 0.01 μ A
4	Current AC Range	Maximum Amps :10A (20A for 30 sec. max) Amps Accuracy : $\pm(1.0\% +2)$ True RMS Maximum Resolution : 0.1 μ A
5	Resistance	Maximum Resistance: 50M Ω Accuracy : $\pm(0.2\% +1)$ Maximum Resolution: 0.1 Ω
6	Capacitance	Maximum Capacitance:9,999 μ F Accuracy : $\pm(1\% +2)$ Maximum Resolution :0.01nF
7	Frequency	Maximum Frequency :200 KHz Accuracy : $\pm(0.005\% +1)$ Maximum Resolution :0.01Hz
8	Duty Cycle	Maximum Duty Cycle :99.9% Accuracy : $\pm(0.2\% \text{ per } +1)$ Maximum Resolution : 0.1%
9	Temperature Measurement	-200.0°C-1090°C -328.0°F-1994.0°F excluding probe
10	80 KB Temperature Probe	-40.0°C-260°C -40.0°F-500°F, 2.2°C or 2% whichever is lower
11	Conductance	Maximum Conductance: 60.00 nS Accuracy : $\pm(1.0\% +10)$ Maximum Resolution : 0.01nS

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12	Diode	Range: 3V Resolution: 1 mV Accuracy: $\pm(2\% +1)$
13	Duty Cycle Range	Accuracy within $\pm (0.2 \% \text{ per KHz} + 0.1 \%)$
14	Operating Temperature	-20° C to + 55° C
15	Storage Temperature	-40° C to + 60° C
16	Humidity (without condensation)	0% -90 % (0° C - 35° C) 0% -70 % (35° C - 55° C)

7. Analog Voltmeter

SI No.	Specifications	Description
1	Voltage AC Range	Voltage Range: 0 to 2500 V Accuracy: 1.0% of FSD True RMS Maximum resolution: 0.1mV
2	Form Factor	Hand held type
3	Operating Temperature	-20° C to + 55° C
4	Storage Temperature	-40° C to + 60° C
5	Humidity (without condensation)	0% -90 % (0° C - 35° C) 0% -70 % (35° C - 55° C)

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8. Clamp meter

AC current range	: 60 / 600 / 1000 A
Filter on	: +-1.5% rdg. at 50 or 60 HZ
Filter off	: +-3 % rdg. at 45 to 66 HZ
Frequency Characteristics	: 40 to 600 Hz
Sampling rate	: 2 times / sec (Bar graph: 4 times / sec)
Crest factor	: 2.8 (< 600 A) and below 1.6 (>600 A)
Core jaw diameter	: 30mm
Dimensions, mass	: 50mm (W) x 136mm (H) x 26mm (D), 90g
Accessories	: 1 no. Carrying case; 1 no. strap

9. Digital Tan Delta Equipment

The digital Tan delta Equipment shall be capable of determining impedance and dielectric losses (C,L,DF TAN (D), PF COS(PHI), QF ETC) of high- voltage equipment and Liquid or solid insulation (on products like VFD motors, Transformers, etc. which are regularly manufactured at BHEL Bhopal Plant) . The supplier shall visit BHEL Bhopal Plant for detailed interactions if required.

The equipment construction shall permit field operation as well as factory operation. The equipment shall conform to the following specifications:

- The user interface shall be based on windows and TFT Display.
- The software functionality shall include but not limited to:
 - Automatic test object temperature correction,
 - Programmable test sequences with pass/ fail limits,
 - graphical results presentation ,trending .
- Standard interface like Ethernet, USB.
- Measurement setting, test data saving in XML format.
- Record following values but not limited to:
 - Capacitance and Inductance
 - Dissipation Factor $\tan \delta$ 1 and Power Factor $\cos \phi$ 1
 - Quality Factor
 - Equivalent series/parallel Impedances
 - Power respectively Losses
 - Current and Voltage
 - Frequency
 - Temp. Correction Factor
 - Test Connection Mode and all Settings
- Signal analysis capabilities like
 - Spectrum Analyser, Digital Scope and Data Logger.

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- Advanced interference suppression to ensure accurate measurement at local power-line frequency

The minimum accuracies shall be as per following table. Vendor may indicate in his compliance statement if the offered parameters are better.

Sl.no.	description	Range	Resolution	Minimum Accuracy	rem
1	Dissipation Factor (tan δ) 1	0 .. 100	0.0001	± 0.5 % rdg ± 0.0001	
2		(0 .. 10000%)	-0.01%	(± 0.5 % rdg ± 0.01 %)	
3	Power Factor (cos ϕ) 1	0 .. 1	0.0001	± 0.5 % rdg ± 0.0001	
4		(0 .. 100%)	-0.01%	(± 0.5 % rdg ± 0.01 %)	
5	Quality Factor 1	0.01 .. 10000	0.0001	± 0.5 % rdg ± 0.0001	
6	Capacitance 2	.01 pF	0.01 pF	± 0.05 % rdg ± 0.3 pF	
7	Inductance 2	.1000 kH	0.1 mH	± 0.1 % rdg ± 3 mH	
8	Test Voltage	Up to 20KV	1 V	± 0.3 % rdg ± 1 V	
9	Test Current INPUT A & INPUT B	20uA.. 15 A	0.1 uA	± 0.3 % rdg ± 1 uA	
10	Test Current INPUT Cn external	20uA .. 300 mA	0.1 uA	± 0.3 % rdg ± 1 uA	
11	Test Frequency	15 .. 1000 Hz	0.01 Hz	± 0.1 % rdg ± 0.1 Hz	
12	Apparent Power S	.1 MVA	0.1 mVA	± 0.8 % rdg ± 1 mVA	
13	Real Power P	.1 MW	0.1 mW	± 0.8 % rdg ± 1 mW	
14	Reactive Power Q	.1 Mvar	0.1 mvar	± 0.8 % rdg ± 1 mvar	
15	Operating Temperature	-10 .. 50°C			
16	Storage Temperature	-20 .. 70°C			
17	Humidity	5 ..95 % r.h			
18	Protection classes,	IP54			

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Sl.no.	description	Range	Resolution	Minimum Accuracy	remark
19	Standards	IEC 61010, CE mark, general IEC 61326-1, IEC 61000-4-X, 61000-3-X, EN 55011, ANSI/IEEE C37.90			
20	Safety Specification	VDE 0411/part 1a , IEC/EN 61010-1:2002			
21	Supply	115VAC / 230 VAC selectable, 250VA, 50 / 60 Hz, PFC			
22	Measuring Time	0.3 sec / measurement @ averaging = 1			
23	Minimum Interfaces	Ethernet 4, RS232 4, USB, Firewire, Mouse (PS2), Keyboard (PS2)			
24	Minimum Data Formats	XML, CSV			

Note:

- 1) **Functional/ operational Demonstration of equipment at customer place (BHEL- Bhopal) will be in the scope of vendor.**
- 2) **The Tan-delta Testing set shall be suitable for testing upto 20KV. In case the main testing is not capable upto 20kV, separate HV supply unit may be provided but the system must be integrated as single unit and the operator software must support the external HV set.**

10. Temperature data logger (RTD) with ambient temperature feature

- Standalone, compact, mobile, head less system (Works even without display)
- Min 16-bit resolution or better; 50/60 Hz noise rejection
- NIST-traceable calibration certificate for guaranteed accuracy
- Up to 400 S/s sampling rate
- 3 and 4-wire RTDs; built-in excitation and automatic detection
- RTD Channel : 28 Nos
- Thermocouple Channel : 6 Nos

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- Built-in Ethernet interface
- Touch Screen display (in case display is not built-in separate laptop along with necessary software and other hardware like switch etc to make the system complete may be quoted)

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11. Phase Sequence Meter

- Nominal Line voltage indication: 25 V to 690 V (+- 0.5%)
- Nominal Line frequency indication: 15 Hz to 100 Hz (+-0.1 Hz)
- Phase Sequence display feature
- Indication of errors for asymmetries and missing phases
- Operating Temperature: -10 degree Celsius to +50 degree Celsius
- Equipments to be provided along with meter
- no. plug-on measurement cables with contact protected plugs; 3 no. test probes for attachment to contact protected plugs; 1 no. alligator clip for attachment to contact protected plugs; 4 no. batteries; 1 no operating instructions; 1 no carrying case

12. Hand-held infrared thermometer

SI No.	Specifications	Description
1	Backlit display for use in poorly lit areas	Yes
2	Holds temperature readings	Yes
3	Range	-32 to 760°C (-25 to 1400° F)
4	MIN/MAX/AVG	All
5	Data logging	Yes
6	Distance to spot ratio	50:1
7	Hi-lo Alarm	Yes
8	Optional RTD probe (Contact temperature measurement)	Yes
9	Emissivity	Digitally adjustable (from 0.1 to 1.0 by 0.01)
10	Measurement Accuracy	-32 to -26°C (-25 to -15°F); ±3°C (±5°F) -26 to -18°C (-15 to 0°F); ±2.5°C (±4°F) -18 to 23°C (-0 to 73°F); ±2°C (±3°F) For targets above 23°C (73°F): ±1% of reading or ±1°C (±2°F), whichever is greater

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13. Non contact laser beam tachometer

Display	: 5 digits, 10mm (0.4") LCD
Sampling Time	: 1 sec. (over 60 RPM)
Test Range	: Auto ranging
Range I	: 5-999.9 RPM
Range II	: 1000-99,999 RPM
Basic Accuracy	: $\pm(0.05\% \text{ rdg} + 1 \text{ dgt})$
Resolution	: 0.1 RPM (5-999.9 RPM) 1 RPM (above 1000 RPM)
Memory	: Last value, Max value, Min value
Detecting Distance	: 50 to 500 mm (Typical)
Operating Temp	: 0-50° C
Power Consumption	: DC 153 mA
Battery	: 4 x 1.5 V AA Battery
Size	: 190 mm x 72 mm x 37 mm
Weight	: 235 gms including batteries
Accessories	: Carrying case, Instruction Manual & 2 pcs of Reflecting Tape (350 mm)

14. Digital Pulse Encoder with Coupling:

The scope includes the supply of 20 Nos. torsionally rigid flexible couplings.

1.0 All the components of the equipment covered by this specification shall be designed , manufactured and tested in accordance with latest relevant DIN/VDE standards.

2.0 Detailed Specifications are as below:-

Type (Incremental encoder)

- a.) No. of pulses per revolution : 600 direct symmetrical square wave pulses
- b.) Max rotational speed : up to 3600 rpm

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- c.) Mounting arrangement : foot and flange mounting
- d.) Control supply : 12 V DC regulated, 120mA maximum.
- e.) Pulse amplitude : Approximately equal to DC supply voltage.
- f.) Enclosure : IP 55 or IP 65
- g.) Connection type : Terminal box with screw type
terminal setup suitable for 1.5 Sq.mm cables.
- h.) Required outputs : a) Dual pulse trains 90 degree phase shifted
(Suitable for max. Loading of 50mA.) b) 1 marker pulse (one per revolution)
- i.) Square wave displacement : less than 10 degrees electrical up to 50KHz
- j.) Mark to space ratio : 1 : 1 +/-5% each period
- k.) Shock proofing : standard version
- l.) Vibration proofing : 20 g (0-2000 Hz mechanical oscillation)
- m.) Resistance to sustained short circuits : Required
- n.) Painting : Shade RAL 7030 (Light grey)
- o.) Over speed setting : 10% more than mentioned maximum speed.

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15. LARGE VIDEO SCREEN:

The supply of Large Video Screen includes the following Items:

Sl. No.	Description	Qty	Make
1	LARGE VIDEO SCREEN	3 set	Panasonic/ Mitsubishi/Toshiba/ reputed.
2.	CCTV Cameras system	10 set	Panasonic/ Mitsubishi/Toshiba/ reputed
3.	Installation at BHEL-Bhopal	1 Lot	

Note: The scope includes all cabling required and installation & commissioning at BHEL, Bhopal. Supplier must consider all necessary cables & Connectors as per site requirement. The CCTV cameras have to be installed at test bed Areas. The vendors are advised to visit BHEL-Bhopal to assess the requirement of customer. The supplier must furnish installation drawing for Purchaser's approval. Functional demonstration of all Items at site to be considered as acceptance criteria.

Technical Specifications

Large Video Screen:

Sl. No	Description	Specifications
1	Screen Size of LVS, Requirements of Display on Cube And Configuration	3 Nos. 67" diagonal LVS with wide viewing angle, high contrast and 1400x1050 pixels resolution each, to be mounted on covered stand / mount. with associated Rear Projection module / engine with dual/redundant lamps. Screen should be such that the light is distributed uniformly while maintaining a high contrast. Screen to be non-reflecting and shall be designed for continuous viewing under normal room ambient lighting without any need to darken the room. Screens should be such that brightness in center and at edges of screen is uniform and there should be no difference in quality of picture at center and edges. Screen should be flicker free and there should be no screen burn in due to prolonged display of same information for a long time. Total of 4 Cubes to be mounted seamlessly in a single tier with provision for adding one on either side as well as on top of each other. Mounts to be fully covered.
2	Resolution	1400 x 1050 or better for each screen.
3	Cables	Set of Display extender Cables to be laid through suitable conduits and be minimum 15m length to be provided for connecting 4 Operator Workstations to LVS on 1 to 1 basis with required video splitters.

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4	Lamp Life	Min 9000 hours. Lamps to be easily replaceable and Power switch to be provided for isolation during lamp replacement.
5	Modularity	Graphics wall expansion, horizontally or vertically to a matrix of minimum 2 x 3 should be possible (2 rows of 3 LVS each).
6	Seam Between the screens	Seamless <= 0.7mm(gap to be indicated by vendor)
7	No. of Colors	True colors
8	Brightness uniformity	>90%
9	Type of projector	DLP
10	Projection / Operation	Rear Projection / 24 x 7 (Confirm suitability of model offered for 24x7)
11	Operating temperature	180 C to 250 C
12	Power supply	230V + 15% AC / 50Hz
13	Type of video wall	Non-Reflecting and suitable for Control
14	Distance control desk-LVS	Around 6-8 meters
15	FAILURE	It should be ensured that failure of any single component should not result in loss of more than one LVS Display Unit. Offer liable for rejection if this clause is not met.
16	Half Gain	V & H: Better than +/- 350
17	Brightness	160 cd/m2
18	SPARES	6 Nos. Lamps

CCTV Camera:

CCTV system should be designed such as to cover the normal views of BHEL- Bhopal LEM & IMM Test bed areas for monitoring from control room located at both LEM and IMM test bed areas separately. High end cameras with Day/Night features to be installed for Indoor applications, these cameras shall be IR Compatible to enhance night vision. The supply and installment of IR lamps with cameras will be in scope of Supplier. The fixed dome cameras shall necessarily be of Vari-focal / fixed lens as per detailed specifications. Day/Night Cameras with built in zoom lenses shall be provided for select indoor/outdoor locations. Also the systems should utilize only industry standard protocol. The output of these CCTV cameras will be given to a Large Video Screen, located at control room, which will be capable to display the Pictures or videos as per camera output.

Key Features:

- True Day & Night
- Real color picture through ATW
- Automatic Back Light Compensation

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- Fixed Vari-focal Lens Support
- Camera picture mode change with built-in CDS sensor
- 8 step Shutter speed control.

Sl. No	Description	Specification
1	Pick-up Device	1/3" Color CCD
2.	Video Output	Composite 1.0Vp-p, 75 ohm
3.	Picture Elements	PAL: 795(H) X 596(V)
4.	Sync. System	Internal
5.	Horizontal Resolution	550 TV Lines
6.	Minimum Illumination	0.04 lx (F1.2, 30 IRE, without LED, B/W)
7.	Lens Type Fixed Lens	3.8mm / 6.0mm Vari- focal Lens
8.	Electronic Shutter	PAL : 1/50 ~ 1/100k
9.	Signal-to-Noise Ratio	More than 48dB (AGC Off)
10.	AGC (Automatic Gain Control)	ON / OFF selectable
11.	White Balance	Auto (Dip switch Select AUTO/Manual)
12.	BLC	ON / OFF selectable
13.	Power Requirements	230V AC,50Hz
14.	Video out	BNC
15.	Operating Temperature	10°C to 55°C
16.	Humidity	Approx. 95% RH (non-condensing)
17.	Certification	FCC, CE

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16. LCD PROJECTOR AND ACCESSORIES:

The Supply of LCD Projector and accessories includes the following Items:

Sl. No.	Description	Qty.	Remarks
1	Multimedia LCD projector with ceiling mounting and cables for all points	2 set	
2	Document camera	2 set	
3	Ceiling Mounting Kit	2 set	
4	White marker board with caster wheel assembly, magnetic duster , Magnetic Button Holder and pen and pen holder	2 set	
5	Fixed Frame Screen	2 set	
6	Cables/ Connectors. (As per site requirement)	1 Lot	
7	Installation at BHEL-Bhopal	1 Lot	

Specifications of Multimedia LCD Projector:

S. No.	Features	Detailed Specifications
1	Resolution	1024*768 XGA
2	Screen size throw distance	Throw distance corresponding to a screen of 3 meter diagonal: recommended screen size 6'x8', 8'x10'
3	Aspect ratio	4:3
4	Computer compatibility	VGA/SVGA/XGA/SXGA
5	Video compatibility	PAL/SECAM/NTSC
6	Projection lamp	180 W Specify wattages under normal and eco mode. Any dip in brightness with respect to ageing to be indicated.
7	Lamp life	2000 hrs minimum. If the lamp life is less than 2000 hrs, an additional lamp will be provided without additional cost in the offer to achieve a lamp life of 2000 hrs.
8	Lamp hour counter	Must be provided.
9	Brightness	2000 ANSI lumens or higher
10	Audio system	1W mono sound or higher.

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11	Zoom/ focusing	Manual zoom and focus. 1.12 min focus.
12	Remote control	Remote control unit for PC with mouse function to move slides shall be a standard feature.
13	Terminal ports with connectors.	2 nos. RGB In/Out, Audio in, S- video, USB-port, RGB Out with splitter is to be provided.
14	Power consumption	250W max.
15	Contrast ratio	400:1
16	Power supply	230V +/- 5% ,50Hz.
17	Operating conditions	10 to 40 degree C,80% RH
18	Distortion free images	Automatic key stone correction and manual also to be provided.
19	Quietness	Max.32dB sound.
20	Warranty	One year warranty will cover all the parts and labor

The projector to have the following addition features:

- i. Two PCs should be connectable to enable any presentation to be given from either of the systems without disturbing the other connections.
- ii. The scope includes all cabling required and installation & commissioning at BHEL, Bhopal. Supplier must consider all necessary cables & Connectors as per site requirement. If necessary the supplier may send their representative to BHEL, Bhopal to assess the requirement. The Conference Room size given is Indicative. The supplier must furnish installation drawing for Purchaser's approval. Functional demonstration of all Items at site to be considered as acceptance criteria.
- iii. The projector must be connectable to VCD or DVD player or digital camcorder or digital camera and computer.
- iv. The projector will be ceiling mounted and hence all ports and cable points including the USB port has to be connectable at the lower level.
- v. The supply will include the ceiling mounting kit with video and computer wiring.
- vi. Two nos. of Laser pointers also will also be provided.

Specifications of Document camera:

Video document camera with digital zoom ,Digital focus ,Auto exposure , 1/4 " color CCD camera , 765 x 596 pixels,440 TV lines ,PAN/TILT mode ,Negative/Positive mode , Mono/color mode, Video input and Remote control, Projecting Opaque materials ,3D Objects ,Books, Photographs and documents.

White marker board:

Caster wheel mounted 4'x 6' size marker board. The board shall be of magnetic ceramic steel. The board will be mounted on moveable stand with locking wheels of good quality.

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Design & fabrication shall be as per standard catalogues/products available in domestic /international market.

Specifications for Framed Screen:

SL. No.	Description	Detailed Specifications
1	Size	250x190cm (300x225cm Optional)
2	Aspect ratio	4:3
3	Frame material	Black epoxy and powder coated cast-aluminum
4	Mounting	Wall mounting type
5	Properties	Micro perforated fabric for acoustical transparency. Fabric shall be stretched perfectly flat to the frame and shall permit broad light dispersion & spectral uniformity for high resolution data projection.
6	Certification	flame retardant certification for fabric

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17. Noise Analyzer :

Display	: 3 1/2 digits liquid large LCD display, (1999 counts)
Low Battery Indication	: Replace the battery when display shows "+ -"
Resolution	: 0.1 dB.
Frequency Range	: 20 Hz- 8 KHz
Calibration	: Internal calibration should be available.
Sampling Rate	: 2.5 times per second
Microphone	: ½ inch Condenser microphone
Accuracy	: ± 1.5 dB
Level Range	: LO: 30~80 dB; Med 50 ~ 100 dB; Hi 80 ~ 130 dB
Analog AC output	: Output voltage : 1Vrms (at full scale) : Output impedance : Approx. 50Ω
Analog DC output	: Output voltage : 10 mV/dB : Output impedance : Approx. 100Ω
Dynamic Range	: 50 to 130 dB
Communication Interface	: RS-232, Ethernet Interface.
Power Supply	: Standard 9V DC battery
DC Adaptor Socket	: 9V (8~13V, MAX), supply current >30mA, Adaptor to be used
Dimensions	: 280 mm (L) X 80 mm (W) X 32 mm (H)
Weight	: approx. 300g (including battery)
Accessories	: Instructions manual, Carrying Case, Screw driver x 1 pc, 3.5Ø plug x 1 pc, 9 V battery x 1 pc

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18. AC HV KIT

AC HV Kit is required for the HV test of electrical machines and its components at various stages to check insulation quality/healthiness. 2 Numbers ACHV testers to the following specifications are required to cater the testing of motors, generators and its accessories.

- 1.0 Operating Voltage : 0-415, 50Hz, AC
- 2.0 Output Voltage : 0 to 17.5KV and 0 to 35 KV AC continuously variable.
- 3.0 Capacity : 1.5 A on HV side
25 KVA in 0 to 17.5 KV range
50 KVA in 0 to 35 KV range
- 4.0 Duty cycle : 50 %
- 5.0 Overall accuracy : $\pm 1.5\%$ or better.
- 6.0 The equipment should be preferably in two or three main units as described below.

6.1 The control and metering panel: This should consist of main input fuses, MCB, contactor fuses; supply indication lamps, push buttons, timers, tripping circuits, meters etc housed in a robust cabinet with adequate ventilation and should have good aesthetic appearance. Digital meters of reputed make for indication as well as for measurement are preferred over analog. The cables/wiring to be terminated on suitable terminal blocks with crimped lugs and ferrule numbers as shown in drawing. Gland plates should be provided at the bottom or rear side for cables entry. The instruments for indications & measurement include followings:

Voltmeter: For primary voltage
Ammeter : For primary current
KV Meter: For output voltage measurement
Ammeter : For leakage in milliamps and amps
Timer : For presetting hold time

6.2 High Voltage Transformer: Oil cooled step up transformer specifically designed to cater HV breakdown applications.

6.2.1 Core: the core of the transformer will be of high grade CRGO steel of M4, M3 or M2 H grade material only.

6.2.2 Coils: the coils will be made of 99.99%pure electrolytic copper conductor with suitable insulation between turns and layers. The primary and secondary coils will be of round shapes so as to withstand mechanical stress during short circuit and during normal operation.

6.2.3 Wiring: The wiring will be carried out with suitable cross section multi strand copper conductor. The cable should be terminated with ferrule and crimped lugs on both ends. The bunch of wire be neatly laid out and secured to the body cabinet with button tape.

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6.2.4 HV point to be brought out with suitable porcelain insulator and should have isolated LV point brought out on the top of body to assist tan delta measurement with our existing equipment.

6.3 Continuously Variable Auto Transformer: Rated to operate on 0-415 Volts, 50Hz, 90 amps continuous, 160% current loading for 2 hours. This unit should be dry type fitted with all accessories and should have standard features.

7.0 Salient features

7.1 A zero start protection shall be built into the system, which will not allow the system to be switched on until & unless the system is set at zero KV output.

7.2 Leakage current setting (20% to 90% of maximum value) through a potentiometer should be provided on the control and metering panel.

7.3 Auto discharge to earth for any residual voltage of the set or the specimen after the set is switched off and on tripping case.

7.4 Equipment to be supplied with all desirable safety features ensuring SAFE OPERATION of the equipment & safety of the personnel.

8.0 General:

8.1 Supplier to submit following along with the offer:

1.0 Circuit/schematic of the equipment

2.0 Detailed BOM with rating/quantity & make of various components.

3.0 OGA drawings with weight of the equipment unit separately.

4.0 4 sets of the O & M manual along with drawings etc will be supplied along with the equipment

5.0 The equipment will be inspected at the supplier's works before dispatch.

6.0 Spare of output measurement meters (KV Meter & leakage amps meter- one number each) to be supplied along with the equipment.

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SECTION IV

INSPECTION & TESTING

Supplier to submit manufacturing / testing QAP for approval. Items offered shall be duly type tested at national laboratories as per latest relevant Indian/International standards. If any type test is not carried out, supplier shall carry out the same at his own cost. All items shall be offered for customer/BHEL inspection. All routine tests/ acceptance tests as per relevant Indian/International standards have to be conducted during inspection. The following tests shall be performed by the supplier on the panel.

SI No.	Name of Test	Inspection type Type Routine	Test Method	Remarks
1	Visual Inspection	B, C	Check for overall dimensions, general arrangements, Painting, rating, make etc.	
2	Degree of protection	A	Check for degree of protection	
3	Routine Test	B,C		

- A - Manufacturer's test certificates would be furnished
- B - Test to be conducted in presence of BHEL representative
- C - Test to be conducted in the presence of customer

4.1 Type test and internal test certificates shall be furnished before inspection.

4.2 BHEL Quality Assurance Plan as per Annexure –I is enclosed for reference. Supplier shall submit the test & Inspection procedure along with QAP immediately along with the offer.

SECTION V

DOCUMENTATION

- 1) Vendors should submit the point wise technical compliance sheet along with their offer.
- 2) Please note that initially two set of documents to be provided for BHEL approval and then after BHEL approval only the documents shall be multiplied (8 Copies each).
- 3) Catalogues / manuals for bought out items shall be provided by the supplier (8 Copies).
- 4) The softcopy of Manuals /catalogs also to be supplied.
- 5) Final payment is subjected to furnishing the complete documentation in required volumes in required number of sets.

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SECTION V – PRICE FORMAT


Sl. No.	Description	Qty.	Unit Price	Total Price	Remarks
1.	Megger 10KV	5 Nos.			
2.	Megger 5 KV	2 Nos.			
3.	LCR Meter	2 Nos.			
4.	Micro Ohm meter	6 Nos.			
5.	Hand megger	14 Nos.			
6.	Digital Multimeter	14 Nos.			
7.	Analog Voltmeter	2 Nos.			
8.	Clamp meter	4 Nos.			
9.	(A). Digital Tan Delta equipment This shall include all necessary hardware/component to make the system complete as per the specification. The vendor shall furnish BOM in the Technical offer.	4 set			
	(B).Functional/ operational demonstration of Item Sl. No. 9 at BHEL Bhopal.	1 lot			
10.	Temperature data logger (RTD) with ambient temperature feature This shall include all necessary hardware/component to make the system complete as per the specification. The vendor shall furnish BOM in the Technical offer.	2 set			
11.	Phase Sequence Indicator	3 Nos.			
12.	Hand held Infrared Thermometer	8 Nos.			
13.	Laser Beam Tachometer	8 Nos.			
14.	(A). Digital Pulse Encoder	14 Nos.			
	(B). Torsionally Rigid flexible couplings	20 Nos.			

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15.	A. Large Video Screen with accessories This shall include all necessary hardware/component to make the system complete as per the specification. The vendor shall furnish BOM in the Technical offer.	3 Set			
	B. CCTV Cameras system	10 Set			
	C. Installation/ commissioning of Item Sl. No.15 at BHEL Bhopal.	1 lot			
16.	A. LCD Projector & Accessories This shall include all necessary hardware/component to make the system complete as per the specification. The vendor shall furnish BOM in the Technical offer.	2 Set			
	B. Document camera	2 set			
	C. Ceiling Mounting Kit	2 set			
	D. White marker board with caster wheel assembly, magnetic duster , Magnetic Button Holder and pen and pen holder	2 set			
	E. Fixed Frame Screen	2 set			
	F. Cables/ Connectors. (As per site requirement)	1 Lot			
	G. Installation/ commissioning of Item Sl. No.16 at BHEL Bhopal.	1 lot			
	Noise Analyzer	5 Nos.			
18.	A. AC HV Test Kit This shall include all necessary hardware/component to make the system complete as per the specification. The vendor shall furnish BOM in the Technical offer.	2 Set			
	B. Functional/ operational demonstration of Item Sl. No. 18 at BHEL Bhopal.	1 Lot			

Annexure-1

	CONTRACTOR:		BHEL-ISG Bangalore		QUALITY ASSURANCE PLAN FOR MISCELLANEOUS ITEMS								PROJECT:		BHEL Bhopal LEM and IMM test bed Modernization and Up gradation Project			
	ORDER NO. & DATE:		IS-1-08-2005										PROJECT NO:					
	SUB-CONTRACTOR:												PACKAGE NAME:					
	ORDER NO. & DATE:																	

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).							CODES FOR EXTENT OF INSPECTION, TESTS, TEST CERTIFICATES & DOCUMENTS <table style="width:100%; border-collapse: collapse;"> <tr> <th style="text-align: left;">Code</th> <th style="text-align: left;">Description</th> <th style="text-align: left;">Code</th> <th style="text-align: left;">Description</th> <th style="text-align: left;">Code</th> <th style="text-align: left;">Description</th> <th style="text-align: left;">DOCUMENTS</th> </tr> <tr> <td>1.</td> <td>Visual</td> <td>12.</td> <td>Routine Test as per IS/Other Standard defined.</td> <td>23.</td> <td>Short time rating</td> <td>D1. Approved GA</td> </tr> <tr> <td>2.</td> <td>Dimensional</td> <td>13.</td> <td>Type Tests as per IS /Other Standard defined</td> <td>24.</td> <td>Operational & Functional Checks</td> <td>D2. Approved SLD/SCHEMS Drawings</td> </tr> <tr> <td>3.</td> <td>Fitment & Alignment</td> <td>14.</td> <td>Impulse Test</td> <td>25.</td> <td>Over speed Test</td> <td>D3. Catalogs / Approved Data Sheets</td> </tr> <tr> <td>4.</td> <td>Physical Test (Sample)</td> <td>15.</td> <td>Partial Discharge Test</td> <td>26.</td> <td>Flame Proof Test</td> <td>D4. Approved BOM</td> </tr> <tr> <td>5.</td> <td>Chemical Test (Sample)</td> <td>16.</td> <td>Heat Run Test/Temp. Rise Test</td> <td>27.</td> <td>Clearance and Creepage distance</td> <td>D5. Un-priced PO Copy</td> </tr> <tr> <td>6.</td> <td>Ultrasonic Test</td> <td>17.</td> <td>Enclosure Protection Test</td> <td>28.</td> <td>Earth Resistance</td> <td>D6. Calibration Certificate of Measuring Instruments & Gauges</td> </tr> <tr> <td>7.</td> <td>Magnetic Particle Test (MPI)</td> <td>18.</td> <td>Calibration</td> <td></td> <td></td> <td></td> </tr> <tr> <td>8.</td> <td>Radiography Test</td> <td>19.</td> <td>Noise & Vibration</td> <td></td> <td></td> <td></td> </tr> <tr> <td>9.</td> <td>Dye Penetration Test</td> <td>20.</td> <td>Test Certificates for Bought out components / Equipment</td> <td></td> <td></td> <td></td> </tr> <tr> <td>10.</td> <td>Measurement of IR Value a) Before HV Test b) After HV Test</td> <td>21.</td> <td>Tank Pressure Test</td> <td></td> <td></td> <td></td> </tr> <tr> <td>11.</td> <td>High Voltage Test / Dielectric Test</td> <td>22.</td> <td>Paint Shade Verification</td> <td></td> <td></td> <td></td> </tr> </table>										Code	Description	Code	Description	Code	Description	DOCUMENTS	1.	Visual	12.	Routine Test as per IS/Other Standard defined.	23.	Short time rating	D1. Approved GA	2.	Dimensional	13.	Type Tests as per IS /Other Standard defined	24.	Operational & Functional Checks	D2. Approved SLD/SCHEMS Drawings	3.	Fitment & Alignment	14.	Impulse Test	25.	Over speed Test	D3. Catalogs / Approved Data Sheets	4.	Physical Test (Sample)	15.	Partial Discharge Test	26.	Flame Proof Test	D4. Approved BOM	5.	Chemical Test (Sample)	16.	Heat Run Test/Temp. Rise Test	27.	Clearance and Creepage distance	D5. Un-priced PO Copy	6.	Ultrasonic Test	17.	Enclosure Protection Test	28.	Earth Resistance	D6. Calibration Certificate of Measuring Instruments & Gauges	7.	Magnetic Particle Test (MPI)	18.	Calibration				8.	Radiography Test	19.	Noise & Vibration				9.	Dye Penetration Test	20.	Test Certificates for Bought out components / Equipment				10.	Measurement of IR Value a) Before HV Test b) After HV Test	21.	Tank Pressure Test				11.	High Voltage Test / Dielectric Test	22.	Paint Shade Verification			
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EQUIPMENT DETAILS							INSPECTION AND TESTS							Test Cfts. And	Acceptance Criteria	Remarks
Sl. No.	Description (With equipment heading, place of use and brief specifications)	Equipment no./	Quantity		Manu- facturer's name & Address	Expected Schedule of Inspection	Raw Material and In process Stage Inspection			Final Inspection and Test By			Documents to be submitted to Inspector	Standard / IS /any other International Standard		
			No	T			MFR	BHEL	Customer	MFR	BHEL	Customer				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
1	Miscellaneous Items	As per PO Specification No: IS-1- 08- 2005/ 030	As per PO Specification No: IS-1- 08- 2005/ 030				1,2,3	1,2,3	1,2,3	1,2,4, 11& 12	1,2,4, 11& 12	1,2,4, 11& 12	D1, D3, D4,D6	APPLICABLE IS / OTHER STDS. AS PER SPECIFICATION		

For SUPPLIER										For BHEL - ISG, B'LORE									
STAMP:					Signature:					QAP NO. IS-1-08-2005/ 030					REV.: 0				
Signature:					Name:					SHEET 01 OF 01									