

PROJECT:

IIT MADRAS RESEARCH PARK-CHENNAI ,
TECHNICAL SPECIFICATION FOR IBMS
AND COMMUNICATION - NETWORKING
TENDER

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1.0 INTRODUCTION

1.1 Project Overview

Indian Institute of technical (IIT) Research Park at Chennai proposed building consisting of 5 blocks in Phase -2, i.e.

- Block -A GF +10 Floors
- Block -B GF +10 Floors
- Block -C GF +08 Floors
- Block -D Basement, GF +10 Floors
- Block -E GF +5 Floors for multilevel car parking

Refer the tender drawings for floor area details and understanding of project. The contractor suggested offering the tender after the site visit of proposed building.

1.2 Scope

The scope of work shall include Design, Supply, Installation, Testing and Commissioning & Handing over of the Integrated Building Management Systems.

The Fire safety and security systems of following have been covered in this tender as follows;

1. Automatic Fire detection and alarm system - FAS
2. Public address system for general cum emergency announcement - PAS
3. IP based Closed circuit television system - IP CCTV
4. Automatic gate management system with Boom Barriers & Tripod
5. Back bone system for Data & voice

The Integrated Building Management Systems - IBMS shall incorporate the following equipment for integrate, monitor, maintain and control the equipment:

1. Chiller plant integration
2. Air Handling Units
3. VFD & VAV Units
4. Ventilation and Exhaust System

The system should be able to provide the following integration and provide consumption report of fit out areas.

1. Energy Meter integration
2. BTU calculation via BMS logic

The system should have open integration in terms of monitoring the chiller parameters and generate necessary report via Modbus protocol.

Also the system should be able to provide the following integration and provide parameters in the IBMS system.

1. PA Integration
2. LIFT integration
3. DG Integration
4. FAS Integration
5. Water management System
6. CCTV Integration for proposed & existing building
7. Access integration

The Details scope of system shall be described under the relevant subsystems.

The work under this system shall consist of supply, installation, testing, training & handing over of all materials, equipment, hardware, software appliances and necessary labour to commission they said system, complete with all the required components strictly as per the enclosed design specifications, design details. The scope also include the supply, installation & commissioning of any material or equipment including civil works that are not specifically mentioned in the specifications and design details but are required for successful commissioning of the project.

1.3 Coordination of work with IIT

- Coordinate the work of this division with the work of all other supply items by IIT team and the incubator company and so arrange that there will be no delay in the proper installation and completion of any part or parts of each respective work wherein it may be interrelated with that of this Contract so that generally all construction work can proceed without delaying the completion of the project.
- Examine contract drawings and specifications for all other trades relating to this project, verify all governing conditions at the site, and become fully informed as to the extent and character of the work required and its relation to other work in the building. No consideration will be granted for any alleged misunderstanding of the materials to be furnished for work to be done.
- Scaled and figured dimensions with respect to the items are approximate only; sizes of equipment have been taken from typical equipment items of the class indicated. Before proceeding with work, carefully check all dimensions and sizes and assume full responsibility for the fitting-in of equipment and materials to the building and to meet architectural and structural conditions.
- Coordinate work with other disciplines. Confer with other contractors whose work might affect this installation and arrange all parts of this work and equipment in proper relation to

the work and equipment of others, with the building construction and with architectural finish so that this work will harmonize in service, appearance, and function.

- Install exposed piping to provide the maximum amount of headroom coordinated with the Architectural drawings above the finished floor. Install piping concealed in areas where hung ceilings or other furred spaces are indicated.
- Refer to the Architectural Drawings for ceiling heights, locations and types of hung ceilings and furred spaces.
- Furnish to the OEM guidelines for general construction, detailed advance information regarding all requirements related to work under other Divisions and/or Sections. Furnish sizes, accurate data, and locations of any and all pads, pits, chases, sleeves, and slots through floor slabs, walls, foundations, ceilings, roof, and other special openings required for work under this Division.

2.0 STANDARDS & REGELATIONS:

NBC	:	National Building Code of India 2005, Part - 4, Fire and Life Safety
NFPA-72	:	National fire protection academy code for fire alarm & public address system
NFPA-72	:	National fire protection academy code for fire alarm & public address system
IS-2189	:	Selection, Installation & Maintenance of Fire Detection and Alarm System.
NFPA 70	:	National Electric Code
UL	:	Underwriters Laboratories, Inc. (UL) Publication-2775
IS-694	:	Specification for PVC insulated cables for working voltages up to and including 1100V
IS-9968 (Pt-1)	:	Rubber Insulated Braided Wire
IS-1554 (Pt-1)	:	PVC Insulated Cables
EN 50130-4:1995	:	To ensure the protection of people and, property in the form of an intruder alarm system, hold-up alarm system, CCTV systems, access control systems or social alarm systems.
	:	In terms of electromagnetic compatibility is necessary to address issues of the conformity assessment of products, selection of suitable components and in particular method of installation in a specific area of deployment.
BS 5887:1980	:	Code of practice for testing of computer based Systems

BS 4808	:	Specification for low frequency cables and wire for Telecommunication
BS 6558	:	Optical fibres and cables
IEC65-WG9 65A	:	Software for computers in the application of industrial safety related Functional safety of programmable electronic systems:
IEC65-WG10	:	Generic aspects 65A (Secretariat)
IEEE802.3	:	CSMA/CD Local Area Network Protocol
IEEE 802.4	:	Token Bus Local Area Network Protocol
IEEE 802.5	:	Token Ring Local Area Network Protocol
ISO 9001:1987	:	Quality Systems: Production, Installation and Servicing Capability
ISO 9000-3	:	Guidelines for the application of ISO 9001 to development, supply and maintenance of software.
ASTM B 3-90	:	Soft or Annealed Copper Wire.
ASTM 4565	:	Cold Bend Test.
ASTM D4566-94	:	Standard Test Methods for Electrical Performance Properties of Insulations and Jackets for Telecommunications Wire & Cable.
ASTM 4565	:	Physical and Environmental Properties of Insulation and Jackets for Telecommunications Wire and Cable.
ANSI/ICEA S-90-661	:	Individually Unshielded Twisted Pair Indoor Cables.
Category 3, 5, 5e & 6	:	For Use in General Purpose and LAN Communications.
ANSI/NFPA 70 2005	:	National Electrical Code (NEC).
NFPA 90A	:	Standard for the Installation of Air Conditioning and Ventilating Systems, 2002 Edition.
NFPA 75	:	Standards for Protection of Information Technology Equipment 2003 Edition.
ANSI/TIA/EIA568B.2	:	Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted Pair Cabling Components Addendum 1 Category 6

3.0 BACK BONE & COMMUNICATION SYSTEM

All category 6 information outlets designed for termination of 4-pair balanced twisted-pair category 6 copper cables must possess the following characteristics at the minimum:

3.1 CAT 6 INFORMATION OUTLET (WORK AREA COMPONENT) SPECIFICATIONS:

1. The CAT 6 information outlets should comply fully or exceed with category 6 connecting hardware specifications for all pair combinations up to 600 MHz.
2. The lead frame design used for information outlet should have advanced pair balancing design with linear crosstalk response. It should ensure full compliance with category 6 specifications.
3. The information outlets should use strain relief mechanism to simplify and reduce installation time protecting the quality of the termination simultaneously.
4. The termination cap shall provide strain relief on the cable jacket, ensure cable twists are maintained to within 1/2" (12.7. mm) and include a wiring scheme label.
5. The information outlet should be backward compatible and should comply with the standard IEC 60603-7 for backward compatibility.
6. All outlets should be compatible with both T568A and T568B wiring options.
7. The jack shall be able to be re-terminated a minimum of 10 times and be available in multiple colours or more for colour-coding purposes.
8. They shall be universal in design, accepting 2, 3, or 4 pair modular plugs without damage to the outer jack contacts.
9. The jacks shall terminate 4 pair 23 or better AWG 100 ohm solid unshielded twisted pair cable.

3.2 UTP Cabling System

Unshielded twisted pair cabling system, TIA /EIA 568-C.2 addendum Category 6 Cabling system		
Parameter	Technical Specification	Compliance with remarks
Networks Supported	10 / 100/1000 Ethernet, 155 Mbps ATM, 1000 Mbps IEEE 802.3ab Ethernet, and Cat 6 Gigabit Ethernet	
Warranty	25-year Performance warranty; Warranty to cover Bandwidth of the specified and installed cabling system.	

Performance characteristics to be provided along with bid	Attenuation, Pair-to-pair and PS NEXT, ELFEXT and PSELFEXT, Return Loss, ACR and PS ACR for 4-connector channel	
Site Certification	Site certification to be done by OEM certified installer for 25 years and certificate to be issued.	
Conductors	23 AWG solid bare copper or better	
Insulation	Polyethylene	
Jacket	Sheath Fire retardant PVC Compound (FRPVC) Flame Rating : 60 deg. C As per UL 1685 CM	
Pair Separator	Cross-member fluted member	
Approvals	UL tested for TIA/EIA-568C.2	
	ETL verified to Cat 6 for channel	
	Zero Bit Error verified by ETL.	
ISO certification	All Quoted product and Brand should have ISO certification for manufacturing	
Operating temperature	-20 Deg. C to +60 Deg. C	
Frequency tested up to	Minimum 600 MHz	
Packing	Box of 305 meters	
Delay Skew	35ns MAX.	
Impedance	100 Ohms + / - 6 ohms, 1 to 600 MHz	
Performance characteristics to be provided along with bid	Pair-to-pair and PS NEXT, ELFEXT and PSELFEXT, Return Loss, ACR and PS ACR	
Attenuation	22.8dB/100m at 250MHz	
	29.4dB/100m at 400MHz	
	39dB/100m at 600MHz	

3.3 Patch Chords:

CAT 6 Modular Chords Specifications

1. The modular cord should be compatible with both T568A and T568B wiring schemes
2. The modular cord should have strain relief boots with a latch guard or a one-piece, tangle-free latch design to protect plug latch from snagging when pulling cords through pathways or cable managers
3. All the modular cords should be factory assembled cords made out of stranded cable and should be 100% tested to 600 MHz
4. The modular cords should be made using excellent plug-to-cable strain relief without causing pair deformation.

5. The modular cord should provide strain and bend relief mechanism to improve the plug-to-cable retention and maximum performance by preventing pair deformation, as caused by mechanical strain.
6. The modular cord boots should be coloured for additional colour-coding.
7. The modular plugs should provide long-term resistance to corrosion from humidity, extreme temperatures, and airborne contaminants.
8. The modular cord plug geometry should meet FCC 68.500 and IEC 60603-7 specifications for modular plugs.
9. The cordage and boots should be available in a wide range of colours for easy identification.
10. The Category 6 Stranded cable used to manufacture the modular patch cords should meet the specifications set forth by both ANSI/TIA/EIA-568 C clause and ISO/IEC 11801:2002.
11. The modular patch cords should have compliance to both '568 and '11801 to ensure minimal cable impedance variation and superior return loss performance.
12. All CAT6 Patch Chords shall be 2m/ 5m standard length and have a standard as recommended by the client at the time of execution.

3.4 Workstation/ Equipment patch Cords

Type	Unshielded Twisted Pair, Category 6, TIA/ EIA 568-C.2	
Parameter	Technical Specification	Compliance with remarks
Conductor	24-26 AWG stranded copper with Cross-member fluted member for Pair Separator	
Length	1 meter, 2 meter and 3 meter with RED colour	
Plug Protection	Matching coloured snag-less, boot to maintain bend radius	
Warranty	25-year component warranty	
Category	Category 6	
Plug		
Housing	Clear polycarbonate	
Terminals	Phosphor Bronze with gold plating , 50 micron" gold over nickel	
Load bar	PBT polyester	
Jacket	PVC	

Insulation	Flame Retardant Polyethylene	
End point connector	Factory standard connector	
Approvals	UL, ETL certificates.	
Material	ROHS compliant	

3.5 Patch Panel

All termination panels shall facilitate cross-connection and inter-connection using modular patch cords and shall conform to EIA standard, 19-inch relay rack mounting requirements.

3.6 CAT 6 JACK PANEL SPECIFICATIONS:

1. The jack panel specifications should meet or exceed EIA/TIA category 6 connecting hardware specifications for all pair combinations up to 600 MHz
2. The Jack Panel should be predominantly silver in colour and should be mountable directly to an EIA standard 19-inch relay rack or cabinet.
3. The Jack Panel should have Icon label holders and designation labels as part of the standard device.
4. The modular outlets should be FCC CFR 47 part 68 subpart F and IEC 60603-7 compliant and should have 50 micro inch gold plated contacts.
5. The Jack Panel should be backwards compatible – can be used with modular cords for category 6e compatibility.
6. The Jack Panel should support universal wiring for both T568A and T568B termination methods.
7. The Jack Panel should incorporate shuttered jacks for superior aesthetics and dust exclusion when not equipped with patch cords.
8. The Jack Panel should also have Metal rear cable manager to properly guide cables to point of termination and come with individual application and colour Icons for identification
9. The Jack Panel should support a strain relief mechanism to simplify and reduce installation time protecting the quality of the termination simultaneously. The Jack Panel should have individual jacks to allow for change-out in the event of damage to any jack- without disturbing the other jacks in the panel.
10. The jacks should have lead-frame design to ensure full compliance and consistency with category 6 specifications.

3.7 UTP JACK PANELS

Type	24-port, Unshielded Twisted Pair, Category 6, TIA / EIA 568-C.2	Compliance with remarks
Parameter	Technical Specification	
Ports	24 / 12 / 8	
Port arrangement	Keystone type. Ports must be individually replaceable with RED colour	
Category	Category 6	
Circuit Identification Scheme	Icons on each of 24-ports	
Port Identification	9mm or 12mm Labels on each of 24-ports (to be included in supply)	
Height	1 U (1.75 inches)	
Modular Jack	750 mating cycles	
Wire terminal (110 block)	200 termination cycles	
Accessories	Strain relief and bend limiting boot for cable	
Materials	ROHS compliant	
Housing	Polyphenylene oxide, 94V-0 rated	
Wiring blocks	Polycarbonate, 94V-0 rated, Spring Contact: Phosphor bronze 50m" gold	
Jack contacts	Phosphorous bronz	
Panel	Black, powder coated steel	
Approvals	UL , ETL and 3P	
Termination Pattern	TIA / EIA 568 A and B;	
Performance Characteristics to be provided along with bid	Attenuation, NEXT, PS NEXT, FEXT and Return Loss	

3.8 CONNECTING BLOCKS

- i. The connecting block shall facilitate cross-connection and/or inter-connection using jumper wire or patch cords. Voice Termination and Cross-connects
- ii. The network cabling system shall be comprised of modular connectors in support of high-speed networks and applications designed for implementation on copper cabling.
- iii. The voice patch panel shall utilize fully interchangeable and individual connector modules that mount side-by-side to facilitate quick and easy moves, adds, and changes.
- iv. The panel should be designed using a high-density patch panel saving the space in the Telco room and offering better manageability.

3.9 CABLE

3.9.1 CAT 6 CABLE SPECIFICATION

CAT 6 cable should provide significant headroom above all TIA/EIA and ISO/IEC category 6 transmission performance specifications. The cable should meet or exceed the proposed requirements of ANSI/EIA/TIA568-C Clause. Transmission Performance Specifications for 4-Pair Category 6 Cabling

Insulation: Conductor Insulation: Thermoplastic PE

Conductor: 23-24 AWG solid bare copper

Isolation Member: To maintain pair geometry before, during and after installation for optimal NEXT Loss performance

Rip Cord: Should be applied longitudinally under cable jacket

Highlights:

- It should be swept tested from 1 to 650 MHz
- Transmission performance should be verified
- It should have round jacket
- The jacket material should be lead free

PACKAGING

- 1000 ft. reel in a box or 3000 ft. reel

- Weight Thermoplastic PE Jacket – 29-lbs/1000 ft.

STANDARDS COMPLIANCE

- ISO/IEC 11801: 2002 (Category 6)
- ANSI/TIA/EIA-568 C Clause (Category 6)

ETHERNET APPLICATIONS SUPPORT

- 1000BASE-T • 100BASE-T • 10BASE-T

Should support any application designed for category 6 or lower cabling

JACKET

- Nominal Cable O.D : Thermoplastic PE Jacket – 0.222 in.
- Jacket Material: PVC

ELECTRICAL CHARACTERISTICS

DC Resistance	-	< 9.38 Ohms \square /328 ft.
DC Resistance Unbalance	-	5%
Mutual Capacitance	-	5.6nF/328 ft.
Capacitance Unbalance	-	<330 pF/328 ft.
Characteristic Impedance	-	1 \leq f \leq 100: 100 \pm 15%
	-	100 \leq f \leq 160: 100 \pm 20%
	-	160 \leq f \leq 250: 100 \pm 22%
	-	250 \leq f \leq 350: 100 \pm 25%
NVP	-	CMP – 70% CMR – 68%
LCL	-	30-10Log(f/100)dB

PHYSICAL PROPERTIES

Pulling Tension 25 lbf(max) 25 lbf(max)

	CMP	CMR
Bend Radius	-	1 in. (min)
Installation Temperature	-	-4 to 140 °F

Storage Temperature	-	-4 to 167 °F	-30 to 167 °F
Operating Temperature	-	-4 to 140 °F	-30 to 140 °F

3.10 OPTICAL FIBRE PRODUCT SPECIFICATIONS

In addition to meeting the specifications outlined in ANSI/TIA/EIA-568-C 2 and ISO/IEC 11801:2000 Ed2.0, the requirements in this section must also be met for all applicable optical fibre products as listed below.

All optical fibre connectors shall meet the following characteristics:

3.11 FIBRE ST AND SC CONNECTORS

1. The ST and SC single mode connectors should support a variety of termination methods...epoxy, anaerobic adhesive etc.
2. The adhesive system should not have a longer cure time (preferably 30 – seconds or less).
3. All connectors should utilize precision zirconia ceramic ferrules and include protective dust caps.
4. The precision zirconia ceramic ferrules utilized in ST and SC multi mode connectors should enable a typical insertion loss performance of 0.10 dB and 30 dB, typical return loss, using a manual polishing method.
5. The Single mode connectors should typically achieve 0.20 dB insertion loss and 55 dB return loss using a simple manual polishing method.
6. The SC Duplex, SC Connector should be UL 94V-0 compliant and should allows each connector to be removed individually. The duplex connector should give access to user so that an individual connector can be removed and re-terminated without disturbing the adjacent connector
7. The ST coupling nut should be metallic to assure optimum durability and engagement. The ramps should be radial to facilitate mating/de-mating
8. The SC outer housing and connector body should be colour coded in accordance with ANSI/TIA/EIA-568-C.Clause and ISO/IEC 11801:2002.
9. The strain and bend relief boots should be provide to improve plug-to-cable retention and to maximize performance by preventing fibre deformation caused by mechanical strain.
10. The SC simplex connectors should employ an outer housing that is colour-coded in accordance with TIA/EIA-568-C clause and ISO/IEC 11801: Edition 2000 requirements (beige for multimode and blue for single mode).

6.12 Single Mode Fibre Optic Cable

Parameter	Technical Specification	Compliance with remarks
Make and Model		
Cable Type	24 core, Single mode, Tight Buffer cable is constructed for outdoor application with tight buffer tubes on each Fibre fibre and Fire retardant orange PVC jacket protects the cable from mechanical stress	
Fibre type	8.2 / 125, Laser Grade, Fibres are strengthened by extruding plastic upto 1310 micron around them	
No. of cores	24 core	
@1310 nm	0.33 dB/Km	
@1550nm	0.19 dB/Km	
Coating / Cladding offset	<= 0.5 microns	
Zero Dispersion Slope	<= 0.092ps / sqmm-km	
Zero Dispersion Wavelength	1310nm< 1324nm	
Fibre core	Should be UL Listed	
Tensile rating	400N	
Maximum Crush resistance	22 N /mm	
Operating Temperature	-40 Degree C to +70 Degree C	
Min Bend	20 X Outer Diameter	
Marking	Identification marking at regular intervals of 1 meter	
Fibre Core	Raw fibre should be from world renowned sources and raw fibre marking should be visible on the OFC cable	
Approval	UL Listed	
ISO certification	All quoted product and Brand should have ISO certification for manufacturing	

6.13 Patch Cords/Pigtails

Fiber equipment cords shall possess the following characteristics:

6.14 FIBRE CABLE ASSEMBLIES & PIGTAILS

1. The fibre used for cable assemblies should meet the IEEE 802.3 10 Gigabit Ethernet Standard as well as IEC-60793-2-10 and TIA-492AAAC specifications for laser bandwidth Differential Mode Delay (DMD) specifications.
2. The assemblies should meet or exceeds all ANSI/TIA/EIA and ISO/IEC insertion loss and return loss requirements.
3. When used in a system these precision cable assemblies should be warranted for 20 years or above.
4. The fibre optic cable assemblies should meet all Telcordia and ISO/IEC specifications for ferrule end face geometry – including radius of curvature, apex offset, and spherical undercut. The compliance to these is important to ensures minimum Return Loss, thereby reducing back reflection of laser energy which could degrade transmission performance or damage transceivers
5. The fibre optic cable assemblies should be available in 1, 3, and 5 meter standard lengths. Dust caps should be included as part of the standard shipment to protect polish from dirt and damage.
6. In a duplex jumper cord the duplex coupling mechanism should offer a polarity correction mechanism, which is independent of the connectors in the coupling.
7. The connectors used in the patch cord should be colour coded as per ANSI/TIA/EIA-568-C 2.
8. It should exceed ANSI/TIA/EIA and ISO/IEC requirements for aging, exposure to humidity, temperature extremes, impact, vibration, coupling strength, and cable resistance to stress and strain Supports

6.15 Fibre Optic Pigtail

<u>Pigtails Type</u>	<u>SC-Style, Simplex SM Pigtails</u>	
Make and Model		
Operating temperature	-20 Degree C to +70 Degree C	
Durability & colour		
SM connectors	220 cycles, Blue	
Ferrules	Pre-radius Ceramic Zirconia Ferrule.	

Attenuation	Not more than 0.75 dB per mated pair	
Insertion Loss	MM:< 0.5 dB	
Standard	Meets and exceeds ITU specifications ,UL listed and 3rd Party RoHS compliant. Fully in compliance with JIS C5973 F04 Type.	
Bayonet Coupling	2.5 mm Zirconia Ferrule	

6.16 PERFORMANCE SPECIFICATIONS

	50/125µm Multimode			Single mode
	850 nm	1300 nm	1300nm*	N/A
Min. Cable Bandwidth (MHz km)	500	500	2000	N/A
Max. Insertion Loss (dB)	0.50 (0.10 Typical)			0.40 (0.10 Typical)
Min. Return Loss (Db)	30 (35 Typical)			55 (60 Typical)

- Laser Bandwidth

6.17 Fibre Optic Patch panels

<u>Fibre optic patch panel</u>	<u>19-inch, Rack mounted Fibre optic patch panel</u>	
Make and Model		
Height	1 U, 1.75 inches	

No. of fibres	24 port	
Dimensions	44 * 410 * 280 mm (H*W*D)	
Material	Complete Aluminium Alloy housing, fully powder coated	
	Splice tray. adapter plate and cable spools to be included	
	Fully cushioned splice holder containing grooves for fixing splice protective sleeves	
No. of OSP Cables for termination	Minimum 24	
Grounding	2 Nos. of earthing lugs, pre-loaded	
Cable Management rings	Front and rear cable management rings, pre-loaded	
No. of 6-port adapter plates	4 max	
Sliding	Panel cover is of slide out for easy maintenance	

6.18 Fibre Optic Adapter

<u>Fibre Optic adapter plate</u>	<u>SC-Style, SM</u>	
Make and Model		
Standard	Meets and exceed ITU specifications, UL listed and 3rd Party RoHS compliant.	

	Fully in compliance with JIS C5973 F04 Type.	
Attenuation	Max of 0.75 Db per mated pair	

6.19 Fibre Optic Patch Cord LC-SC TYPE.

<u>Fibre Optic Patch Cords</u>	<u>SM patch cord LC-SC TYPE</u>	
Make and Model		
Type	1.6mm or 3mm simplex or Duplex Zipcord.	
Outside Diameter	(Simplex): 1.6mm x 3.0mm (Duplex): 1.6mm x 3.3mm	
Minimum Cable Retention Strength	1.6mm: 11.24 lbs (50 N)	
Insertion Loss	Less than 0.5 dB for MM	

6.20 Enclosures

All interconnect centres, panels and trays (units) shall provide cross-connect, inter-connect, splicing capabilities and contain cable management for supporting and routing the fibre cables/jumpers. All the enclosures

1. Should not be bigger than one rack mount space and accommodate up to 24 ports for SC, or 24 ports for ST or FC adapters plates.
2. Should take in duplex adapter
3. Should have preloaded adapter plates with ST and SC fibre adapters in 6 and 8-port version, as well as a 24 port version for the SC, MT-RJ and LC adapters.
4. Should have blank adapter plates for future growth of the fibre infrastructure.
5. Should have six and eight port fibre adapter plates, which allow for color coding connectors.
6. Should have fibre adapter plates with snap-in installation and one-finger removal.
7. Should accommodate hybrid adapter plates for ST-to-SC or SC-to-ST connections.
8. Be modular in design with internal fibre managers that provide slack storage to comply with fibre bend radius and the recommended slack storage length.
9. Should have a snap-on front shield to be used as a labelling surface and to protect jumpers. This shield should also be relocating able to another position during termination to maintain circuit identification.
10. Should accommodate a splice tray for mechanical or fusion splices.
11. Should be available with a drawer mechanism, which allows the panel to slide forward or to the rear, and has defeat able latches to allow removal from the rack or cabinet.

6.21 Cable

In addition to meeting the applicable performance specifications, all optical fibre cable shall be appropriate for the environment in which it is installed.

6.22 Multimode Optical Fibre Cable

All horizontal multimode optical fiber cable must be a minimum of six strands of 62.5/125 or 50/125µm multimode.

Multimode fibre optical fibre cables shall meet all of the requirements delineated within the Industry Requirements except the limits for attenuation and bandwidth for cables containing 50/125 or 62.5/125 fibre shall be as noted below:

Minimum Performance Parameters for MM Qualified Cables						
Fibre	Maximum Attenuation (dB/km)		Minimum Bandwidth (MHz•km)		Guaranteed Transmission Distance (m)	
	850nm	1300nm	850nm	1300nm	850nm	1300nm
50/125	3.5	1.5	500	500	550	550
62.5/125	3.5	1.5	200	500	275	550

Attenuation: Cables shall perform in accordance with the attenuation limits as noted above when tested per ANSI/EIA/TIA-455-46, -53, -61 or -78 (as applicable).

Bandwidth: Cables shall perform in accordance with the bandwidth limits as noted above when tested per ANSI/EIA/TIA-455-51 or IEC/ISO 793-1-C2A.

Transmission Distance: The protocol pertinent to the transmission distances noted above for cables is Gigabit Ethernet per IEEE 802.3:2002.

6.23 Single mode Optical Fibre Cable

Single mode optical fiber cable shall be used for 1st and 2nd Level Backbone applications only. Single mode optical fiber cables shall meet all of the requirements delineated within the specified Industry Requirements. Attenuation and Zero Dispersion limits are noted below for convenience:

Minimum Performance Parameters for SM Cables					
Fibre	Cable Type	Maximum Attenuation (dB/km)		Zero Dispersion Wavelength (nm)	Zero Dispersion Slope (nm ² •km)
		1310nm	1550nm		
Single mode	Inside Plant	1.0	1.0	1300-1324	< 0.093

	Outside Plant	0.5	0.5		
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Attenuation: Cables shall perform in accordance with the attenuation limits as noted above when tested per ANSI/EIA/TIA-455-46, -53, -61 or -78 (as applicable).

Zero Dispersion Wavelength and Slope: Cables shall perform in accordance with the Zero Dispersion wavelength and slope limits as noted above when tested per ANSI/EIA/TIA-455-168, -169, or -175 (as applicable).

6.24 MOUNTING OPTIONS

FACE PLATE SPECIFICATION (WORK AREA COMPONENT)

1. The work area, faceplates should offer a sleek, clean appearance for mounting Outlets. The designation labels cover the mounting screws (should be included as part of the standard equipment) and provide ample circuit identification.
2. The faceplates should offer write-on circuit designation labels (as part of the standard equipment) protected by clear plastic cover concealing the mounting screws.
3. The faceplates should be available in white versions,
4. The faceplates should be UV resistant, should be made using high impact plastic to prevent color fading and to provide added durability.
5. The faceplates should include quick pressure-release designation label covers for quick, tool-less removal.
6. The information outlets should be easily snapped out from the back of faceplates making moves, adds, and changes quick and easy.
7. Faceplate should be available in 1,2,3,4,5 and six Gang

6.25 OUTDOOR CABLE INSTALLATION

All outdoor cables within the premises shall be installed along with the communicable cables in the same trench or in exclusive excavation as specified in the drawing. The installation shall be as per project cable installation specifications. All above ground cables shall be installed in cable trays attached to the pipe racks and other structures. The horizontal cable trays shall be supported suitably to ensure no sagging occurs for the entire length of the tray.

Cable shall enter the equipments, cabinets, Junction Boxes, Marshalling Boxes and other enclosures properly secured on cable trays from the ground level. The cable glands shall be according to the communication classifications.

4.0 BUILDING MANAGEMENT SYSTEM - TECHNICAL SPECIFICATION

SCOPE

The scope of this section includes design, supply, installation, testing, commissioning, and performance testing of integrated Building Management System (IBMS) as per the technical specification according with other services like HVAC, Electrical, Lifts, DG, UPS, water management etc

SL.NO	DESCRIPTION	SUPPLY SCOPE	ERECTION & COORDINATION FOR TESTING & COMMISSIONING	TESTING & COMMISSIONING
1	BMS SOFTWARE	IIT	CONTRACTOR	IIT
2	DDC CONTROLLER	IIT	CONTRACTOR	IIT
3	BTU	IIT	CONTRACTOR	IIT
4	FIELD EQUIPMENT & HMI	CONTRACTOR	CONTRACTOR	CONTRACTOR
5	ALL CABLES	CONTRACTOR	CONTRACTOR	CONTRACTOR
6	MODBUS INTERFACE	IIT	CONTRACTOR	IIT

SERVER & HUMAN MAN INTERFACE- HMI:

One PC-based microcomputer (Dell) with minimum configuration as follows: The vendor shall check the minimum hardware & software requirement of Computer. If any of the technical parameters given below is less than the minimum required for the proposed system, the vendor is responsible to propose higher version as required.

Server specifications

- The minimum hardware configuration of the servers shall be:

- 3.0 GHZ each processor (in case the offered server is RISC & EPIC based processor speed shall be at least 1.2GHz)
- Minimum 2 Processors - Quad Core Intel Xeon E5640
- 12GB Main memory (RAM).
- 80 GB SATA II hard drive
- 216 GB Auxiliary memory (Hard disk drive).
- CD R/W drive,
- 21" HD colour monitor
- Graphic adaptor cards
- Keyboard & Mouse
- Dual 10/100/1000Mbps Ethernet ports & 1 No HDMI port minimum
- One hot pluggable port for external Cartridge magnetic tape drive
- TPC/ Spec mark performance compliance
- Redundant power supply
- Redundant fan

HMI specifications

- The minimum hardware configuration of Human Machine Interface (HMI) shall be:
- 2.1 GHz processor (in case RISC & EPIC it shall be at least 1.2GHz)
- 8GB Main memory (RAM)
- 216 GB Auxiliary memory (Hard disk drive)
- 48x24x48 CD-R/W drive
- 21" TFT/LED colour monitors
- Graphic adaptor cards
- Two speakers for audible alarms with configurable tones
- Keyboard & Mouse
- Dual 10/100/1000Mbps Ethernet ports
- One hot pluggable for external Cartridge magnetic tape drive
- Parallel, serial and USB (2.0) ports to accommodate printers, mouse and other peripherals etc

FIELD EQUIPMENTS:

TEMPERATURE SENSOR

Temperature sensors for space, pipes and ducts, shall be of the Resistance Temperature detector (RTD) type or thermistors. These shall be two wire type and shall conform to the following specifications :

- 1) Immersion sensors shall be high accuracy type with a high resistance versus temperature change. The accuracy shall be at least ± 0.33 degrees F and sensitivity of at least 2 ohm/F.
- 2) Immersion sensors shall be provided with separate stainless steel thermo well. These shall be manufactured from bar stock with hydrostatic pressure rating of at least 10 kgf/cm².
- 3) The connection to the pipe shall be screwed $\frac{3}{4}$ inch NPT (M). An aluminum sleeve shall be provided to ensure proper heat transfer from the well to the sensor. Terminations to be provided on the head. Flying leads shall not be acceptable.
- 4) The sensor housing shall plug into the base so that the same can be easily removed without disturbing the wiring connections.
- 5) Duct temperature sensors shall be with rigid stem and of averaging type. These shall be suitable for duct installation.
- 6) Outdoor air temperature sensor shall be provided with a sun shield.
- 7) The sensors shall not be mounted near any heat source such as windows, electrical appliances etc.

The temperature sensors may be of any of the following types :

- 1) PT 100, PT 1000, PT 3000
- 2) NI 100, NI 1000
- 3) Balco 500.
- 4) Thermistor

TEMPERATURE AND HUMIDITY SENSOR

Space and duct humidity sensors shall be of capacitance type with an effective sensing range of 10% to 90% RH. Accuracy shall be + 3% or better. Duct mounted humidity sensors shall be provided with a sampling chamber. Wall mounted sensors shall be provided with a housing. The sensor housing shall plug into the base so that the same can be easily removed without disturbing the wiring connections. The sensors shall not be mounted near any heat source such as windows, electrical appliances etc.

FLOW METER

Water flow meters shall be Ultrasonic type. The housing shall have IP 55 protection. Vendors shall have to get their design/ selection approved by the Consultant, prior to the supply.

The exact ranges to be set shall be determined by the contractor at the time of commissioning. It should be possible to 'zero' the flow meter without any external instruments, with the overall accuracy of at least $\pm 1\%$ full scale.

PRESSURE TRANSMITTER FOR WATER

Pressure transmitters shall be piezo-electric type or diaphragm type. (Bourdon Tube type shall not be acceptable). Output shall be 4-20mA or 0-10V DC and the range as specified in the data sheet depending on the line pressure. Power supply shall be either 24 V AC, 24 V DC or 230 V AC. Connection shall be as per manufacturer's standards. The pressure detector shall be capable of withstanding a hydraulic test pressure of twice the working pressure. The set point shall fall within 40%-70% of the sensing range and detector shall have sensitivity such that change of 1.5% from the stabilized condition shall cause modulation of the corrective element. The sensor must be pressure compensated for a medium temperature of -10°C to 60°C with ambient ranging between 0°C to 55°C .

DIFFERENTIAL PRESSURE SWITCH FOR PIPE WORK

These shall be used to measure pressure differential across suction and discharge of pumps. The range shall be as specified in the data sheet. Switch shall be ON with increase in differential. Housing for these shall be weather proof with IP 55 protection. The pressure switch shall be capable of withstanding a hydraulic test pressure of 1.5 times the working pressure. The set point shall fall in 40-70% of the scale range and shall have differentials adjustable over 10%-30% of the scale range. The switches shall be provided with site adjustable scale and with 2 NO/NC contacts.

DIFFERENTIAL PRESSURE SWITCH FOR AIR SYSTEMS

These shall be diaphragm operated. Switches shall be supplied with air connections permitting their use as static or differential pressure switches.

The switch shall be of differential pressure type complete with connecting tube and metal bends for connections to the duct. The housing shall be IP 54 rated. The pressure switches shall be available in minimum of 3 ranges suitable for applications like Air flow proving, dirty filter, etc. The set point shall be concealed type. The contact shall be SPDT type with 230 VAC, 1 A rating.

The switch shall be supplied suitable for wall mounting on ducts in any plane. It should be mounted in such a way that the condensation flow out of the sensing tips. Proper adaptor shall be provided for the cables.

The set point shall fall within 40%-70% of the scale range and have differentials adjustable over 10%-30% of the scale range.

The switches shall be provided with site adjustable scale and with 2 NO/NC contacts.

AIR FLOW SWITCHES

Air flow switches shall be selected for the correct air velocity, duct size and mounting attitude. If any special atmospheric conditions are detailed in the Schedule of Quantity the parts of the switches shall be suitably coated or made to withstand such conditions. These shall be suitable for mounting in any plane. Output shall be 2 NO/NC potential free. Site adjustable scale shall also be provided

AIR PRESSURE SENSOR

The pressure sensor shall be differential type. The construction shall be spring loaded diaphragm type. The movement of the membrane in relation to the pressure should be converted by an inductive electromagnet coupling which would give an output suitable for the controller. The pressure sensor shall be in a housing having IP 54 ratings in accordance with IEC 529. Suitable mounting arrangement shall be available on the sensor. The sensor shall come complete with the PVC tubes & probes.

WATER FLOW SWITCH

These shall be paddle type and suitable for the type of liquid flowing in the line. Output shall be 2NO/2NC potential free.

TRANSDUCERS FOR ELECTRICAL SERVICES

Electrical transducers shall be integrated electronic type and rack mounted on the field. These shall work on 230 V supply with the output being standard type i.e. 4-20 mA, 0- 10 Volts etc.

Power factor, Voltage, Current, Frequency and Kilowatt transducers shall have standard output signal for measurement for the specified variable.

Kilowatt-Hour metering(if any) shall be poly-phase, three- element with current transformer (CT) operated type. The metering shall feature high accuracy with no more than +/- 1% error over the expected load range. The coils shall be totally encapsulated against high impulse levels.

LEVEL SWITCH

The level switches shall have to meet the following requirement :

Type	:	Float Type/Capacitance /Conductivity type
Mounting	:	To suit application.
Connection	:	Flanged ANSI 150 lbs RF Carbon steel
Float material	:	316 SS
Stem Material	:	316 SS
Output	:	2 NO, 2 NC potential free
Switch Enclosure	:	IP 55

INSTALLATION:

- A. All equipment shall be installed in a neat and professional manner.
- B. Cabling shall be neatly routed and bundled along the equipment cabinet sides. Cabling shall not hang or cross in the racks. Cabling shall be run at right angles to the rack.
- C. Cable connectors shall be the mating connector to the premises on the equipment. Adapters will not be accepted to interface a cable connector to the equipment jack.
- D. Installer shall follow factory installation guidelines for pulling tension and bending radii for all cables.
- E. Cables shall be one continuous piece between each system device.
- F. Dress cables routed to equipment with sufficient slack to allow for service of equipment and avoid strain on connections or cable.
- G. Use wire ties for supporting low voltage cable runs concealed above ceilings. Do not run cables loose on ceiling tiles. Cables shall be grouped in bundles and support from structure above.
- H. All equipment power and signal wiring shall conform to the National Electrical Code and to applicable local codes.
- I. All equipment and devices shall be securely mounted to a permanent cabinet or panel. No device shall be supported by its wires or cables.
- J. Terminate each cable to premises blocks in sequence, including grounding drain wires.
- K. Premises locations and cables shall be labelled, legibly, with permanent embossed labels or by labelling pen. Identification shall be labelled on As-built Drawings.

TESTING

- A. All system functions shall be tested for proper performance. All test results shall be documented for inclusion in the as-built manuals.
- B. Complete system programming shall be done by a person who has received factory training in the programming of the installed system.
- C. The system shall be tested for intelligibility in every room after all installation and testing is finalized. The intelligibility tests shall follow NFPA 70 and IEC 60849 or BS 5839 Part 8.

TRAINING

- Provide a minimum of four hours of on-site in-service training in the operation of the Public Address/Voice Evacuation System. The training shall be provided by a training specialist specifically trained in the operation, programming and features of the installed system.

Note: BMS - IO controllers, Software & Modbus interface will be given by IIT.

TECHNICAL DATA SUBMITTAL

A. CENTRAL CONTROL STATION EQUIPMENT

1. CENTRAL PROCESSING UNIT

- a. Manufacturer :

- b. Country of Origin :

- c. Local Agent :

- d. Model :

- e. Processor :

- f. Minimum ROM (K Bytes) :

- g. Clock Frequency :

- h. RAM Capacity Installed :

- i. Ram Capacity Expandable :
- j. Cache Memory (K Bytes) :
- k. Hard Disk Capacity (M Bytes) :
- l. Floppy Disk Drive Capacity (M Bytes) :
- m. Floppy Disk Drive Size :
- n. Split Screen Capacity :
- o. Dimension Overall (mm) :
- p. Ambient Operating Temperature (deg.C) :
- q. Ambient Operating R.H (%) :
- r. Power Supply :
- s. Power Consumption (Watts) :
- t. UL Listing :

2. COLOUR GRAPHIC MONITOR

a. Manufacturer :

b. Country of Origin :

c. Local Agent :

d. Type :

e. Model :

f. Screen Size :

g. Resolution :

h. Input Signal Level :

i. Colours :

j. Dimension (mm) :

k. Power Supply :

l. Power Consumption (Watts) :

m. Ambient Operating Temperature (deg.C) :

n. Ambient Operating R.H (%) :

o. RAM Capacity :

3. **KEYBOARD**

a. Manufacturer :

b. Country of Origin :

c. Local Agent :

d. Type :

e. Model :

f. No. of Keys :

g. Type of Keys :

h. Make of Keys :

4. **MOUSE**

a. Manufacturer :

b. Country of Origin :

c. Local Agent :

d. Type :

e. Model :

5. **REPORT PRINTER**

a. Manufacturer :

b. Country of Origin :

c. Local Agent :

d. Type :

e. Model :

f. Print Speed :

g. Number of Columns :

h. Number of Pins :

i. Paper Feed :

j. Dimension (mm) :

k. Power Supply :

l. Power Consumption (watts) :

6. **ALARM PRINTER**

a. Manufacturer :

b. Country of Origin :

c. Local Agent :

d. Type :

e. Model :

f. Print Speed :

g. Number of Columns :

h. Number of Pins :

i. Paper Feed :

j. Dimension (mm) :

k. Power Supply :

l. Power Consumption (Watts) :

B. SENSORS CONTROLLERS, SENSORS & TRANSDUCERS

1. DDC CONTROLLER

a. Manufacturer :

b. Country of Origin :

c. Local Agent :

d. Model :

e. Micro Processor Model :

f. No. of Bits :

g. Clock Frequency :

h. RAM Memory :

i. RAM Backup Battery :

j. Battery Backup (Hrs) :

k. Transmission Rate :

l. Peer Communication :

m. Alphanumeric LCD Display :

n. Radio Interference Standards :

o. Enclosure Dimensions (mm) :

q. Power Supply :

r. Power Consumption (watts) :

s. Ambient Operating Temperature (deg.C) :

t. Ambient Operating R.H (%) :

u. Degree of protection (IP) :

2. SYSTEM INTEGRATION UNITS

a. Manufacturer :

b. Country of Origin :

c. Local Agent :

d. Model :

e. Micro Processor Model :

f. No. of Bits :

g. Clock Frequency :

h. RAM Memory :

i. RAM Backup Battery :

- j. Battery Backup (Hrs) :
- k. Transmission Rate :
- l. Peer Communication :
- m. Alphanumeric LCD Display :
- n. Radio Interference Standards :
- o. Enclosure Dimensions :
- p. Weight (Kg) :
- q. Power Supply :
- r. Power Consumption (Watts) :
- s. Ambient Operating Temperature (deg.C) :
- t. Ambient Operating R.H (%) :
- u. Degree of protection (IP) :

3. IMMERSION TEMPERATURE SENSOR

a. Manufacturer :

b. Country of Origin :

c. Local Agent :

d. Type :

e. Model :

f. Accuracy :

g. Sensor Material :

h. Temperature Coefficient :

i. Resistance Tolerance :

j. Resistance :

- k. Sensing Range :
- l. Length of Sensing Element :
- m. Ambient Operating Environment :
- n. Accessories :
- o. Degree of protection (IP) :

4. DUCT TEMPERATURE & HUMIDITY SENSOR

- a. Manufacturer :
- b. Country of Origin :
- c. Local Agent :
- d. Type :
- e. Model :

f. Accuracy :

g. Sensor Material :

h. Temperature Coefficient :

i. Resistance Tolerance :

j. Resistance :

k. Sensing Range :

l. Length of Sensing Element :

m. Ambient Operating Environment :

n. Accessories :

o. Degree of protection (IP) :

5. OUTSIDE TEMPERATURE SENSOR

- a. Manufacturer :
- b. Country of Origin :
- c. Local Agent :
- d. Type :
- e. Model :
- f. Accuracy :
- g. Sensor Material :
- h. Temperature Coefficient :
- i. Resistance Tolerance :
- j. Resistance :
- k. Sensing Range :

l. Length of Sensing Element :

m. Ambient Operating Environment :

n. Accessories :

o. Degree of protection (IP)

6. OUTSIDE TEMPERATURE & RELATIVE HUMIDITY SENSOR

a. Manufacturer :

b. Country of Origin :

c. Local Agent :

d. Type :

e. Model :

f. Sensing Range :

g. Output Signal :

h. Mounting :

i. Accuracy :

j. Time Constant :

k. Power Supply :

l. Power Consumption (Watts) :

m. Maximum Wiring :

n. Operating Ambient limits :

o. Dimensions (mm) :

p. Weight (Kg) :

q. Length Sensor (mm) :

r. Degree of Protection (IP) :

7. PRESSURE TRANSMITTER

a. Manufacturer :

b. Country of Origin :

c. Local Agent :

d. Model :

e. Pressure Sensing Element :

f. Range :

g. Temperature Compensation :

h. Repeatability :

i. Hysterisis :

j. Shock Resistance Compliance :

k. Monitoring :

l. Enclosure :

m. Supply Voltage :

n. Output Signal :

o. Degree of Protection (IP) :

8. WATER FLOW SWITCHES

a. Manufacturer :

b. Country of Origin :

c. Local Agent :

d. Type :

e. Model :

f. Body Construction Material :

g. Stem Construction Material :

h. Flapper Construction Material :

i. No. of Contacts :

j. Type of Contacts :

k. Connections :

l. Power Supply :

m. Switch Rating :

n. Degree of Protection (IP) :

9. DIFFERENTIAL PRESSURE SWITCHES FOR PUMPS

a. Manufacturer :

b. Country of Origin :

c. Local Agent :

d. Type :

e. Model :

f. Construction Material :

g. Dimensions (mm) :

h. Mounting :

i. Switch Rating :

j. Body Construction Material :

k. Sensing Element Material :

l. Fill Material :

- m. Sensing Range :
- n. Over Range Protection :
- o. Maxm. Static Pressure on one side :
- p. No. of Contacts :
- q. Type of Contacts :
- r. Power Supply :
- s. Degree of Protection (IP) :

10. DIFFERENTIAL PRESSURE SWITCHES FOR FILTERS

- a. Manufacturer :
- b. Country of origin :
- c. Local Agent :

d. Type :

e. Model :

f. Construction material :

g. Dimensions (mm) :

h. Mounting :

i. Switch Rating :

j. Body construction material :

k. Sensing element material :

l. Fill material :

m. Sensing Range :

n. Over range protection :

o. Maxm. static pressure on one side :

p. No. of Contacts :

q. Type of Contacts :

r. Power Supply :

s. Degree of protection (IP) :

11. DIFFERENTIAL PRESSURE SWITCHES FOR BLOWERS

a. Manufacturer :

b. Country of Origin :

c. Local Agent :

d. Type :

- e. Model :
- f. Construction Material :
- g. Dimensions (mm) :
- h. Mounting :
- i. Switch Rating :
- j. Body Construction Material :
- k. Sensing Element Material :
- l. Fill Material :
- m. Sensing Range :
- n. Over Range Protection :
- o. Maxm. Static Pressure on one side :

p. No. of Contacts :

q. Type of Contacts :

r. Power Supply :

s. Degree of Protection (IP) :

12. FLOW METERS

a. Manufacturer :

b. Country of Origin :

c. Local Agent :

d. Type :

e. Model :

f. Construction :

- g. Liner Material :
- h. Sensor Material :
- i. Impulse Piping Material :
- j. Manifold Material :
- k. Dimensions (mm) :
- l. Output Signal :
- m. Accuracy :
- n. Mounting Arrangement :
- o. Connection Type :
- p. Type of Flow Measuring Element :
- q. Operating Voltage :

r. Degree of Protection (IP) :

13. LEVEL SWITCHES

a. Manufacturer :

b. Country of Origin :

c. Local Agent :

d. Type :

e. Model :

f. Float Construction Material :

g. Shaft Construction Material :

h. Flange Construction Material :

i. Dimensions (mm) :

j. Mounting :

k. Type of Switch :

l. Type of Contacts :

m. No. of Contacts :

n. Power Supply :

o. Degree of Protection (IP) :

14. LEVEL TRANSMITTER

a. Manufacturer :

b. Country of Origin :

c. Local Agent :

d. Type :

e. Model :

f. Flange Construction Material :

g. Dimensions (mm) :

h. Mounting :

i. Power Supply :

j. Degree of Protection (IP) :

C. CABLES

1. SIGNAL CABLES

a. Manufacturer :

b. Country of origin :

c. Local agent :

d. Type :

e. Characteristics :

2. COMMUNICATION CABLES

a. Manufacturer :

b. Country of origin :

c. Local agent :

d. Type :

e. Characteristics :

3. LOCAL AREA NETWORK CABLE

a. Manufacturer :

b. Country of origin :

c. Local agent :

d. Type :

e. Characteristics :

10.0 LIST OF TENDER DRAWINGS:

SL NO	DESCRIPTION	DRAWING NO
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3	IBMS SYSTEM	
a	R1-IITMRP-BMS SCHEME-CONCEPT DRAWING	IIT-ZA-IBMS-012
b	R1-IITMRP-IBMS SCHEME-CONCEPT DRAWING	IIT-ZA-IBMS-013

11.0 LIST OF APPROVED MAKES

Sl. no	Material description	Vendor list
Back bone communication system		
1	Network racks	Panduit / amp / Molex /Tyco / lucent / Netrack
2	OFC & its accessories	Molex / Amp / Systemax / Tyco
3	Cat 6 cable & patch chord	Molex / Amp / Systemax / Tyco
4	Patch panels	Molex / Amp / Systemax / Tyco
5	Data sockets & face plates	Molex / Amp / Systemax / Tyco
6	PVC conduit	Avonplast / Finolex / Precision / VIP
7	Raceways & GI cable trays	Profab / Sintex / Metalam / Havel / Sadhana / obo better man
8	Multi pair cables	Fine core / Tyco / Finolex / Polycab
Building management system		
1	Human user interface unit server	Dell, HP, Lenovo
2	Monitoring station unit	Dell, HP, Samsung, Sony
3	IBMS software & Modbus interface	IIT
4	DDC controller	IIT
5	Water level switch	Siemens, Honeywell, Senix, Stevens or equivalent
6	Communication cable	Polycab, Varsha, Teleflex, universal