INDRADHANUSH GAS GRID LIMITED (IGGL)
(Joint Venture of IOCL, ONGC, GAIL, OIL and NRL)
GUWAHATI, ASSAM

NORTH -EAST GAS GRID PIPELINE PROJECT

BID DOCUMENT FOR

MISCELLANEOUS WORKS FOR SCADA & APPS SYSTEM AND TELECOM SYSTEM FOR FEEDER LINES UNDER NORTH EAST GAS GRID (NEGG) PROJECT OF M/S INDRADHANUSH GAS GRID LIMITED (IGGL)

OPEN DOMESTIC COMPETITIVE BIDDING

Tender ID: 2025_IGGL_237956_1

Bid Document No.: 05/51/23VC/IGGL/001(i)-7

VOLUME – II OF II

PREPARED AND ISSUED BY

MECON LIMITED
(A Govt. of India Undertaking)
Delhi, India

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VOLUME–II OF II

MISCELLANEOUS WORKS FOR TELECOMMUNICATION SYSTEM, SCADA & APPS SYSTEM AND ELECTRICAL SYSTEM FOR FEEDER LINES OF IGGL

INDRADHANUSH GAS GRID LIMITED

NATURAL GAS PIPELINE PROJECT
FOR
NORTH EAST GAS GRID PIPELINE FOR IGGL

MR No.: MEC/05/E5/T/23VC/MR-098

MATERIAL REQUISITION
FOR
MISCELLANEOUS SCADA & TELECOM SYSTEM WORKS FOR FEEDER LINES OF IGGL

PREPARED AND ISSUED BY

MECON LIMITED

(A Govt. of India Undertaking)
MECON Limited, 13th & 15th Floor,
North Tower, SCOPE MINAR,
Laxmi Nagar District Centre, Delhi-110092 (India)

Rev	Date	Prepared by	Checked by	Approved by
2	25.03.2025	Namita	Ratnadeep Gupta	Pankaj Shrivastava

MATERIAL REQUISITION

ITEM : MISCELLANEOUS SCADA & TELECOM WORKS FOR FEEDER LINES OF IGGL
PROJECT : NORTH EAST GAS GRID PIPELINE PROJECT FOR IGGL
MR NO. : MEC/05/E5/T/23VC/IGGL/098
CLIENT : INDRADHANUSH GAS GRID LIMITED (IGGL)

	MISCELLANEOUS WORKS	**Unit**	**Qty (Assam)**	**Qty (Tripura)**	**Total Qnty**
Sl.No	**Description of Item**				
	For Miscellaneous works of SCADA & Telecom the scope of work (not limited to) as Project Management, System Design, Detail Engineering, Supply of Materials, Inspection & Factory Acceptance Testing (Equipment & Integrated with subsystem), Packaging, forwarding, Insurance, Transit Insurance, Shipping, Port Handling, Custom Clearance, Inland Transportation to store, Supply of all related erection goods including Mandatory spares, Commissioning spares, power supply devices, surge protection device, Loading, Unloading & Handling, Storage & Safe custody, Transportation from store to site , Supply of all type of Erection Items, Erection, erection of foundation support channel on trench for panel erection, Pre-commissioning activity, Integration with existing Telecom system, Integration with existing SCADA and APPS system, Testing, Trial Run, Commissioning, Training, Warranty, Extended warranty, Post Warranty Maintenance contract – comprehensive for 5 years for all supplied equipment, Including minor civil works, documentation of miscellaneous works related to Telecommunication System, SCADA & APPS system and Electrical works (mainly Solar system etc), Complete in all respect and shall be executed as Turnkey individual work contract basis as per Job Specification, technical specification and in compliance to various clauses as per tender requirement. Integration with existing Telecommunication System, SCADA and APPS System of IGGL as per requirements is also in bidder's scope. Location details will be provided during detailed engineering.				
T.S	**Supply: Supply with all works defined above**				
T.S.1	OFC based Type-1 MPLS-TP (10 G) equipment, fully wired with Free-standing Rack as required complete in all respect as per Particular job specification, technical specification and various clauses as per tender requirement. Client / PMC reserve the right to order as per the requirement of project.	Sets	1	0	1

T.S.2	OFC based Type-2 MPLS-TP (10 G) equipment, necessary accessories etc as required complete in all respect as per Particular job specification, technical specification and various clauses as per tender requirement. (Including spare in Assam)	Sets	19	03	22
T.S.3	Type-2 MPLS-TP (10G) equipment Network Management System (NMS) Server (Rack Mounted) including all Hardware & Software, accessories for Telecommunication System as required complete in all respect as per Particular job specification, technical specification and various clauses as per tender requirement				
T.S.3.1	All Hardware and accessories, as required, as per above	Set	1	1	2
T.S.3.2	All Software (including MPLS- TP) as per above	Set	1	1	2
T.S.4	Type-2 MPLS-TP (10G) equipment Network Management System (NMS) Client work station including all Hardware & Software, accessories for Telecommunication System as required complete in all respect as per Particular job specification, technical specification and various clauses as per tender requirement				
T.S.4.1	All Hardware and accessories, as required, as per above	Set	1	1	2
T.S.4.2	All Software (including MPLS- TP) as per above	Set	1	1	2
T.S.5	Type-1 Remote terminal units (RTU) with fully wired free standing Panel consisting all Hardware, necessary accessories, GPRS MODEM etc complete in all respect, as required and as defined complete in all respect as per Particular job specification, technical specification and various clauses as per tender requirement. Client / PMC reserve the right to order as per the requirement of project.	Sets	1	0	1
T.S.6	Type-2 Remote terminal units (RTU) consisting all Hardware, necessary accessories, GPRS MODEM, etc complete in all respect, as required and as defined complete in all respect as per Particular job specification, technical specification and various clauses as per tender requirement. (including spare in Assam)	Sets	7	1	08
T.S.7	Explosion Proof PoE powered IP telephones including power supply adaptor, Ethernet Cable & patch cord, mounting kit with required hardware, cabling / accessories, etc. as required complete in all respect as per Particular job specification, technical specification and various clauses as per tender requirement.	Sets	1	1	02
T.S.8	PTZ Camera with IR illuminator with housing accessories, Mounting Arrangements, Ethernet switches, Converter, Gateways and necessary accessories etc. as required complete in all respect as per Particular job specification, technical specification and various clauses as per tender requirement	Sets	14	2	16

T.S.9	**SKID MOUNTED SPV POWER SOURCE** System Design, Detailed Engineering, procurement of materials, Inspection/FAT (Factory acceptance test), Supply of materials, Transportation, loading/unloading, insurance, Storage at warehouse/store (hired by bidder) of complete Skid Mounted Solar PV based Power source with two days autonomy (72 Hrs Backup) for 150W DC load for twenty four hours operation per day operation as per tender specification, data sheet, scope of work and block diagram enclosed including commissioning spares as required at each SV station. The system shall include following- (i) ATEX / EX type Solar PV Panel (for use in hazardous area as per Class 1, Div 2/ Zone 2) with explosion proof junction boxes, Steel structure for skid and mounting of the solar panels and battery box. (ii) Dual redundant Solar charge controller-MPPT type (output suitable to charge the battery bank in CC & CV mode) (iii) SMF- VRLA battery cells (12V DC) in Ex (FLP) junction boxes (iv) Interconnecting cables among arrays, hybrid charge controller, battery bank, junction boxes etc including supply of all accessories like FLP cable glands, cable tray, tinned-cu lugs etc as required. (v) Earthing and lightning protection system as required to complete the system. (vi) Erection materials & Other miscellaneous work. Rating of SPV array, charge controller and battery bank shall be selected to meet the load requirement as specified above. However, each subsystem rating shall not be less than the value given below-				
T.S.9.1	Solar PV Modules- Ex type (for use in hazardous area as per Class 1, Div 2/ Zone 2) for SPV array along with junction boxes as per specification and scope of work (Total capacity Min 1920 Wp)	Sets	1	0	1
T.S.9.2	Dual redundant MPPT Solar Charger in PESO approved Ex-d enclosure (with Exd/Exe breather) with 230V AC to 24V DC SMPS. It shall have redundant inputs (one from solar panel and other from 230V AC to 24V DC SMPS) to charge the battery bank & supply external load. Necessary O-Ring MOSFET Module also to be provided.	Sets	1	0	1
T.S.9.3	SMF Battery Min @ 12 V, 200 Ah x 6 nos (2 in series) in FLP (Ex- d certified) junction boxes (one battery in each junction box with Exd/Exe breather) as per specification.	Sets	1	0	1
T.S.9.4	Balance of System (BOS) materials & equipment for solar system for 72 hrs back up system- 1) Interconnecting cables among arrays (solar grade), charge controller, battery pack, converter, junction	Sets	1	0	1

	boxes etc including supply of all accessories like FLP cable glands, cable tie, cable tray, tinned-cu lugs etc as required. 2) Lightning protection system as required to complete the system. 3) Supply of 2 year O&M spares as per list attached in scope of work 4) Required material for Erection work, Civil & Other miscellaneous work				
T.S.10	**SKID MOUNTED SPV POWER SOURCE** System Design, Detailed Engineering, procurement of materials, Inspection/FAT (Factory acceptance test), Supply of materials, Transportation, loading/unloading, insurance, Storage at warehouse/store (hired by bidder) of complete Skid Mounted Solar PV based Power source with two days autonomy (48 Hrs Backup) for 150W DC load for twenty four hours operation per day operation as per tender specification, data sheet, scope of work and block diagram enclosed including commissioning spares as required at each SV station. The system shall include following- (i) ATEX / EX type Solar PV Panel (for use in hazardous area as per Class 1, Div 2/ Zone 2)with explosion proof junction boxes, Steel structure for skid and mounting of the solar panels and battery box. (ii) Dual Redundant Solar charge controller-MPPT type (output suitable to charge the battery bank in CC & CV mode) (iii) SMF- VRLA battery cells (12V DC) in Ex (FLP) junction boxes (iv) Interconnecting cables among arrays, hybrid charge controller, battery bank, junction boxes etc including supply of all accessories like FLP cable glands, cable tray, tinned-cu lugs etc as required. (v) Earthing and lightning protection system as required to complete the system. (vi) Erection materials & Other miscellaneous work. Rating of SPV array, charge controller and battery bank shall be selected to meet the load requirement as specified above. However, each subsystem rating shall not be less than the value given below-				
T.S.10.1	Solar PV Modules- Ex type (for use in hazardous area as per Class 1, Div 2/ Zone 2) for SPV array along with junction boxes as per specification and scope of work (Total capacity Min 1920 Wp)	Sets	6	1	7
T.S.10.2	Dual redundant MPPT Solar Charger in PESO approved Ex-d enclosure (with Exd/Exe breather) with 230V AC to 24V DC SMPS. It shall have redundant inputs (one from solar panel and other from 230V AC to 24V DC SMPS) to charge the battery bank & supply external load. Necessary O-Ring	Sets	6	1	7

	MOSFET Module also to be provided.				
T.S.10.3	SMF Battery Min @ 12 V, 200 Ah x 4 nos in FLP (2 in series) (Ex- d certified) junction boxes (one battery in each junction box with Exd/Exe breather) as per specification.	Sets	6	1	7
T.S.10.4	Balance of System (BOS) materials & equipment for solar system for 48 hrs backup system- 1) Interconnecting cables among arrays (solar grade), charge controller, battery pack, converter, junction boxes etc including supply of all accessories like FLP cable glands, cable tie, cable tray, tinned-cu lugs etc as required. 2) Lightning protection system as required to complete the system. 3) Supply of 2 year O&M spares as per list attached in scope of work 4) Required material for Erection work, Civil & Other miscellaneous work	Sets	6	1	7
T.S.11	230V AC Lighting distribution board (IP-65, weather proof & Flame proof) with Cu bus-bar (1 no- 32A 2P AC RCBO 30mA I/C, 5 nos- 10A DP MCB & 4 nos 16A DP O/G with indicating lamp) as per specification for normal power distribution.	Sets	7	1	08
T.S.12	Supply of integral flame proof well glass fixture (CIMFR approved for Zone-1/2 gas group IIA & IIB) with 72 W LED luminaire with inbuilt flame proof control gear Model no. FLPW-1245 of Baliga make or equivalent) complete with mounting bracket, flame proof control gear box, lamps etc as per specifications. drawings	Sets	28	4	32
T.S.13	Supply of Street lighting pole 6mtr high GI octagonal pole (Type BOP-6030 of Bajaj make or equivalent) complete with bracket, GI clamps, FLP Cable glands, flame and weather proof (IP-65) junction boxes (4 way) as per standard drawing (MEC/SD/05/E9/77/04) & specification (MEC/TS/05/E9/077B).	Sets	28	4	32
T.S.14	Design, Detailed Engineering, procurement of material, Inspection/FAT (Factory acceptance test), Supply, Transportation, loading/unloading, insurance, Storage at warehouse/store (hired by bidder) of Solar Street lighting system complete with GI pole and GI mounting bracket, control gear box, internal cable from fitting to junction box, and min FLP WG LED fixture (PESO Approved), three days battery backup with VRLA battery with Ex-d FLP box (2x75 AH), Solar PV Module (2x100Wp) (for use in hazardous area as per Class 1, Div 2 / Zone-2),, earthing, electronics, charger, dusk-dawn operation, GI -pole (5 Mtr, with 80 Micron Galvanization) etc including pipe inserts for cables and connecting work, civil work and commissioning spares as required, with all material and labour as per specifications, drawings and instruction of Engineer-in-	Sets	4	0	04

	charge. Work to be completed in all respects.				
T.S.15	**Mandatory Spares:** Supply of loose Mandatory Spares Complete in all respect, as required and as per Particular job specification, technical specification and various clauses as per tender requirement (Bill of Material has to be provided along with offer, any fraction quantity should be round off to nearest number in higher side).	LOT	1	1	2
T.S.16	Fully wired Explosion Proof Junction Boxes with power supply converters (SMPS), Fibre Optic Patch Panel/ LIU, other accessories complete in all respect, as required and as per Particular job specification, technical specification and various clauses as per tender requirement. The junction box shall be provided for housing of Type-2 MPLS-TP equipment and shall be provided with explosion proof breather valve. 2 nos. of junction box shall be provided which shall be connected internally. 1 no. of type-2 MPLS-TP equipment shall be installed in each junction box and all other equipment shall be distributed in both the junction boxes accordingly.	Sets	7	1	08
T.S.17	Fully wired Explosion Proof Junction Box for field area with power supply converter (SMPS), other accessories complete in all respect, as required and as per Particular job specification, technical specification and various clauses as per tender requirement. The junction box shall be provided for housing of Type-2 RTU and shall be provided with explosion proof breather valve.	Sets	7	1	08
T.S.18	Fully Wired CRCA Console consisting all hardware, necessary accessories complete in all respect, as required and as per Particular job specification, technical specification and various clauses as per tender requirement.	Sets	1	1	2
T.S.19	Extended Warranty per month (The extended warranty of the complete supplied system (including all type-1 MPLS-TP equipment, Type-2 MPLS-TP equipment, IP phones, CCTV cameras, Type-1 RTU, Type-2 RTU, Skid Mounted Solar PV based Power source, junction box, lights, all accessories etc.) (Refer Note 7 to MR)	Months	24	24	48
T.E	**Service and Site Work** Site work, Installation, Integration with existing systems, testing, commissioning, trial run, handover, including supply and erection of – (all installation materials, accessories, connectors, Distribution boxes, MDF, IDF, cables {FRLS Armoured Power cables, FRLS Armoured control cables, co-axial cable, multi-pair armoured telephone cables, FRPVC Armoured CAT-6 Ethernet Cables, Arnoured Optical fibre cable}, cable glands {ex-proof as per the area classification}, civil				

	foundation for all the supplied system, cable trays, SPD, double pole MCBs, power supply converters, OFC Splicing, OFC connectors, patch cords, pigtails, cable management, Cable tails), earthing, junction boxes, mounting arrangements for all supplied system and free issue system (MPLS-TP System, Telephones, CCTV Cameras, MDF Krone modules, NMS, Solar Power supply system, RTU etc) as required complete in all respect as per the site condition), trenching & backfilling, cabling, glanding, termination, seamless integration with existing telecom system (MPLS-TP, CCTV, EPABX System) and existing SCADA & APPS system of IGGL NEGG pipeline , etc for all the functions as specified under various clause of tender line, Training, Warranty, Post Warranty Comprehensive Maintenance Contract (after warranty), Mandatory & commissioning spares, Power testing of already laid 24 F OFC fiber, supply of OFC connectors, minor civil works & documentation of Telecommunication System and SCADA and APPS System and all other items / work not indicated here but required for completion of the scope of work., complete in all respect as specified in various documents attached with tender Particular job specification, technical specification and various clauses as per tender requirement and as per the site condition.				
T.E.1	All site works as defined above at respective station including supply and installation of erection accessories, cabling, glanding, termination, etc. as required for installation, testing and commissioning of OFC based Type-1 MPLS-TP (10 G) equipment, fully wired with Free-standing Rack as required complete in all respect as per Particular job specification, technical specification and various clauses as per tender requirement. This is an optional item and shall be executed as per the requirement of IGGL/ MECON.	Sets	1	0	1
T.E.2	All site works as defined above at respective station including supply and installation of erection accessories, cabling, glanding, termination, etc. as required for installation, testing and commissioning of OFC based Type-2 MPLS-TP (10 G) equipment complete in all respect as per Particular job specification, technical specification and various clauses as per tender requirement	Sets	19	3	22
T.E.3	All Site work as defined above at respective station including supply and installation of erection accessories, cabling, glanding, termination, etc. as required for installation, testing and commissioning of Type-2 MPLS-TP (10G) equipment Network Management System (NMS) Server (Rack Mounted) and client work station including all Hardware & Software, accessories for Telecommunication System as required				

	complete in all respect as per Particular job specification, technical specification and various clauses as per tender requirement				
T.E.3.1	All Hardware and accessories, as required	Sets	1	1	2
T.E.3.2	All software (including MPLS-TP) as required	Sets	1	1	2
T.E.4	All Site work as defined above at respective station including supply and installation of erection accessories, cabling, glanding, termination, etc. as required for installation, testing and commissioning of Type-2 MPLS-TP (10G) equipment Network Management System (NMS) Client work station including all Hardware & Softwares, accessories for Telecommunication System as required complete in all respect as per Particular job specification, technical specification and various clauses as per tender requirement				
T.E.4.1	All Hardware and accessories, as required, as per above	Set	1	1	2
T.E.4.2	All Software (including MPLS- TP) as per above	Set	1	1	2
T.E.5	All Site work as defined above at respective station including supply and installation of erection accessories, cabling, glanding, termination, etc. as required for installation, testing and commissioning of Type-1 Remote terminal units (RTU) with fully wired free standing Panel consisting all Hardware, necessary accessories, GPRS MODEM etc complete in all respect, as required and as defined complete in all respect as per Particular job specification, technical specification and various clauses as per tender requirement. This is an optional item and shall be executed as per the requirement of IGGL/ MECON.	Sets	1	0	1
T.E.6	All Site work as defined above at respective station including supply and installation of erection accessories, cabling, glanding, termination, etc. as required for installation, testing and commissioning of Type-2 Remote terminal units (RTU) consisting all Hardware, necessary accessories, GPRS MODEM etc complete in all respect, as required and as defined complete in all respect as per Particular job specification, technical specification and various clauses as per tender requirement	Sets	7	1	08
T.E.7	All Site work as defined above at respective stations including supply and installation of erection accessories, cabling, glanding, termination, etc. as required for installation, testing and commissioning of Explosion proof PoE powered IP telephones including power supply adaptor, Ethernet Cable & patch cord, mounting kit with required hardware, accessories, etc. as required complete in all respect as per Particular job specification, technical specification and various clauses as	Sets	1	1	02

	per tender requirement				
T.E.8	All Site work as defined above including supply and installation of erection accessories, cabling, glanding, termination, etc. as required for installation, testing and commissioning of Weather Proof IP PTZ cameras, complete in all respect as per Particular job specification, technical specification and various clauses as per tender requirement	Sets	14	2	16
T.E.9	All Site work as defined above including supply and installation of erection accessories, cabling, glanding, termination, etc. as required for **SKID MOUNTED SPV POWER SOURCE FOR INSTRUMENTATION, SCADA & TELECOM LOAD including** Installation, testing, commissioning and performance test at site of complete Solar PV based Power source with three days autonomy (72 Hrs Backup) for 150W DC load for twenty four hours operation per day operation as per tender specification, data sheet, scope of work and block diagram enclosed including commissioning spares as required at each station. The system shall include following- (i) ATEX / EX type Solar PV Panel(for use in hazardous area as per Class 1, Div 2/ Zone 2) with explosion proof junction boxes, Steel structure for skid and mounting of the solar panels and battery box. (ii) Dual Redundant Solar charge controller-MPPT type (output suitable to charge the battery bank in CC & CV mode) with BMS system. (iii) SMF- VRLA battery cells (12V DC) in Ex (FLP) junction boxes (iv) Interconnecting cables among arrays, hybrid charge controller, battery bank, junction boxes etc including installation of all accessories like FLP cable glands, cable tray, tinned-cu lugs etc as required. (vi) Earthing and lightning protection system as required to complete the system. (vii) Erection materials & Other miscellaneous work Rating of SPV array, charge controller and battery bank shall be selected to meet the load requirement as specified above. However, each subsystem rating shall not be less than the value given below-				
T.E.9.1	Solar PV Modules- Ex type (for use in hazardous area as per Class 1, Div 2/ Zone 2), for SPV array along with junction boxes as per specification and scope of work.	Sets	1	0	1
T.E.9.2	Dual redundant MPPT Solar Charger in PESO approved Ex-d enclosure (with Exd/Exe breather) with 230V AC to 24V DC SMPS. It shall have redundant inputs (one from solar panel and other from 230V AC to 24V DC SMPS) to charge the battery bank & supply external load. Necessary O-Ring MOSFET Module also be provided.	Sets	1	0	1

T.E.9.3	SMF Battery Min @ 12 V, 200 Ah x 6 nos (2 in series) in FLP (Ex- d certified) junction boxes (one battery in each junction box with Exd/Exe breather) as per specification.	Sets	1	0	1
T.E.9.4	Balance of System materials & equipment for 72 hrs backup system- 1) Interconnecting cables among arrays (solar grade), charge controller, battery bank, Grid charger, DCDBs, junction boxes etc including erection of all accessories like FLP cable glands, cable tray, tinned-cu lugs etc as required. 2) Earthing and lightning protection system as required to complete the system. 3) Erection materials, Civil & Other miscellaneous work	Sets	1	0	1
T.E.10	All Site work as defined above including supply and installation of erection accessories, cabling, glanding, termination, etc. as required for **SKID MOUNTED SPV POWER SOURCE FOR INSTRUMENTATION, SCADA & TELECOM LOAD including** Installation, testing, commissioning and performance test at site of complete Solar PV based Power source with two days autonomy (48 Hrs Backup) for 150W DC load for twenty four hours operation per day operation as per tender specification, data sheet, scope of work and block diagram enclosed including commissioning spares as required at each SV station. The system shall include following- (i) ATEX / EX type Solar PV Panel (for use in hazardous area as per Class 1, Div 2/ Zone 2) with explosion proof junction boxes, Anodized AL/ Hot dipped Galvanized M-Steel structure for skid and mounting of the solar panels and battery box. (ii) Dual redundant Solar charge controller-MPPT type (output suitable to charge the battery bank in CC & CV mode) with BMS system. (iii) SMF- VRLA battery cells (12V DC) in Ex (FLP) junction boxes (iv) Interconnecting cables among arrays, hybrid charge controller, battery bank, junction boxes etc including installation of all accessories like FLP cable glands, cable tray, tinned-cu lugs etc as required. (vi) Earthing and lightning protection system as required to complete the system. (vii) Erection materials & Other miscellaneous work Rating of SPV array, charge controller and battery bank shall be selected to meet the load requirement as specified above. However, each subsystem rating shall not be less than the value given below-				
T.E.10.1	Solar PV Modules- Ex type (for use in hazardous area as per Class 1, Div 2/ Zone 2), for SPV array along with junction boxes as per specification and scope of work.	Sets	6	1	07

T.E.10.2	Dual redundant MPPT Solar Charger in PESO approved Ex-d enclosure (with Exd/Exe breather) with 230V AC to 24V DC SMPS. It shall have redundant inputs (one from solar panel and other from 230V AC to 24V DC SMPS) to charge the battery bank & supply external load. Necessary O-Ring MOSFET Module also be provided.	Sets	6	1	07
T.E.10.3	SMF Battery @ 12 V, 150 Ah x 4 nos in FLP (Ex certified) junction boxes as per specification and scope of work for system-I with battery management system	Sets	6	1	07
T.E.10.4	Balance of System materials & equipment for 48 hr back up system- 1) Interconnecting cables among arrays (solar grade), charge controller, battery bank, Grid charger, DCDBs, junction boxes etc including erection of all accessories like FLP cable glands, cable tray, tinned-cu lugs etc as required. 2) Earthing and lightning protection system as required to complete the system. 3) Erection materials, Civil & Other miscellaneous work	Sets	6	1	07
T.E.11	All Site work as defined above including supply and installation of erection accessories, cabling, glanding, termination, etc. as required for installation, testing and commissioning of 230V AC Lighting distribution board (IP-55, weather proof) with Cu bus-bar in Guard Room (1 no- 32A 2P AC RCBO 30mA I/C, 5 nos- 10A DP MCB & 4 nos 16A DP O/G with indicating lamp) as per specification for normal power distribution.	Sets	7	1	08
T.E.12	All Site work as defined above including supply and installation of erection accessories, cabling, glanding, termination, etc. as required for installation, testing and commissioning of integral flame proof well glass fixture (CIMFR approved for Zone-1/2 gas group IIA & IIB) with 72 W LED luminaire with inbuilt flame proof control gear Model no. FLPW-1245 of Baliga make or equivalent) complete with mounting bracket, flame proof control gear box, lamps etc as per the tender.	Sets	28	4	32
T.E.13	All Site work as defined above including supply and installation of erection accessories, cabling, glanding, termination, etc. as required for installation, testing and commissioning of Street lighting pole 6mtr high GI octagonal pole (Type BOP-6030 of Bajaj make or equivalent) complete with bracket, GI clamps, FLP Cable glands, flame and weather proof (IP-65) junction boxes (4 way) as per standard drawing (MEC/SD/05/E9/77/04) & specification (MEC/TS/05/E9/077B).	Sets	28	4	32
T.E.14	All Site work as defined above including supply and installation of erection accessories, cabling, glanding, termination, etc. as required for installation, testing and commissioning of Solar Street lighting system	Sets	4	0	4

	complete with GI pole and GI mounting bracket, control gear box, internal cable from fitting to junction box, and min FLP WG LED fixture (PESO Approved), three days battery backup with VRLA battery with Ex-d FLP box (2x75 AH), Solar PV Module (2x100Wp) (for use in hazardous area as per Class 1, Div 2 / Zone-2),, earthing, electronics, charger, dusk-dawn operation, GI -pole (5 Mtr, with 80 Micron Galvanization) etc including pipe inserts for cables and connecting work, civil work and commissioning spares as required, with all material and labour as per specifications, drawings and instruction of Engineer-in-charge. Work to be completed in all respects				
T.E.15	All Site work as defined above including supply and installation of all required materials, cabling, glanding, termination, etc. as required for supply and installation of advance maintenance free earthing system with 3mtr earth electrode of low carbon steel with 250 micron copper coating with carbon based backfill compound (Resitivity of compound shall be less than 1 ohm-m) as per IS 3043/IEEE-80. (25 mm dia, 3M long steel rod with 250 micron CU bonding) with Civil Chamber.	Sets	14	2	16
T.E.16	All Site work as defined above including supply and installation of erection accessories, cabling, glanding, termination, etc. as required for supply and laying of 1.1kV grade XLPE insulated, PVC sheathed, FRLS power and control cables (conforming to IS:7098 and specification) for illumination/ street lights in underground trench /trays-				
T.E.16.1	3x 2.5 mm2 2XWY – Outdoor lighting & other loads	Mtr	1050	150	1200
T.E.16.2	3x 4 mm2 2XWY- from DB to Hybrid Charger	Mtr	700	100	800
T.E17	All Site work as defined above including supply and installation of erection accessories, etc. as required for Supply and installation of following Hot Dip Galvanized Perforated Type cable trays (as per IS 2629) including bends, tee, crosses, horizontal and vertical splices etc. as required including supply of all G.I hardware, as per approved drawings, specification-				
T.E.17.1	50 mm wide	Mtr	140	20	160
T.E.17.2	75 mm wide	Mtr	210	30	240
T.E.18	All Site work as defined above including supply and installation of erection accessories, etc. as required for Supply and installation GI earth strip for earthing of electrical equipment, instrument panels, field instruments, process equipment and pipes/ flanges including all associated civil work with all material and labour as per specification and drawings approved by the company.				
T.E.18.1	GI Strip (50X6) mm	Mtr	560	80	640

T.E.18.2	GI Strip (25X3) mm	Mtr	1260	180	1440
T.E.19	All Site work as defined above including supply and installation of erection accessories, etc. as required for Supply and installation of Miscellaneous earthing material -Supply of GI Wire rope (8mm- dia/ 25 Sqmm) , (50 mm x 2 mm thick/ 25 Sqmm PVC insulated flexible CU cable) for jumper for flanges/ pipe bonding, 2.5 sq mm insulated flexible Cu wires cable (Green) for field instruments etc for all the stations. 1 Lot comprises of all required work at 1 station.	Lot	7	1	08
T.E.20	All Site work as defined above including supply and installation of erection accessories, cabling, glanding, termination, etc. as required for installation, testing and commissioning of Type-2 MPLS-TP Fully wired Explosion Proof Junction Box with power supply converter, Fibre Optic Patch Panel/ LIU, other accessories complete in all respect, as required and as per Particular job specification, technical specification and various clauses as per tender requirement.	Sets	7	1	08
T.E.21	All Site work as defined above including supply and installation of erection accessories, cabling, glanding, termination, etc. as required for installation, testing and commissioning of Type-2 RTU Fully wired Explosion Proof Junction Box for field area with power supply converter, other accessories complete in all respect, as required and as per Particular job specification, technical specification and various clauses as per tender requirement.	Sets	7	1	08
T.E.22	All Site work as defined above including supply and installation of erection accessories, cabling, glanding, termination, etc. as required for installation, testing and commissioning of Fully Wired CRCA Console consisting all hardware, necessary accessories complete in all respect, as required and as per Particular job specification, technical specification and various clauses as per tender requirement.	Sets	1	1	2
T.E.23	All Site work as defined above including supply and installation of IS grade Structural Steel supports of MS including channels, angles, Pipes, plates etc complete in all respect, as required for erection of all the supplied equipment as per the tender requirement.	Metric Ton (MT)	7	1	08
T.E.24	All the works required for integration of the supplied Type-2 MPLS-TP equipment with the existing Telecom Network of IGGL NEGG pipeline including supply and installation of all required hardware and software at both ends, configuration in existing NMS of MPLS-TP system, configuration in existing MPLS-TP equipment, etc. as required, complete in all respect, as required and as per Particular job specification, technical specification and various clauses as per tender requirements.	Sets	19	3	22

T.E.25	All the works required for integration of the supplied NMS of Type-2 MPLS-TP equipment with the existing Telecom Network of IGGL NEGG pipeline including supply and installation of all required hardware and software at both ends, configuration in existing NMS of MPLS-TP system, configuration in existing MPLS-TP equipment, etc. as required, complete in all respect, as required and as per Particular job specification, technical specification and various clauses as per tender requirements.	Sets	1	1	2
T.E.26	All the works required for integration of the supplied CCTV Cameras with the existing CCTV Servers (Tentatively at MMS and BMS-1 location) of Telecom Network of IGGL NEGG pipeline including supply and installation of all required hardware and software at both ends, configuration in existing NMS of MPLS-TP system, configuration in existing MPLS-TP equipment, configuration in existing CCTV system etc. as required, complete in all respect, as required and as per Particular job specification, technical specification and various clauses as per tender requirements.	Sets	14	2	16
T.E.27	All the works required for integration of the supplied explosion proof IP Phones with the existing IP EPABX (Tentatively at MMS, BMS-1 and BMS-2 locations) of Telecom Network of IGGL NEGG pipeline including supply and installation of all required hardware and software at both ends, configuration in existing NMS of MPLS-TP system, configuration in existing MPLS-TP equipment, configuration in existing EPABX system etc. as required, complete in all respect, as required and as per Particular job specification, technical specification and various clauses as per tender requirements.	Sets	1	1	02
T.E.28	All the works required for integration of the supplied and free issued Type-1 MPLS-TP (10G) equipment with the existing NMS (tentatively at MMS, BMS-1 and BMS-2 locations) of Telecom Network of IGGL NEGG pipeline including supply and installation of all required hardware and software at both ends, configuration in existing NMS of MPLS-TP system, configuration in existing MPLS-TP equipment, etc. as required, complete in all respect, as required and as per Particular job specification, technical specification and various clauses as per tender requirements.	Sets	5	0	5
T.E.29	All Site work as defined above for Integration and Augmentation of all the signals of the supplied Type-2 RTU with the existing SCADA and APPS system of IGGL NEGG pipeline, including supply of all hardware, software, licenses, development of graphics, reports, tags , mapping, simulation etc. as required, complete in all respect, as required and as per Particular job specification, technical specification and various clauses	Sets	7	1	08

	as per tender requirements.				
T.E.30	All Site work as defined above for Integration and Augmentation of all the signals of the supplied and free issued Type-1 RTU with the existing SCADA and APPS system of IGGL NEGG pipeline, including supply of all hardware, software, licenses, development of graphics, reports, tags , mapping, simulation etc. as required, complete in all respect, as required and as per Particular job specification, technical specification and various clauses as per tender requirements.	Sets	3	0	3
T.E.31	Shifting of Existing spare equipment (Type-1 MPLS-TP equipment with fully wired panel, CCTV cameras, IP phones etc) of existing telecommunication system from existing store location of Assam , Tripura and Meghalaya states to respective stations including transportation, insurance, loading, unloading at site, of all equipment of existing telecommunication system, complete in all respect as per the tender. The details of existing store location in Assam state, Tripura state and Meghalaya is mentioned in the tender. If any fault or damage is observed in the system during transportation, the same shall be rectified or replaced by the bidder without any cost implication to IGGL/ MECON. All the required documents shall be provided by IGGL and payment of all required taxes shall be carried out by IGGL. The shifting shall be carried out as per the following details – i. From existing store location in Assam to Injection Point station of ONGC, SUAB WHI Source, near Jorhat/ Golaghat, Assam ii. From existing store location in Assam to Injection Point station of ONGC, Koraghat Source, near Jorhat/ Golaghat, Assam iii. From existing store location in Tripura to Injection Point station of ONGC, Barbejia WHI Source, near Jorhat/ Golaghat, Assam iv. From existing store location in Meghalaya to CGD station of NEGDCL near Tejpur in Assam	Lot	4	0	4
T.E.32	Shifting of Existing spare equipment (Type-1 RTU equipment with fully wired panel etc) of existing SCADA and APPS system from existing store location of Assam to respective stations including transportation, insurance, loading, unloading at site, of all equipment of existing SCADA and APPS system, complete in all respect as per the tender. The details of existing store location in Assam state is mentioned in the tender. If	Lot	2	0	2

	any fault or damage is observed in the system during transportation, the same shall be rectified or replaced by the bidder without any cost implication to IGGL/ MECON. All the required documents shall be provided by IGGL and payment of all required taxes shall be carried out by IGGL. The shifting shall be carried out as per the following details – i. From existing store location in Assam to Injection Point station of ONGC, Barbejia WHI Source, near Jorhat/ Golaghat, Assam ii. From existing store location in Assam to Injection Point station of ONGC, CGD station of NEGDCL, near Tejpur, Assam				
T.E.33	Training for MPLS-TP System at site and at OEM works / integration centre, as required complete in all respect as per Particular job specification, technical specification and various clauses as per tender requirement	LOT	1	0	1
T.E.34	Training for RTU System at site and at OEM works / integration centre, as required complete in all respect as per Particular job specification, technical specification and various clauses as per tender requirement	LOT	1	0	1
T.E.35	All inclusive per month rates for maintaining store at site (State wise / regions wise for the complete supplied material). Any land, area or building of any type will not be provided by IGGL/ MECON for storage of materials. All the required area/ land/ building for storage of all supplied items shall be arranged by the bidder and is included in scope of the bidder. (Refer Note 8)	Months	24	24	48
T.P.W	Comprehensive Post warranty maintenance contract (PWMC) as defined in the bid document for complete supplied system for 5 years after completion of main warranty, as required, complete in all respect as per Particular job specification, technical specification and various clauses as per tender requirement.				
T.P.W.1	Comprehensive Post Warranty Maintenance for First year after completion of warranty.	Lumpsum	1	1	2
T.P.W.2	Comprehensive Post Warranty Maintenance for Second year after completion of warranty.	Lumpsum	1	1	2
T.P.W.3	Comprehensive Post Warranty Maintenance for Third year after completion of warranty.	Lumpsum	1	1	2
T.P.W.4	Comprehensive Post Warranty Maintenance for Fourth year after completion of warranty.	Lumpsum	1	1	2
T.P.W.5	Comprehensive Post Warranty Maintenance for Fifth year after completion of warranty.	Lumpsum	1	1	2

NOTES:

1. Bidder shall quote for all the items. All the items /sub-items will be considered for evaluation purpose. Order will be awarded to lowest priced bidder as completion of total work as a TURNKEY work responsibility.

2. Bidder has to note that the Time schedule shall be as define in the tender; supply and site work shall be executed as per the written intimation from client/PMC.

3. Inspection of the various Items shall be executed as per the time schedule (CDD) and as defined in the Particular Job specification. For the Inspection (by client/ PMC) any provision / facilities as required shall be arrange by the bidder at the time of Inspection and FAT at integration centre. Details and procedure of Inspection will be finalised with successful bidder during detailed engineering stage.

4. Each lot Commissioning spare as required will be part of the offer and shall be available at the time of commissioning.

5. Details of Mandatory spares with part no., make etc. shall be given separately with the offer & enclosed with techno-commercial documents.

6. The quantity and location of the stations may change due to any change in site location/ requirements; bidder shall to take prior approval for procurement and erection.

7. The Main warranty of the complete supplied system (including mandatory spares) including all components will be 24 months from the date of commissioning and handing over of the complete supplied system as defined in completion schedule. In case, any works are not completed till 26 months from FOA; Extended warranty will start for all the supplied / commissioned system so that the main warranty is intact for 24 months from the date of commissioning and handing over of the complete supplied system as defined in completion schedule. All materials will be considered in custody of contractor with applicable conditions of warranty till handing over of the system to Client.

   The Extended warranty shall be applicable for the complete scope of supply including mandatory spares. The extended warranty per month rate will be used to allow the contractor to provide and intact the main warranty for the delayed commissioning & handing over of system not attributed to contractor, so that the Main warranty (i.e. 24 months) is made available on commissioning and handing over of the complete supplied system. After the commissioning and handing over of the complete system to the Client, Main warranty of the System (for 24 months) shall start.

   In case of delayed supply attributable to bidder, extended warranty will start after adding delayed period of last supply to completion schedule for which cost of warranty/extended warranty is to be borne by bidder.

   Start of extended warranty per month is to be intimated by the bidder and will be confirmed by the client / PMC. The Extended warranty rates shall be for the complete scope of supply including mandatory spares and Test equipments.

   The Extended warranty rates shall be for complete scope of supply including mandatory spares and to be billed as per SOR. Refer respective Clause for Warranty in Particular Job specification of the tender.

8. Bidder has to complete the work as per the schedule. Bidder shall maintain store at site for storage of all the supplied materials in each state. Any land, area or building of any type will not be provided by IGGL/ MECON for storage of materials. All the required area/ land/ building for storage of all supplied items shall be arranged by the bidder and is included in scope of the bidder. Payment for the store shall be claimed by the bidder as per the quoted rates after receipt of material at store, from date of receipt of material at store to the date till which the materials are stored in the store.

The store has to be maintained by the bidder and billed as per the requirements. Insurance of all materials in the store is included in scope of the bidder and cost of the same shall be covered in the quoted price. Safety and security of store shall be the responsibility of bidder and is included in scope of the bidder. Bidder shall be responsible for all the supplied material till handing over of the material to Client.

9. Post warranty maintenance contract (comprehensive) as defined in the bid shall be provided by original equipment supplier along with bidder for **05 years of periods** as defined in the tender for complete scope of supply. PWMC work will start after completion of Main warranty at same time for the complete supplied materials. At the time of FOA; order for supply and site services shall be placed, however client will placed separate order for Post Warranty Maintenance as per terms & condition of the contract on or before 3 months of completion of main warranty.

10. Operation & maintenance OEM suggestive spares (for 2 years) required after PWMC, each module, with complete list, part no, unit rate shall be provided at the time of bid. The validity of rates shall be upto contractual period including PWMC from date of commissioning / acceptance of complete work (i.e. 7 year – 2 year warranty + 5 year PWMC). Refer PJS for details.

11. The quantity of any number of MR line items can be increased or decreased as per the requirement of IGGL/ MECON as finalized during detail engineering. The quantity of each line shall be finalized during detail engineering and quantity finalized during detail engineering shall be final and binding to the bidder and accordingly bidder shall execute the same at the price (as per LOA/ Purchase order) for each respective line item.

12. The prices for each line item (as per LOA/ Purchase order) shall be valid till commissioning of the entire system as per the schedule provided in the tender. IGGL/ MECON may place repeat order for any quantity of any number of line items as per their requirement. The repeat order may be placed at any time before the commissioning of the entire system as per the schedule provided in the tender. The prices in the repeat order for any line item shall be same as the price as per LOA/ Purchase order for respective line item.

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VENDOR DATA REQUIREMENTS

The table hereunder specifies the quantities and the nature of the documents to be submitted by the Vendor to the Client / Consultant for Approval / Record.

Any document, even when preliminary, shall be binding and therefore duly identified and signed by the Vendor. It shall bear the Project reference, the PO no. and the document identification number.

THE DOCUMENTS ARE FULLY PART OF THE SUPPLY WHICH SHALL BE COMPLETE ONLY IF AND WHEN THE DOCUMENTS COMPLYING FULLY WITH THE MATERIAL REQUISITION EQUIREMENTS ARE RECIVED BY THE CLIENT / CONSULTANT.

Sl. No.	Documents and Data	Along with Quotes	Certified information required after Purchase Order			
			Soft Copy	Printed Matter	Date needed from FOI	Date Promised
1	Network Management System (NMS)	1	4	4	04 weeks	-
2	Functional design Specification for Telecommunication System and sub system	1	4	4	04 weeks	-
3	Panel and JB Wiring diagram	-	4	4	08 weeks	-
4	Filled various From (attached with the tender) duly filled and signed by the bidder	1	-	-	-	-
5	Bill of Material (Station wise)	1	4	4	08 weeks	-
6	List of Mandatory Spares	1	4	4	08 weeks	-
7	List of Commissioning Spares	1	4	4	08 weeks	-
8	Functional design Specification for RTU System, Electrical System	-	4	4	12 weeks	-
9	Equipment Interconnection diagram including details of various interfaces etc.	-	4	4	12 weeks	-
10	Panel/ JB internal Layout including mounting arrangement, interconnection	-	4	4	12 weeks	-
11	Internal layout of cabinets, consoles, desks if reqd including mounting arrangement, interconnection etc.	-	4	4	12 weeks	-
12	MPLS –TP equipment & NMS	1	4	4	08 weeks	-
13	Datasheets of Various equipment	1	4	4	08weeks	-
14	Integration Philosophy	1	4	4	08 weeks	-
15	Standard Equipment Manual for operation & maintenance	-	4	4	-	W/S
16	User guides, maintenance & configuration manuals for all supplied equipments / subsystems	-	4	4	-	W/S

17	Quality Assurance Plan	1	4	4	04 weeks	-
18	FAT Procedure	-	4	4	12 weeks	-
19	SAT Procedure	-	4	4	12 weeks	-
20	Test Run Procedure	-	4	4	12 weeks	-
21	IP address & protocol structure at each station	-	4	4	12 weeks	-
22	RTU Database	-	4	4	12 weeks	-
23	Channeling Plan & Link Engineering	1	4	4	12 weeks	-
24	Optical Budget System Engineering	1	4	4	12 weeks	-
25	Station wise power consumption calculations of Telecom Eqpt & sub system at MS and other stations	1	4	4	12 weeks	-
26	Earthing arrangements	-	4	4	12 weeks	-
27	Necessary Exp. Proof certificate as applicable	-	4	4	12 weeks	-
28	List of spares for O&M for main & sub system	1	4	4	12 weeks	-
29	List of special Tools & Tackles	1	4	4	12 weeks	-
30	Project execution schedule	-	4	4	2 weeks	-
31	Unpriced order copies of sub items and FDS	1	4	4	04 weeks	-

Notes:

1. The above VDR based on the schedule (Supply : 16 weeks ETC: 24 weeks from FOI; any different schedule it will be reconfirmed during placement of order.
2. Categories proceeded with "*" will be approved for fabrication by MECON LIMITED. The remaining drawings are needed for information only.
3. Fold all drawing to 210mm x 297mm.
4. Vendor to provide all printed matter and the soft copy to MECON LIMITED.
5. Legends:
   A/C = As completed, W/S = With Shipment, W= Weeks
6. Final technical document file shall be supplied in hard copy as indicated and in electronic format (.pdf Acrobat files) on two (2 Nos.) CD-ROM
7. All these documents shall be submitted along with dispatch of the system to site
8. FAT procedure documents must include clause wise reference of tender specification for its compliance. This document shall be prepared in consultation with owner / owner's representative
9. The documents / information required with offer sheets to be furnished otherwise the offer shall be liable for rejection.
10. **During detail engineering stage, 1 sets of printed matter and 2 soft copies shall be submitted till the final approval of documents/drawings. After approval 4 sets of**

Soft copy has to be provided in 2 nos. suitable portable SSD hard disks with password protection.

11. **As built Drawings & Documents – 2 sets of hard copy and 6 sets soft copies (contents – PO, FDS, FAT, IC, SAT, testing reports, Commissioning & Handing over Reports) . The Soft copy has to be provided in 3 nos. suitable portable SSD hard disks with password protection.**

MECON Limited

Vendor Drawing/ Document Submission Schedule

Client/ Project: FEEDER LINES OF M/s IGGL **BID Doc No.:**	**Vendor's Name :**	**Contact Person (Name/ Tel/ Fax/ email) :**	**Status Date:**

Item Description : **Miscellaneous Works**	**PR No.:** **Date of LOI:**	**Review Status Code:** 1. APPROVED - No Comments 2. APPROVED AS NOTED - Proceed with manufacture/ fabrication as per commented document. Revised document required. 3. NOT APPROVED Document does not conform to basic requirements as marked. Resubmit for Review. R: Retained for Reference V: Void
Doc No. MEC-S-05-E5-23VC-SPUR 98-F01, Rev 0	**PO No.:** **Date of PO:**	
Department :	**Contact Person:**	

S. No.	Drawings / Documents as per MECON Vendor Data Requirement	Vendor Drg/ Doc No. Title	Category Review (R)/ Records (I)	Schedule Date of 1st Submission (Rev. 0)	Anticipated (Ant) Date of submission by vendor Actual (Act) Date of submission by vendor Date of Return (Rew) by MECON Review Status (Code)	Rev. 0	Rev. 1	Rev. 2		Form Electronic (E)/ Print (P)	Remarks
					Ant						
					Act						
					Rew						
					Code						
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VENDOR DRAWING/ DATA APPROVAL PROCEDURE

1. Vendor must take care of the following while submitting drawings and documents for review as indicated in Vendor Data Requirements enclosed.

   A blank space measuring 75mm W x 40mm H shall be provided on all vendor drawings for marking review codes etc. by MECON LIMITED.

   The review of vendor drawings shall be done as applicable under the following review codes:

   a) Review Code Approved : Approved

   b) Review Code Approved As Noted: Proceed with manufacture/ fabrication as per commented drawings. Revised drawing required.

   c) Review Code Not Approved: Document does not conform to basic requirements as marked. Resubmit it for review.

2. Review of the vendor drawings by MECON would be only to check compatibility with basic design and concepts and would in no way absolve the manufacturer/ fabricator of his responsibility to meet applicable codes, specification and statutory rules/ regulations.

3. For drawings/ documents indicated as FOR INFORMATION in the Vendor Data Requirement, Vendor must mark FOR INFORMATION ONLY on the submitted drawings/ documents.

INDRADHANUSH GAS GRID LIMITED

NATURAL GAS PIPELINE PROJECT
FOR
NORTH EAST GAS GRID PIPELINE

PARTICULAR
JOB SPECIFICATION

MISCELLANEOUS WORKS FOR TELECOM SYSTEM,SCADA & APPS SYSTEM & ELECTRICAL SYSTEM FOR FEEDER LINES

PJS No.: MEC/05/E5/T/23VC/SPUR/PJS-098

PREPARED & ISSUED BY

MECON LIMITED
(A Govt. of India Undertaking)
DELHI - 110092

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****

1. INTRODUCTION

1.1. The purpose of this specification is to define the outline requirement of Miscellaneous Works(Telecommunication Works, SCADA and APPS Works, Electrical Works) for feeder lines of IGGLincluding all stations used for NG transporting services. These feeder lines are used to connect the Gas Source with the existing station of IGGL. The feeder lines are proposed in state of Assam and Tripura as per the tender.

1.2. In case of any conflict between the specifications, enclosed data sheets, enclosed attachments, related codes and standards etc. Before award of the contract, Vendor shall refer the matter in writing to the purchaser, and shall obtain clarification in writing before starting the manufacturing/selecting of the instrument.

1.3. In case of any conflict between the specifications, enclosed data sheets, enclosed attachments, related codes and standards etc. after award of the contract, the stringent among all the data shall be followed without any cost implication and no extra payment shall be made towards the same.

1.4. Vendor shall be responsible for selection of the correct system to meet the purchaser's specifications. In case of any modification / change in selected equipment model has to be changed at a later date to meet the Purchaser's Specifications, the same shall be done by the vendor without any price and delivery implications.

1.5. The following definitions shall apply for this tender:

a) CLIENT/ PURCHASER/ OWNER: IGGL

b) CONSULTANT/ PMC : MECON Limited

c) VENDOR/ BIDDER/ TENDERER/ CONTRACTOR : Individual or organization entering into agreement with Purchaser to perform services or work and/ or to supply materials specified in Purchase Document.

d) PURCHASE DOCUMENT: All the written materials, in addition to the Specifications, Data sheets and Drawings which describe the contract terms and conditions, delivery requirements and instructions and any other information/ instructions required by the vendor to perform the specified services and/ or to supply the specified materials

2. SCOPE OF WORK

2.1 The bidder's responsibility for complete system defined in this document shall be on turnkey basis and shall include but not limited to -

Project Management, System Design, Detail Engineering, Supply of Materials, Inspection & Factory Acceptance Testing (Equipment & Integrated with sub-system, Packaging, forwarding, Insurance, Transit Insurance, Shipping, Port Handling, Custom Clearance, Inland Transportation to store, Supply of all related erection goods including Mandatory spares, Commissioning spares,power supply, surge protection device, Loading, Unloading & Handling, Storage & Safe custody, Transportation from storetosite, Supply of all type of Erection Items, Erection, erection of foundation support channel on trench for panel erection, Pre-commissioning activity, Testing, Trial Run, Commissioning, Training, Warranty, Post Warranty Maintenance contract – comprehensive for 5 years for all supplied equipment, Including minor civil works, documentation of Telecommunication System, SCADA & APPS System, Electrical System, Complete in all respect and shall be executed as Turnkey individual work contract basis as per this Job Specification and technical specification.

The proposed Telecommunication system shall comprise of MPLS –TP , Telephones and accessories, Cameras (PTZ & Fixed). As per requirements, the following has been proposed for Telecommunication System-

- OFC based Type-1MPLS –TP (10G) optical fiber based telecommunication system with fully wired panel and all accessories
- OFC based Type-2 MPLS –TP (10G) optical fiber based telecommunication system, fully wired explosion proof junction box and all accessories
- OFC based MPLS –TP Network Management Systems of Type-2 MPLS-TP Equipment (location to be finalized

during detail engineering) with fully wired panel and all accessories

- Integration of all the supplied Type-1 MPLS-TP Equipment and Type-2 MPLS-TP Equipment with existing MPLS-TP Equipment of NEGG Pipeline of IGGL at respective stations.
- Integration of all the supplied Type-1 MPLS-TP Equipment with existing NMS of MPLS-TP equipment of NEGG Pipeline of IGGL at MMS, Guwahati, BMS-1, Numaligarh and BMS-2, Silchar stations of IGGL. The spare licenses available in the NMS shall be utilized for integration.
- IP phones, Exp proof IP phones.
- Integration of all the supplied IP phones, Exp proof IP phones with existing IP-EPABX of NEGG Pipeline of IGGL atMMS, Guwahati, BMS-1, Numaligarh and BMS-2, Silchar stations of IGGL. The spare licenses available in the existing IP-EPABX shall be utilized for integration.
- Integration of all the supplied IP phones, Exp proof IP phones with existing NMS of IP-EPABX of NEGG Pipeline of IGGL atMMS, Guwahati, BMS-1, Numaligarh and BMS-2, Silchar stations of IGGL. The spare licenses available in the existing NMS of IP-EPABX shall be utilized for integration.
- IP CCTV PTZ & Fixed cameras
- Integration of all the supplied IP CCTV PTZ & Fixed cameras with existing NVMS Server of CCTV System of NEGG Pipeline of IGGL at MMS, Guwahati, BMS-1, Numaligarh and BMS-2, Silchar stations of IGGL. The spare licenses available in the existing NVMS Server of CCTV Systemshall be utilized for integration.
- Integration of all the supplied IP CCTV PTZ & Fixed cameras with existing NAS of NVMS Server of CCTV System of NEGG Pipeline of IGGL at MMS, Guwahati. In addition, all the supplied IP CCTV PTZ & Fixed cameras shall also be integrated with existing NAS at the BMS-1, Numaligarh and BMS-2, Silchar stations of IGGL. However, half of supplied cameras shall be integrated at BMS-1 and rest half of the supplied cameras shall be integrated at BMS-2. The spare space available in the existing NAS ofNVMS Server of CCTV Systemshall be utilized for integration.
- Integration of all the supplied IP CCTV PTZ & Fixed cameras with all the existing NVMS Client of CCTV System of NEGG Pipeline of IGGL.
- All accessories, hardware and software as required for installation, integration, testing and commissioning
- All cables, cable trays and other accessories
- Any equipment or material not mentioned explicitly but required to complete the work as per tender requirement
- All the integration shall be done as per the philosophy of the existing respective systems.

The proposed SCADA and APPS system shall comprise of Type-1 RTU, Type-2 RTU. As per requirements, the following has been proposed for SCADA and APPS System -

- Type-1 RTU with fully wired Panel and all accessories
- Type-2 RTU, with fully wired explosion proof junction box and all accessories
- Integration and augmentation of all the signals of all the supplied Type-1 RTU and Type-2 RTU with existing SCADA and APPS system of NEGG Pipeline of IGGL at MMS, Guwahati, BMS-1, Numaligarh and BMS-2, Silchar stations of IGGL and all the Remote workstations of SCADA and APPS, including graphics and data base preparation in existing SCADA and APPS system. The spare licenses available in the SCADA system shall be utilized for integration. However, for integration with APPS system, if any license need to be provided, same shall be provided for complete integration as per the requirement for integration of each feeder pipeline of this tender with existing APPS system. The RTUs shall be integrated using DNP 3.0 Protocol over TCP/IP communication with SCADA servers for all RTUs.
- All accessories, hardware and software as required for installation, integration, testing and commissioning
- All cables, cable trays and other accessories
- Any equipment or material not mentioned explicitly but required to complete the work as per tender requirement
- All the integration shall be done as per the philosophy of the existing respective systems

The proposed Electrical system shall comprise of solar power supply system with battery, solar charge controller, outdoor lights, power distribution junction box, cables, etc. As per requirements, the following has been proposed for Electrical System –

- Solar power supply system with ATEX/ CSA certified PV panels, battery, hybrid solar charge controller etc

- Explosion proof junction box and all accessories
- All equipment and works for earthing of complete telecom, SCADA and APPS and Electrical System of each station including construction of earth pits, supply of all equipment for construction of earth pits, all cables for earthing, GI strips for earthing etc
- Explosion proof lights for field
- Explosion proof power distribution junction box in field
- All cables, cable trays and other accessories
- Any equipment or material not mentioned explicitly but required to complete the work as per tender requirement

a) In case of any ambiguity, decision taken by EIC (Engineer In-charge) of IGGL/ MECON at site shall be final and binding to bidder.

b) In the event of any conflict between this specification, data sheets, BOQ, related standards, codes etc. after award of contract, stringent among all the data shall be followed without any implication and no extra payment shall be made towards the same.

c) Each item of electrical equipment (Junction Box, Cable glands, Camera, Phones, Speakers, Handsets, Field stations etc.) installed in an area classified as hazardous with respect to potential gas explosion shall be constructed in accordance with the recommendations of IEC60079 for Zone 1 , Gr IIA/B. Every item of equipment installed in a hazardous area shall carry PESO certification (except for Solar PV module, Solar PV module shall be PESO/ATEX/CSA certification) attesting to its suitability for use in that area.

d) Electrical equipment intended for use in Hazardous Areas shall be PESO certified (except for Solar PV module, Solar PV module shall be PSO/ATEX/CSA certified) for the following types of protection as defined in ATEX Directive 95 / IEC 60079:
   - Sparking or potentially sparking apparatus: Ex ia, Ex ib or Ex d
   - Non-sparking apparatus: Ex e, or any of the above

e) Junction Box installed in the buildings (Indoor Junction Box) shall be weather proof (IP 65)

f) The bidder shall carry out site visit to existing IGGL locations prior to submitting the bid to gather all the data required by the bidder for execution of the work (as per the tender) and for integration of different systems supplied under this tender with existing system as per the tender requirements. It shall be the responsibility of the bidder to gather all the inputs/ information required for installation, testing and integration purpose. IGGL/ MECON shall not be held responsible for any missing / lack of input/ information. After award of the contract, all the works required, as per the tender, shall be carried out by the bidder at both ends. Since, the existing Telecom system, SCADA and APPS system is covered under the respective clauses of warranty and Post warranty, it will be mandatory for the bidder to hire the services of existing Telecom vendor of NEGG pipeline of IGGL and existing SCADA and APPS vendor of NEGG pipeline of IGGL to carry out any works for integration, modification, testing in existing system and commissioning. Bidder, on his own, shall not carry out any work in any of the existing system without the involvement of existing Telecom Vendor and existing SCADA and APPS vendor.

g) All software license shall be perpetual and shall be in name of IGGL. Soft license shall be provided, dongle keys shall not be acceptable.

h) All the supplied equipment shall be considered for 24*7 operation.

i) The scope of integration shall include supply and installation of all hardware and software, licenses etc as required for complete and seamless integration of the respective systems.

j) Any item, which is not in BOM but required for to meet the complete functionality of the system as per the tender , is included in scope of the bidder and should be supplied by Vendor free of cost. The cost of the same shall be included in the quoted prices of the available SOR items.

k) Supply and erection of all items required for installation, integration, testing and commissioning of all supplied items and to meet the functionality of all the supplied system as per the tender is included in

scope of the bidder. If separate line item is not available for any such item in the SOR, bidder shall supply the same and cost of the same shall be included in the quoted price of installation of the respective equipment for which the item shall be used for erection, testing and commissioning

l) As this is pipeline work and is dependent on site work progress, Bidder to visit site as per site readiness multiple times. Based on the readiness of different stations for telecom, SCADA & APPS and Electrical works, bidder shall deploy and remove the manpower to stations for erection works multiple times. Bidder to consider the same in the quoted prices of erection works of each station.

m) All underground cables shall be laid in trench prepared by the bidder as per the specifications provided elsewhere in the tender document. All above ground cable (including cables in control room, field etc) shall be laid on perforated GI cable trays (as per specifications provided elsewhere in the tender document).

n) Door Switch shall be provided in the junction box of each Type-2 MPLS-TP equipment, Junction box of LIU/ FOPP and Junction Box of Type-2 RTU at each station and each door switch shall be wired to the DI card of RTU for JB door status.

o) All junction boxes shall be provided with 2 nos. explosion proof breather.

p) The centralized server of SCADA shall poll the RTUs through high speed links. The communication between MMS , BMS and RTUs will be through DNP 3.0(TCP/IP)

q) The successful bidder shall undertake full responsibility on turnkey basis for providing the complete system as per the tender requirement meeting the objectives, functional and specific requirements described in the tender.

r) For smooth monitoring & control of pipeline facilities with centralized SCADA system, all the new RTUs have to be interfacedwith the existing centralized SCADA system (OEM- M/s ABB India Limited). Only RTUs compatible to centralized SCADA have been envisaged for procurement & commissioning with following activities:

- Supply, engineering, installation and integration of New RTU'S and integration with Main Master Station (MMS) at Guwahati, Backup Master Station-1 (BMS-1) at Numaligarh and Backup Master Station-2 (BMS-2) at Silchar.
- Configuration of terminal I/O's in RTU and in SCADA.
- Testing of all the I/Os from SCADA to field.

s) The tentative station wise I/Os are indicated in tender. The major IED (Intelligent Electronic Devices) to be connected with the RTU's through RS 485 are Flow computers, LEL panel, solar power supply system (provided by bidder), along with hardwired signal from field instruments.

t) Storage and safe keeping of all the supplied materials is the responsibility of the bidder and is included in the scope of the bidder.

u) It is the prime responsibility of bidder to establish communication between RTU, Telecom and SCADA. During interfacing stage, if any extra item would be required at RTU end which was not ascertained by bidder during bidding/ document approval stage, it shall be made available by the bidder without any implication of extra cost to IGGL/ MECON.

v) Since the existing Telecommunication System of NEGG project of IGGL is operational, bidder shall hire the services of the existing Telecom Vendor to carry out any works in the existing Telecommunication System (for integration of supplied system with the existing system). Similarly, since the existing SCADA and APPS system of NEGG project of IGGL is operational, bidder shall hire the services of the existing SCADA Vendor to carry out any works in the existing SCADA and APPS System (for integration of supplied system with the existing system).

w) The RTU for Centralized SCADA System proposed to be supplied shall be from the existing range and should have been successfully tested for similar application. Theproposed RTU should be proven and should be working satisfactorily for at least for 12 months on DNP 3.0 protocol. If the bidder is not a manufacturer of RTU then bidder has to provide the commitment letter from the OEM for offered RTU.

x) All the signals of each supplied RTUs shall be augmented and added to all the existing SCADA Servers at MMS, BMS-1 and BMS-2 locations and all the remote work stations. The augmentation and addition of signals in the existing SCADA server shall be carried out in such a manner that all the functionalities of the existing system shall be made available in the new supplied equipment. This augmentation shall be carried out in a way to minimize downtime of existing SCADA system. Development of necessary graphics, trends, alarms/event screens, interlocks etc. shall also be in the scope of vendor. The complete philosophy of the existing system shall be followed including graphics, logics, reports, integration with APPS system etc. Since, the existing SCADA system is operational and functional, all the works shall be carried out in the existing system without affecting the functionality of existing SCADA system. In case any damage is observed in the functionality of existing SCADA system or system is shut down unexpectedly due to any activity, bidder shall be held completely responsible for it and shall rectify the system and bring it to its original functional form without any cost implication to IGGL/ MECON. If the bidder fails to do so, IGGL/ MECON reserve the right to get the rectification works done at the risk and cost of the bidder. Bidder shall plan the works in coordination with IGGL/ MECON to minimize the downtime of the existing SCADA system. The augmentation and addition of all the signals of each supplied RTUsin existing SCADA systemshall be carried out such that all the functionalities of SCADA system for the complete pipeline is made available in SCADA server and is accessible through any of the existing SCADA work station. Accordingly, the augmentation and addition shall be done. All works required for addition of all the signals of each supplied RTUs in the existing SCADA server and workstations, including Configuration, supply of all hardware, software, licenses, development of graphics, reports , etc., as required and as per the direction of Engineer In-charge of IGGL/ MECON is included in scope of the bidder. Bidder shall hire the services of existing SCADA system provider to carry out all the works in the existing SCADA system. All the cost for the same is included in scope of the bidder. Bidder shall have written agreement with OEM of existing SCADA system to own complete responsibility of all activities, QA/QC, technical support, guarantee performance, warranty & post warranty alongwith bidder for all the works (including supply of all related software and hardware) related to SCADA system. All the required signals of each supplied RTUs shall be integrated with the existing APPS system as per existing the philosophy of integration between existing SCADA and APPS system of IGGL.

y) The type of telecom connectivity shall be TCP/IP for each RTU. RTU shall have Single CPU with Single power supply. RTU polling shall be made on Ethernet link. Each RTU will be able to poll the SCADA servers with one as active and the other on stand-by mode. Bidder has to provide dedicated independent Ethernet Ports With DNP 3.0 buffer in RTU for polling to both Servers simultaneously. The Ethernet ports available on the CPU can be used for Polling of MMS & BMS-1/ BMS-2 only. The Ethernet ports available on CPU cannot be used for interfacing with any IED. For interfacing with any IEDs, Separate ports shall be provided.

z) Communication protocol between MMS / BMS / FEP and RTUs shall confirm to OSI Communication model, DNP 3.0 (TCP/IP) and it will be standard protocol for all the station communications

aa) The specification covers the minimum requirements for the design, material, manufacturing, inspection, testing, supply, shipment and delivery to site, installation, SAT and trial run of each system specified in this document. The description and requirements contained in this specification are concise by necessity and cannot include all details. However, it is the responsibility of the bidder to execute the job on a turnkey basis in accordance with the specifications and internationally recognized good engineering practices for smooth, safe and successful operation of telecommunication system

bb) Increase or decrease in quantity may be done to any number of items (provided in the SOR) as per the quoted price in the SOR. Quantity of any number of SOR line item may be increased or decreased as per the requirement during the execution of the project, as per the requirement of IGGL/ MECON. Any

quantity of any item, increased or decreased, shall be binding to the bidder and bidder shall execute the work accordingly

cc) All the supplied Servers, clients to be taken care with respect to cyber security measures like Antivirus (for machines with Windows Operating system), Antispam solutionetc

dd) All the Servers, Clients to be provided with licensed antivirusvalid till end of PWMC.

2.2 Detailed Scope of work:

The proposed shall comprise of the following -

2.2.1. OFC based Type 1 MPLS-TP (10G) Telecom system

i) OFC based Type 1 MPLS-TP (10G) Telecom equipment fully wired with free standing Rack, compatible to operate with ITU-T G-652D & G-655 fibre, configured and equipped with all specified interfaces, Ethernet Patch Panel and capable of supporting specified interfaces, complete as per specifications. Supply of OFC based Type 1 MPLS-TP (10G) Telecom equipment fully wired with free standing Rack considered in the SOR is optional and shall be provided, if required by IGGL/ MECON. The requirement of supply of Type-1 MPLS-TP (10G) Telecom equipmentshall be finalized by IGGL/ MECON during detail engineering.

ii) 4 Nos. Type-1 MPLS-TP (10G) equipment, fully wired with free standing Rack (Rack dimensions 2000mm (H) x 800mm (W) x 800mm (D) + 100 mm plinth) shall be free issued to the bidder for installation, integration, testing and commissioning. The no. of free issued equipment shall be finalized during detail engineering and same shall be final and binding to the bidder.

iii) Type-1 MPLS-TP (10G) equipment, fully wired with free standing Rack (Rack dimensions 2000mm (H) x 800mm (W) x 800mm (D) + 100 mm plinth) shall be free issued to the bidder from the following state wise store locations (store is maintained by existing telecom vendor of NEGG pipeline project of IGGL) –

- Store Maintained in District Darrang, Post Kharupetia in Assam State (Pin Code- 784115)
- Store Maintained in Agartala (West) in Tripura State (Pin Code- 799014)
- Store Maintained in Aizawl in Mizoram State (Pin Code – 796001)
- Store Maintained in Shillong in Meghalaya State (Pin Code – 793015)

Bidder shall take over the materials from the designated store locations of respective state. The material shall be handed over to the bidder in packed boxes without opening of the box. Bidder shall ensure the boxes are packed and packaging is not damaged before taking over of the materials from the store. All the works including taking over of the material from the store, transportation of material from store to respective site location, loading, un-loading, insurance, storage and safe-keeping of all the free issue materials shall with the bidder only. The cost of transportation, loading, unloading, insurance etc shall be included in the erection cost quoted by the bidder. Bidder shall coordinate with the existing Telecom Vendor for exact location of store and taking over of the material. All the responsibility of the free issued equipment shall be with the bidder till handing over of the system after successful commissioning andat the time of erection, testing or commissioning, if any damage, theft or any other problem is observed in free issued material, bidder shall be responsible for the same and shall rectify the problem as per the instruction of Engineer-In- Charge without any cost implication to IGGL/ MECON.

iv) All the responsibility for installation, integration, testing and commissioning of each free-issued Type-1 MPLS-TP equipment (with fully wired free standing rack) is included in scope of the bidder. All the works including supply and installation of all hardware and software required at both ends of integration for complete integration shall be provided by the bidder and is included in scope of the bidder. Bidder shall provide necessary patch cords (10 Meter) conforming to G.652D and G.655 standards for interconnecting systems with back bone fibre optic cable for all supplied and free-issued equipment.

v) Amplifier, DCM module, as required with SFP, attenuators, power supply, patch chords etc. as per site requirement and job specification shall be provided for all supplied and free-issued equipment

vi) All the works for transportation of the free issued equipment to the designated site of installation including safety, insurance etc. is included in scope of the bidder.

vii) The make and model of the free issue Type-1 MPLS- TP (10G) equipment is as follows –
Make – Tejas
Model – TJ1400

viii) Type-1 MPLS- TP (10G) equipment shall be installed at locations where Control room and UPS power supply is available. The integration of Type-1 MPLS- TP (10G) equipment shall be done with the existing MPLS-TP (10G) equipment of NEGG pipeline of IGGL. The make and model of the existing MPLS- TP (10G) equipment of NEGG pipeline of IGGL is as follows –
Make – Tejas
Model – TJ1400

The integration shall be done such that all the features of the existing MPLS-TP(10G) equipment is available in the new equipment (supplied as well as free-issued).Amplifier, DCM module, as required for integration shall be provided by the bidder and is included in scope of the bidder.

ix) 25% spare Ethernet ports shall be provided after consumption of all the ports for each application

x) To meet the manageability of respective equipment (all supplied and free-issued equipment), bidder shall integrate each supplied and free-issued type-1 MPLS-TP (10G) equipment with the existing NMS of MPLS-TP equipment of NEGG Pipeline Project of IGGL. The existing NMS of MPLS-TP equipment is provided at MMS, Guwahati, BMS-1, Numaligarh and BMS-2, Silchar stations of IGGL.Bidder has to hire the services of existing Telecom vendor of NEGG pipeline project of IGGL to carry out any works for integration, modification, testing in existing telecommunication system of NEGG pipeline project of IGGL. Bidder, on his own, shall not carry out any work in any of the existing system without the involvement of existing Telecom Vendor.

xi) The make of existing NMS software for MPLS-TP equipment is Tejas.

2.2.2. OFC based Type 2 MPLS-TP Equipment Telecom system

i) OFC based Type 2 MPLS-TP Equipment Telecom system, compatible to operate with ITU-T G-652D & G-655 fibre, configured and equipped with all specified interfaces and capable of supporting specified interfaces, shall be provided complete as per specifications.

ii) The OFC based MPLS-TP Type 2 equipment is required to be provided at locations where field mounted solar power supply system is being provided by the bidder. The stations where OFC based MPLS-TP Type 2 equipment is required to be provided shall be finalized during detail engineering and same shall be final and binding to the bidder. 2 Nos. MPLS-TP Type 2 equipment shall be provided at each such station and they shall also be configured in redundant configuration. However, required configuration shall be finalized during detail engineering.

iii) The Type 2 MPLS-TP Equipment shall be connected with other Type 2 MPLS-TP Equipment over 1G (Optical) Interface.

iv) Bidder shall utilize the existing clock for synchronization of the supplied MPLS-TP equipment.

v) In addition, MPLS-TP Type 2 equipment shall also be provided at locations where Type-1 MPLS-TP (10G) equipment are available (either existing or installed by bidder). The MPLS-TP Type 2 equipment at such locations shall be provided for integration of Type-2 MPLS-TP equipment with Type-1 MPLS-TP (10G) equipment. At these stations, the type-2 MPLS-TP equipment shall be installed in existing Telecom Panel of Type-1 Equipment and shall be integrated with the Type-1 MPLS-TP equipment over ethernet so that required data traffic is exchanged between the two types of equipment so as to provide redundant data

path for the data. The final philosophy for integration shall be finalized during detail engineering. Bidder has to hire the services of existing Telecom vendor of NEGG pipeline of IGGL to carry out any works for integration, modification, testing in existing system. Bidder, on his own, shall not carry out any work in any of the existing system without the involvement of existing Telecom Vendor.

vi) The Type-2MPLS-TP equipment shall be installed in the field at respective stations. Suitable fully wired explosion proof junction box shall be provided by the bidder for housing of Type-2 MPLS-TP equipment and the MPLS-TP type 2 equipment shall be installed in that explosion proof junction box. Separate junction box shall be provided with each MPLS-TP type-2 equipment and both the junction box shall be connected together to form 1 set of junction box. The size of the junction box shall be such that all the MPLS-TP type-2 equipment along with all accessories (such as SPD, MCB etc) shall be housed inside the JB and 20% spare space is available in the JB after installing all the components. The depth of the junction box shall be provided such that some gap is available between the junction box cover and Ethernet cable (as well as OFC patch cord) connected to the MPLS-TP Type 2 equipment (as well as any other material where ethernet cable is terminated). 2 nos. explosion proof breather shall be provided with each junction box.

vii) 48F LIU / FOPP (fibre Optic Patch panel) shall be provided at each station (where Type-2 MPLS-TP equipment is provided by bidder in the filed) for termination of 24F (all 24F as per G.652D) OFC. The 24F OFC shall be laid across the pipeline by other contractor. The LIU/ FOPP provided by the bidder shall be installed in the field at respective locations. Suitable fully wired explosion proof junction box shall be provided by the bidder and that JB shall be internally connected to the JB of MPLS-TP Type 2 equipment such that all the JBs shall together form a single assembly. The OFC shall be terminated on the LIU/ FOPP by the bidder as per the channeling plan finalized during detail engineering. If 48F LIU/ FOPP can be accommodated in the Type-2 MPLS-TP equipment junction box, then it shall be installed in the type-2 MPLS-TP JB and same shall be finalized during detail engineering. Decision of IGGL/ MECON in this regard shall be final and binding on the bidder.

2.2.3. Network Management System for Type 2 MPLS-TP equipment-

i) The Type-2 MPLS-TP equipment NMS Server shall be provided by the bidder at station as finalized during detail engineering, including all hardware and software as required as per the following -

a. To meet the manageability of respective equipment, bidder shall supply, install and commission new latest version of NMS system for monitoring of OFC Communications system parameters. Network Management System (NMS) shall comprise of the following-

- NMS Server (rack mounted) with all necessary hardware and software
- NMS Client Workstation with all necessary hardware and software
- CRCA computer console for MPLS –TP Client and chair
- Other Accessories etc. as defined in specifications and as required during detail engineering for complete scope.

b. The NMS shall monitor all critical system functions and provide warning of faults. NMS should have capability of monitoring the LASER transmitter power and receive power.

c. The NMS server shall have license for all the nodes supplied by the bidder. In addition, 25% spare licenses shall be provided for future addition of nodes.

2.2.4. Design, Detailed engineering including link budget as per the calculation has to be provided by bidder. OFC for the pipeline will be laid by other contractor and handed over to telecom vendor in healthy condition after end to end power testing upto FTC end. Telecom vendor has to do splicing and termination of OFC on FTC, Modify (if required) as per Telecom requirement as per the Network philosophy agreed with IGGL/MECON. Telecom vendor shall do power testing end to end of the fibre for the smooth operation on wavelength before taking over OFC for each sections / stations.

Any rectification work / modification required before handing over will be in other contractor's scope. However, if required, any rectification and restoration for any damaged / cut in laid OFC (fresh location not attributed to laying contractor) after taking over of OFC will be in bidder's scope and for this rate has to be quoted in the item provided in the SOR. These works include Identification of the fault, rectification, restoration, Power Testing of laid OFC, Earthing & readiness of OFC for telecom equipment.

2.2.5. IP- EPABX system

a. For providing voice communication, IP-EPABX system is existing for the NEGG pipeline of IGGL.

b. The make of existing IP-EPABX System is CoreIP, Model UCX 1000.

c. Following Phones should be provided-

- Explosion proof IP phone (with dual SIP)

Explosion proof IP telephone shall be provided as per the following philosophy –

- The explosion proof IP phones considered in the SOR are optional and shall be provided, if required by IGGL/ MECON. The requirement of explosion proof IP phone shall be finalized by IGGL/ MECON during detail engineering.

Each IP phone shall be provided with dual SIP license such that it can be used to call IP phones connected to EPABX .

d. All the phones should be integrated with the existing EPABX of NEGG Pipeline of IGGL. The existing IP-EPABX of NEGG pipeline of IGGL has been provided at MMS, Guwahati, BMS-1, Numaligarh and BMS-2, Silchar stations of IGGL. Complete integration of all the telephones supplied by the bidder should be carried out with the existing EPABX such that all the functionality present in the existing IP telephones should be available in the new IP telephones provided by the vendor. For integration purpose, all required configuration in existing IP- EPABX is the responsibility of the bidder and is included in scope of the bidder. Spare licenses available in existing IP-EPABX shall be used by the bidder for integration. Bidder has to hire the services of existing Telecom vendor of NEGG pipeline of IGGL to carry out any works for integration, modification, testing in existing system. Bidder, on his own, shall not carry out any work in any of the existing system without the involvement of existing Telecom Vendor.

e. The IP phones supplied by the bidder should be compatible with the existing EPABX. Responsibility of checking the compatibility of Explosion Proof IP telephones (which are to be supplied) with the existing EPABX system as well as Integration of the supplied items to the existing EPABX system will be that of bidder.

f. All accessories such as PoE injector, junction box, adapter, power supply converter etc as required for functionality and integration of each supplied phone shall be provided by the bidder.

g. All hardware and software as software as required for integration of all the new phones with existing EPABX should be provided by the bidder (at both ends) and is included in the scope of the bidder.

2.2.6. IP based CCTV system

a. IP based CCTV system is existing for NEGG Pipeline for operational & safety enhancements of respectivestations. New CCTV cameras should be provided for new facilities. The new CCTV cameras should support open architecture (ONVIF). The cameras in the plant should be high speed day night cameras with in-built IR illuminators.

b. The make of the existing CCTV Video Management Software is i2V Systems.

c. CCTV cameras should support normal recording (24 x 7) and recording based on Video Motion Detection (VMD).

d. CCTV cameras should record at 4ClF, 25 FPS and support a minimum resolution of 1920 x 1080 pixels.

e. The cameras should be day and night camera with inbuilt IR illuminator. The images should be clear and persons, objects should be able to be clearly identifiable on CCTV footages (of day time as well as of night time) for any investigation etc.

f. The new CCTV cameras should be integrated to the existing CCTV System. For integration of the new cameras, spare licenses available in the existing system shall be used by the bidder.

g. All the accessories such as PoE injector, media converter, LIU box, Junction box etc as required should be provided by the bidderfor each supplied CCTV camera.

h. All the accessories such as PoE injector, media converter, LIU box, Junction box etc as required should be provided by the bidder for integration of CCTV cameras in the field to the existing CCTV System.

i. Local storage at camera level shall be provided and the camera shall have removable memory card. The capacity of the card shall be designed to store minimum 3 days of data on FIFO manner. This storage shall be synchronised with CCTV NAS

a. Following CCTV cameras should be provided -

i. Weather Proof PTZ camera - The Weather proof PTZ camera should be provided as per following philosophy -

- 2 Nos. WP PTZ camera is envisaged in each station where Type-2 MPLS-TP equipment shall be installed. The camera shall be installed ateast 5 mtrs away from process area.

All the CCTV cameras supplied by the bidder shall be integrated with the existing CCTV servers of NEGG Pipeline of IGGL for viewing , recording and storage. All the cameras shall be integrated with existing CCTV server at MMS- Guwahati location. In addition, approximately 50% of the cameras shall be integrated with existing CCTV server at BMS-1, Numaligarh and approximately 50% of the cameras shall be integratedwith existing CCTV server at BMS-2, Silchar. However, the number of cameras to be integrated at each BMS location shall be finalized during detail engineering and project execution stage. Spare CCTV camera license available in each of the CCTV server shall be utilized for integration purpose. Also, all the cameras supplied by the bidder shall be integrated with existing CCTV Client workstation.

Spare space available in existing CCTV NAS storage of respective CCTV server shall be configured for storage of camera recording. Minimum 90 days data of each camera shall be stored. All the cameras shall be integrated with existing CCTV stoarge at MMS- Guwahati location. In addition, approximately 50% of the cameras shall be integrated with existing CCTV stoarge at BMS-1, Numaligarh and approximately 50% of the cameras shall be integrated with existing CCTV stoarge at BMS-2, Silchar. Spare space available in existing storage shall be utilized. All the works, including supply and installation of all hardware and software, as required for integration purpose at both ends is included in scope of the bidder. Complete integration of all the cameras supplied by the bidder should be carried out with the existing CCTV servers and client workstations such that all the functionality present in the existing CCTV system should be available in the new cameras provided by the vendor. For integration purpose, all required configuration in existing CCTV System is the responsibility of the bidder and is included in scope of the bidder. Bidder has to hire the services of existing Telecom vendor of NEGG pipeline of IGGL to carry out any works for integration, modification, testing in existing system. Bidder, on his own, shall not carry out any work in any of the existing system without the involvement of existing Telecom Vendor

2.2.7. Type 2 RTU

i) The Type 2 RTU is required to be provided at locations where field mounted solar power supply system is being provided by the bidder. The stations where Type 2 RTU is required to be provided shall be finalized during detail engineering and same shall be final and binding to the bidder. 2 Nos. MPLS-TP Type 2 equipment shall be provided at each such station and they shall also be configured in redundant configuration. However, required configuration shall be finalized during detail engineering.

ii) The Type 2 RTU of each station shall be connected with the Type 2 MPLS-TP Equipmentof that respective station over TCP/ IP links. 2 nos. of connection for LAN A and LAN B shall be connected, one with each type-2 MPLS-TP Equipment.

iii) The Type-2RTUshall be installed in the field at respective stations. Suitable fully wired explosion proof junction box shall be provided by the bidder for housing of each Type-2 RTU and the type 2 RTU shall be installed in that explosion proof junction box. The size of the junction box shall be such that all the MPLS-TP type-2 equipment along with all accessories (such as SPD, MCB etc) shall be housed inside the JB and 20% spare space is available in the JB after installing all the components. The depth of the junction box shall be provided such that some gap is available between the junction box cover and Ethernet cable connected to the RTU (as well as any other material where ethernet cable is terminated). 2 nos. explosion proof breather shall be provided with each junction box.

iv) All the field instruments(as per the P&ID including remote actuated valves) shall be connected to the RTU supplied by the bidder. For connection of field instruments, bidder's scope shall include supply and laying of cables from field instruments to RTU JB, glanding and termination (including ferruling, clamping etc) of all the cables of field instruments at RTU end, powering up of the field instruments, testing of field instruments from RTU and existing centralized SCADA(after integration).

v) 2 nos. RTU configuration and diagnostic software shall be provided by the bidder (with license) suitable for the configuration and diagnostics of all the RTUs. The software shall be supplied by the bidder and same is included in scope of the bidder. The software shall be installed in the existing SCADA PDT (laptop) of IGGL.

vi) Following security features shall be provided for incorporation at RTU level in addition to existing technical requirements:
   a. DNP 3.0 protocol with Secure Authentication
   b. Encryption/ Decryption

vii) RTU should be capable to bulk AO (writing): SCADA – RTU on DNP protocol, RTU To IED (FC) on Modbus RTU take AO all the around 10 gas composition parameter (as per AGA-3/8]

viii) RTU should have calculation features in it for defining RTU resident calculation points.

ix) Provision for whitelisting of 6 IP address (LAN A and B of 2 FEP Servers, PDUs) shall be provided in RTU

x) Interposing Relays shall be provided for each channel of DO card (including the spare and un-used channel)

xi) CYBER SECURITY REQUIREMENTS FOR RTU

The proposed RTU by the vendor shall have the following cyber security features from the outset.
Any licensed software or license required to meet the following cyber security features shall be provided by the vendor with the RTU –

a) DNP3 with Level – 2 & Above
b) DNP3 SAv2 or above
c) Cyber Security Standard IEC62351
d) RTU should be capable to bulk AO (writing): SCADA – RTU on DNP protocol, RTU To IED (FC) on Modbus [RTU take AO all the around 10 gas composition parameter (as per AGA-3/8] from SCADA and then buffer it and calculate total Gas composition to 100%, only then RTU should write to FC) which is in compliance of O&M maintenance policy.

e) User access control
f) Password complexity
g) Role Based Access Control
h) Patch management (The frequency of patches as provided by OEM shall also be indicated)
i) Should be able to restrict Master IP

xii) The RTU shall have the ability to attach to each analog and digital event signal a time tag to enable the occurrence to be recorded with a resolution of at least one second. For digital points the time stamp shall occur when the change of state is first noted before the denounce timer starts. For analogue and pulse accumulator points the time stamp shall be the time when the RTU analogue point is polled

xiii) The RTUs shall have a self-diagnostic features and software watch dog timer devices to monitor and report the healthiness of CPU, memory, power supply, communication interfaces and input/output modules at local level. Further the RTUs shall support remote diagnostics from MMS and BMS locations so that all these status shall be transmitted to SCADA and displayed in the RTU status graphic

2.2.8. Electrical System-

Following items and equipment shall be provided as part of the electrical system-

i. SPV based Solar Power Supply System including Flameproof ATEX/ CSA certified SPV solar Panels, MPPT Charger (Solar Charge controller), VRLA SMF Batteries, Explosion proof Junction Boxes, 230V AC to 24V DC SMPS, DC-DC converters, cables, explosion proof cable glands, connectors etc as required as per the tender.
ii. Supply of 2 years O&M spares for Solar power supply system as per the list provided in the TS of SPV system
iii. 230V AC Lighting distribution board (IP-65, weather proof & Flame proof) with Cu bus-bar (1 no- 32A 2P AC RCBO 30mA I/C, 5 nos- 10A DP MCB & 4 nos 16A DP O/G with indicating lamp) as per specification for normal power distribution. This distribution board shall be provided and installed in field for connection of all outdoor lights supplied by bidder. MCBs of suitable rating shall be provided in the distribution board along with 20% spare MCB. The size of the junction box shall be provided such that minimum 30% spare space is available in the junction box after all the MCBs are installed in the junction box.
iv. integral flame proof well glass fixture (CIMFR approved for Zone-1/2 gas group IIA & IIB) with 72 W LED luminaire with inbuilt flame proof control gear Model no. FLPW-1245 of Baliga make or equivalent) complete with mounting bracket, flame proof control gear box, lamps etc as per specifications, drawings
v. Street lighting pole 6mtr high GI octagonal pole (Type BOP-6030 of Bajaj make or equivalent) complete with bracket, GI clamps, FLP Cable glands, flame and weather proof (IP-65) junction boxes (4 way) as per standard drawing (MEC/SD/05/E9/77/04) & specification (MEC/TS/05/E9/077B).
vi. Solar Street lighting system complete with GI pole and GI mounting bracket, control gear box, internal cable from fitting to junction box, and min FLP WG LED fixture (PESO Approved), three days battery backup with VRLA battery with Ex-d FLP box (2x75 AH), Solar PV Module (2x100Wp) (for use in hazardous area as per Class 1, Div 2 / Zone-2),, earthing, electronics, charger, dusk-dawn operation, GI -pole (5 Mtr, with 80 Micron Galvanization) etc including pipe inserts for cables and connecting work, civil work and commissioning spares as required, with all material and labour as per specifications, drawings and instruction of Engineer-in- Charge.
vii. FRLS cables as per MR
viii. Ladder type GI cable trays as per MR
ix. GI wire rope for earth connection
x. Structural Steel for mounting of all supplied equipment

2.2.9. Special Tools & Tackles required for the supplied system shall be arranged by the bidder for erection & commissioning.

2.2.10. Mandatory Spare shall be supplied (for MPLS –TP , CCTV System with cameras, IP Exchange, Gateways, etc) as minimum requirements as per SOR. (Bill of Material has to be provided during detail engineering, any fraction quantity should be round off to nearest number in higher side). **Unit rate for Mandatory spares with cards**

details, part no., make etc shall be given separately during detail engineering. Mandatory spare shall be calculated as per the clause define in this PJS.

2.2.11. Dedicated advance maintenance free earthing at each station is in scope of bidder and it shall be dedicated for the system supplied by the bidder. Bidder shall supply and installall the items required for construction of earth pits. Earth connection from earth pits to respective equipment is also included in scope of the bidder.

2.2.12. Surge protection for incoming power supply & lightening protection for indoor Telecom equipment shall be in bidder's scope.

2.2.13. Preparation of SCADA database for all the signals of the supplied RTU is included in scope of the bidder. Bidder shall prepare and submit final terminal details along with final IO list for SCADA Database along with the FDS document and to be approved by IGGL/ MECON during FDS approval. However, the IO list shall be approved with remarks during FDS approval and the final IO list shall be prepared by the contractor during commissioning of RTUs. Any changes requiredin the IO list as per the site conditions shall be incorporated in the IO list and accordingly implemented in the RTUs during erection/ pre-commissioning activities. Any number of changes required in the SCADA database prepared by the bidder as per the requirement during execution and commissioning is included in scope of the bidder without any cost implication to IGGL/ MECON.

2.2.14. The complete integrated System (PV modules, Junction boxes for Solar charge controller & SMPS, Junction boxes for battery, Junction boxes for type-2 MPLS-TP equipment, junction boxes for Type-2 RTU) shall be installed as a single skid. Complete structural skid shall be fabricated by the bidder which should include the PV modules on the top, canopy for junction boxes and the junction boxes shall be installed beneath it. The design and document for the complete structural skid shall be provided by the bidder for approval during detail engineering and skid shall be fabricated as per the approved document.

2.2.15. Mandatoryrequirements for centralized SCADA for RTU

Following has to be considered while designing the RTU and integration with centralized SCADA of client. In case of any conflict; the requirement of client will prevail.

a. The RTU vendor shall inform client about product discontinuation one year in advance so that client can procure the spares of the RTUs to maintain it for its remaining useful life.

b. RTU should have event logging and buffering feature. In case of communication loss, RTU shall store the events in the buffer and transmit to Master Station on restoration of link.

c. RTU should have calculation features in it for defining RTU resident calculation points.

d. RTU should have surge/lightening protection for power supply & communication channel (AllEthernet and Serial ports includingspare port). Surge protector shall be provided for all input supply, serial and ethernet communication ports (including the spare ports) apart from the inbuilt surge if available on RTU.

e. RTU shall be interfaced with Centralized SCADA system without using any interfacing Device / Protocol convertor between SCADA server and RTU [RTU which is connected to field devices (hardwired IO, FC and GC) & SCADA directly].

Communication related aspects for RTU

a. RTU shall have dual Ethernet ports (configurable independently) for TCP/IP communication (IEC protocol, if mentioned, shall be ignored) with SCADA system on multi-dropped environment.

b. Both the communication port should support Class 0 and Class 1, 2, 3 polling from SCADA independently.

c. Serial ports should be independently and individually configurable at all respect.

d. It shall be possible to do configure / write IED interface in RTU for which necessary software tools shall be supplied.

e. For communication with IEDs through serial ports, the RTU shall support 16-bit, 32-bit, signed, unsigned, integer and floating point data type.

f. In case RTU software installation in PC or server requires additional software like Dot NET / Java etc, it should be declared and provided by RTU Vendor.

g. RTU configuration and diagnostic tool should be able to connect to RTU remotely over TCP/IP even during polling from SCADA FEP on same TCP/IP.

h. RTU configurator and diagnostic tool should have suitable software authentication like username and password.

i. RTU configuration and diagnostic tool should have provision to warm restart of RTU.

I/O points and RTU card related aspects

a) The Digital Output should be configured for pulse duration. No separate program or logic will be acceptable at RTU end.

b) On RTU restart/ power failure, RTU shall not reset the output circuit, shall not generate false control signal and cancel all pending control signal.

c) All the field / IED Paramaters should be configurable at the RTU end.

d) For each channel of AI, AO, DI and DO card, fused TBs of suitable rating has to be provided for termination of incoming cables from field/TIC panel. Loop/ Common fuse TB must not be provided and the same shall not be acceptable.

e) Each AI shall be wired in Sink mode configuration. However, if source mode configuration is required, the same will be decided during detail engineering.

f) Active Analog barriers have to be provided for each channel of AI and AO in the RTU.

g) RTU should be internally wired between IO cards and terminal blocks for all the IO points in all the IO cards (including spare) in the RTU.

Aspects related to RTU configuration and diagnostics

a) Licensed RTU configuration software (along with software CD) shall be supplied. RTU configuration software licenses shall be preferred in software (software key) form instead of hardware (dongle).

b) RTU configurator / diagnostic software shall have the following provision:

i. Index of all I/O along with present real time field data to be available in diagnostic software table/window.
ii. All RTU channels health points are to be configured in RTU and DNP/IEC index of same are to be reflected in I/O list and all serial ports should be independently configurable.
iii. Error detection/control feature to ensure data integrity.

c) RTU should have the utility for configuration and diagnostics through remote and local.

d) RTU should have diagnostic provision without uploading / downloading RTU configuration to PC/laptop.

e) The RTU should have diagnostic feature for hardwired IOs, DNP/IEC and IED communication.

f) RTU should be internally wired between IO cards and terminal blocks for all the IO points in all the IO cards in the RTU.

2.2.16. Based on the availability of site, bidder shall mobilize and de-mobilize the site team multiple times to complete the work. The cost for the same shall be included in the quoted prices of available SOR line item.

2.2.17. Sites being remote, Vendor to arrange/hire their own dedicated transport to site as and when required.

2.2.18. Installation, Integration, Site Testing, Trial Run & Commissioning (including all supply of installation materials, accessories, connectors, Distribution boxes, MDF, cables {FRLS armoured power cables, OFC, co-axial cable, multi-pair armoured & unarmoured telephone cables, Ethernet Cables}, pole { 3/6/8 mtrs as per site requirement} with shades & mounting arrangement for CCTV cameras, civil foundation for pole, Power testing of already laid 24 F OFC fiber, OFC connectors all work for MPLS –TP system, cameras, phones, electrical System, RTUs, warranty, Post warranty Maintenance as per all other items / work not indicated here but required for completion of the system).

2.2.19. Hardware supplied should be of latest model and should not be phased out / become obsolete before commissioning of the system. If the system gets phased out before commissioning then bidder has to replaced phased out hardware with new latest hardware having equivalent configurations

2.2.20. Scope of Site Services

In general, the activities given below are in the Vendor's scope at minimum.

- Obtaining relevant permits and approvals for site work.
- Obtaining entry passes and completing all the formalities for Vendor manpower (includes Contractor manpower).
- Distribution of AC/DC power within Vendor supplied system etc.
- Powering up of the system to complete commissioning.
- Loading/Checking of system configuration.
- Hardware/software additions / deletions / changes.
- Site Acceptance Test.
- Integration of various sub-systems, third party systems etc.
- Integration with existing Telecommunication system viz, MPLS-TP System, CCTV Syste, IP_EPABX System etc
- Integration with existing SCADA and APPS System
- Configuration including new channeling plan for main and back-up routes.
- Commissioning of systems and sub-systems.
- Tuning of the system.
- Availability of hardware/software engineers during warranty period.
- Generation of Over, Shortage & Damage (OS&D) reports as required and providing further necessary assistance to the Owner for insurance claims.
- Issue final reconciliation report for all the material used.
- After installation check all drawings for correct installation in accordance with the relevant drawings. Modify the site changes in drawings & bring all drawings to as built level. All changes to be documented and countersigned by the relevant engineer.
- Supply of temporary power during construction and commissioning phase if the Owner's supply is not available.
- Storage of telecom equipment

The specification covers the minimum requirements for the design, material, manufacturing, inspection, testing, supply, shipment and delivery to site, installation, SAT and trial run of complete supplied systems specified in this document. The description and requirements contained in this specification are concise by necessity and cannot include all details. However, it is the responsibility of the bidder to execute the job on a turnkey basis in accordance with the specifications and internationally recognized good engineering practices for smooth, safe and successful operation of telecommunication system

2.2.21. Design, Engineering, Supply, Installation and Testing of complete cabling system comprising of FRLS Armoured Power Cables, FRPVC Armoured Ethernet cables (minimum CAT 6), Armoured OFC (as required),

FRLS Armoured Telephone Cables, FRLS Signal cables, FRLS Control Cables, and FRLS armoured any other cable, all types of cable glands, as required complete in all respect as per the specifications, drawings etc.

2.2.22. Supply, Installation and Testing of all the erection hardware such as media converters, cable trays , supports, poles, structural steel, LIU etc., any other items required during erection, complete in all respect for the supplied system and as the specifications, drawings etc.

2.2.23. All necessary works (minimum civil, trenching, backfilling including end to end power testing etc.) for Rectification & Restoration of already laid Optic Fiber Cable during trial run if required.

2.2.24. Bidder shall provide Channelling plan to include all the requirements of Telecommunication facilities specified in the tender for MPLS –TP , CCTV system & Cameras allocations, various phones, for RTU LAN A & LAN B channel including all software and hardware to realise the system in totality.

2.2.25. All equipment shall be protected with all type of voltage fluctuations. Surge protection device for the power and communication shall be considered both internal and external type confirming to IEC or UL standards. Surge Protection devices shall be provided as per following philosophy-

- For all incomer power supply to each supplied Type -1 and Type-2 MPLS-TP equipment
- For all incomer power supply to each Type-1 and Type-2 RTU
- For each camera
- SPD for each Explosion proof IP phone

Surge Protection

All outdoor telecommunications structures shall be protected against lightning. Equipment shall have protection against hazards to personnel safety, system errors and hardware damage resulting from electrical transients, voltage surges and lightning surges on signal and power circuits.

2.2.26. Furniture - CRCA Computer Console (as per the specification)andexecutive chairs shall be provided with each workstation.
1 No. CRCA Computer Console shall be provided for each WorkstationSupplied by the bidder. 2 Nos. Chairs shall be provided for each WorkstationSupplied by the bidder.

2.2.27. There shall be designated interfaces between telecommunication systems and other discipline systems. The interfaces shall be determined during the detailed design phase of the project. Telecommunication interfaces involving information interchange shall make use of TCP/IP for this purpose, wherever possible.

2.2.28. The scope of job includes excavation in all kinds of soils including hard soils for cable trenches of 800 mm deep & width as per the site requirement, Supply & laying of sand of 150 mm compacted thick in two layers (75 mm below the cable & 75 mm above the cable) as directed at site, Supply & laying of good quality Class-1 red bricks of standard size (min 200 mm length and min crushing strength 35 kg/cm sq) inside the cable trench as directed at site, backfilling the cable trench & providing cable route markers at every 30 m & at all corners as directed at site, etc complete as required for completion of whole job. The complete requirement as contained in the Bid Document shall be executed on turnkey indivisible works contract basis.

2.2.29. All the power supply to each Equipment shall be provided with Miniature Circuit Breakers (MCB) of required capacity.

2.2.30. Any item, which is not in BOM but required for commissioning/operation of the system, should be supplied by Vendor free of cost.The cost of the same shall be considered included in the quoted price of the available SOR items.

It is not the intent of Purchaser to specify every piece of equipment/item/ work but nevertheless any item / work not specifically mentioned but required as per Good Engineering Practice and for the safe & trouble free operation of the Telecom system deemed to have been specified & shall be in the scope of Bidder without any implication in the price or schedule. Any work required necessary to complete the interfacing during engineering / site installation commissioning shall be in bidder's scope. The quantities and the locations are likely to change, and shall be finalised during detailed engineering / execution. Bidder shall take prior approval before procurement or Installation from IGGL/ MECON.

2.3 SPARES:

Supply of Mandatory spares and Commissioning Spares of all supplied equipment shall be provided as per the following:

a) <u>MANDATORY SPARES</u>

For calculation of mandatory spare, statewise quantity shall be considered and accordingly, state wise mandatory spare shall be provided. 10% or min one number (Whichever is higher) of modules and equipment (out of the modules / equipment supplied / provided) in the MPLS-TP System (both Type-1 and Type-2), Solar Power supply System, RTU (both Type-1 and Type-2) shall be supplied as mandatory spares. For solar power supply system, the PV module and batteries shall not be considered under mandatory spare and only charge controller, SMPS shall be considered under mandatory spare. Module / equipment of each type, for all types of cards / modules used in their system / sub-system including cross connect unit, optical interface card, SFP module, Ethernet interface card, gateways, extension cards, interface cards, various types of cameras with IR lamps, media convertors, power supply convertors, patch connectors, Ethernet managed switches, surge protection devices, etc. shall be supplied as mandatory spare but shall not include hardware like hard disk, disk drives, visual display unit, junction boxes, batteries etc. The spare shall be provided as part of base quote and shall be supplied as loose items.CCTV cameras full equipment shall be considered as spare, state wise. **In case total installed cards are 1 or 2 then only one spare card shall be provided. Bill of material (with spare calculation) must be furnished along with offer.**
If separate cards are not provided in any equipment (MPLS-TP, Solar power supply System, RTU etc), then complete equipment shall be provided as Mandatory spare.

A. For Telecom, Full equipment shall be considered as spare for the following-
- CCTV cameras of each type
- Ethernet Switch of each type
- Surge Protection Device of each type
- Media converters
- SFP module of each type
- power supply convertors of each type
- patch connectors
- MCBs
- Terminal Blocks of each size
- Power supply for cameras

B. For RTU, following shall be provided as Mandatory Spare (however, if separate cards are not provided in RTU, then full RTU equipment shall be provided under Mandatory Spare) –

a) CPUcards
b) PowerSupplycards , power supply converters
c) AICards
d) DICards
e) AOCards
f) DOCards along with interfacing relays and relay boards
g) All NetworkSwitches (supplied with RTU or supplied loose)
h) OEM Termination CABLES , pre-fab Ethernet cables
i) Termination board
j) Back pane &RTU chassis
k) Surge protection device of each type
l) Ethernet Cards, DNP cards etc (wherever supplied)
m) Terminal Blocks (each type)
n) Network Communication Card, MODBUS Communication Card
o) MCBs
p) Consumables like fuses etc.

q) Any item required but not specified above

C. For Solar Power Supply System, following shall be provided as Mandatory Spare (however, if separate cards are not provided, then full module shall be provided under Mandatory Spare)
   a) SMPS of each type
   b) Solar charge controller of each type

The above spares are not applicable for all Servers, Telephones, monitor, Workstations, printer, Video Monitor. Spares shall be provided from the same manufacturing facilities/location from where the respective equipment, subsystems are offered.

In case when the quantity of mandatory spare comes out in decimal number, the next highest integer number shall be considered for quantity. For example, if the quantity of mandatory spare of any item comes out as 2.1, 3 Nos. shall be considered as quantity of mandatory spare for that item.

100 % spares shall be provided for consumables e.g. fuses, lamps, plugs, clamps etc. consumable for Power systems etc.

For spares Vendor shall provide the address, contact person, fax and telephone numbers of the manufacturer for spare parts. The vendor shall warrant that spare part for the system would be available for minimum of 10 years after warranty period from the date of system commissioning. After this period if the vendor discontinues the production of the spare parts, then he shall give at least 12 months notice prior to such discontinuation so that Owner may order the requirements of spares in one lot.

The Vendor shall provide unit price of each Spare Module card, which shall be valid for the procurement of the spares for operation and maintenance in subsequent 10 years as & when requested or during detailed engineering.

b) <u>COMMISSIONING SPARES:</u>

The commissioning spares shall be arranged by the vendor to cater to the needs/requirement during installation, commissioning, site acceptance testing, trial run and warranty period. These spares shall be readily available with the vendor. If the spares not used they may be retained by the vendor for maintenance.

These commissioning spares are different from Mandatory spares and vendor shall not use mandatory spares as commissioning spares. Vendor shall provide a list of commissioning spares (with Serial & Part number for each system, sub-system) at the time of offer and it will be part of main offer. However, any additional spares required during commissioning shall be supplied by bidder at no additional time and cost to Client / Owner

Bidder shall provide warranty& commissioning spares and consumables mandatorily as part of Lump sum quote. It is Bidder's responsibility to ensure the adequacy & completeness of the spares & consumables and supply the spares & consumables as required during the commissioning period. The spares & consumables shall be arranged by the bidder to cater to the requirement during installation, pre-commissioning, site acceptance testing, trial-run and commissioning. It shall be obligatory on the part of Telecom vendor to modify/ upgrade, rectify any hardware problems in the system or replace any hardware component in the supplied equipment's during installation and commissioning and operation & maintenance of the Telecom system. The spares and consumables shall be readily available with the bidder and the bidder shall built-up the cost for commissioning spares & consumables required for complete telecom system as part of initial bid itself and separate list of these spares is required to be provided as part of their proposal. Any additional spares required during commissioning shall be supplied by bidder at no additional time and cost to Client / Owner. The consumables during installation & commissioning shall be adequate and complete, and shall include as a minimum USB Hardisks, DVDs, CDs, fuses, plugs, clamps, lamps as required for the telecom equipment's, printers, workstations and servers.

Bidder shall handover unused commissioning spare toIGGL after completion of warranty and extended warranty period (as per the tender). Bidder shall provide separate list for commissioning spares.

3. QUALITY ASSURANCE PROGRAMME AND IMPLEMENTATION METHODOLOGY

- This shall include but not limited to preparation of detailed quality assurance programme, quality control parameters for equipment manufacturing and implementation of the systems, preparation of implementation methodology covering schedule of supply, installation, testing and commissioning. The Equipment/System design has to be approved by IGGL/MECON before actual manufacturing/supply of the equipment.

- IGGL/MECON shall carry outFactory Acceptance Test (FAT) and Integrated Factory Acceptance Test (IFAT) for the offered system/equipment. Vendor shall make necessary arrangement for the testing of the same in presence of Owner's representatives before the dispatch of materials to the sites. Subsequently, vendor shall take up the installation and commissioning of the equipment / system at site.

- Upon successful completion of installation of the equipments / systems at sites, Site Acceptance Tests (SAT) shall be undertaken. SAT plan shall be proposed by vendor and approved by Engineer-in-charge. After successful completion of SAT of all supplied equipments/items, Test run shall be conducted.

- For FAT, IFAT, SAT & Test Run, vendor shall also adhere to the instructions as specified under "Inspection & Testing Guidelines" mentioned below.

4. TEST CATEGORIES

The following tests (in the same sequence) shall be conducted for acceptance of all the supplied equipment and the system before final acceptance of the system.

1. Pre-Factory Acceptance Testing,
2. Factory acceptance Testing (FAT)
3. Integrated Factory Acceptance Testing (IFAT)
4. Pre-commissioning Test (after installation) for total integrated system.
5. Site Acceptance Testing. (SAT)
6. Trail Run.

A detailed procedure for FAT, IFAT, SAT shall be provided for approval as a minimum requirement for a system. IFAT and SAT requirements for individual sub systems shall also be provided. Where possible the Owner prefers a FAT and IFAT at one location for checking the functionality of telecommunications system in totality.
These tests shall be carried out on all equipment supplied by Bidder. Bidder shall arrange all necessary test instruments, manpower, test-gear and accessories for FAT, IFAT and SAT
All technical personnel assigned by Bidder shall be fully conversant with the system specifications and requirements. They shall have the specific capability to make the system operative quickly and efficiently and shall not interfere or be interfered by other concurrent testing, construction and commissioning activities in progress. They shall also have the capability to incorporate any minor modifications/suggestions put forward by IGGL/ MECON.

4.1 INSPECTIONS AND TESTING GUIDELINES:

i. TEST PLAN :

For all types of inspection & testing under FAT, IFAT, SAT & Test Run vendor shall prepare and submit Test Procedures & Plans to IGGL/MECON for their approval. The Test plans & procedures need to be submitted well in advance before the commencement of actual testing. The procedures/plans shall include time schedule for the tests, purpose/objective of test, test set-up schematic, required test equipment, identification of test inputs, test procedure and details of desired output/test result, a column for actual value obtained during the tests and remarks on test result.

ii. TEST REPORT:

The observations and tests results obtained during various tests shall be compiled and documented to produce Test reports by the Vendor.

The Test reports shall be prepared & submitted for each equipment/ item and the system. The report shall contain the following information as a minimum:

- Unit/Equipment under Test
- Test equipment used
- Test conducted.
- Test procedures.
- Test results.
- Remarks & comparison of tests results with the anticipated test result as given in test plans and reasons for deviations if any.

iii. IGGL and/ MECON or third party/agency (appointed by IGGL), reserve the right to inspect and test each equipment at manufacturing / supplier premises and at site during the installation & commissioning of the system. The inspection and testing shall include components, sub-assemblies, produced units for verifying and testing their guaranteed performance & specifications.

iv. It shall be explicitly understood that under no circumstances shall any approval of IGGL/MECON or his representative shall relieve the Vendor of his responsibility for material design, quality assurance and the guaranteed performance of the system and its constituents.

v. Vendor shall inform the owner, at least 14 days in advance of the date at which the system would be ready for Inspection & Testing. All relevant documents and manuals shall be submitted to IGGL /MECON before the time for factory inspection and testing.

vi. Bidder shall arrange all that is required e.g., quality assurance, personnel, space, test gear for successful carrying out of the job by the Owner/Consultant, at Bidder's cost, at the Bidder works.

vii. IGGL /MECONshall have free entry and access to all parts of the Bidder's facilities associated with manufacturing and testing of the system at any given time.

viii. Owner or his representative shall, after completion of inspection and testing to their satisfaction, issue inspection certificates to release the equipment for shipment. No equipment shall be shipped under any circumstances unless a inspection/ inspection waiver certificate has been issued for it, unless agreed otherwise by IGGL /MECON

- Vendor shall arrange sufficient manpower of required skill and material for implementation of new equipment & associates systems/items at sites. All technical personnel assigned by the Vendor shall be fully conversant with the system specifications and requirements. They shall have the specific capability to make the system operative efficiently and shall also have capability to incorporate any minor modifications/ suggestions put forward by the owner.

- Till IGGL/MECON accepts the system, a log of each and every failure of components shall be maintained. It shall give the date and time of failure, description of failed component, circuit, module, component, effect of failure of component on the system/ equipment, cause of failure, date and time of repair, resolution of fault, mean time to resolution etc.

  Repair/modification done at any point of time at one site shall be carried out by bidder at all the sites. Detailed documentation for the same shall be submitted to Owner for future reference

  If the malfunctions or failures of a unit/module/sub-system/equipment; repeat during the test, the test shall be terminated and Vendor shall replace the necessary component or module to correct the deficiency. Thereafter, the tests shall commence all over again from the start.

  If after the replacement, the equipment still fails to meet the specifications, Vendor shall replace the equipment with a new one and tests shall begin all over again.

If a unit/sub-system/module has failed during the test, the test shall be suspended and restarted all over again only after the Vendor has placed the Equipment back into acceptable operation. Owner's approval shall be obtained for any allowable logistics time required to replace the failed component/unit/module/sub-system.

Readjustments

No adjustments shall be made to any equipment during the acceptance tests. If satisfactory test results cannot be obtained unless readjustments are made, Vendor shall carry out only those readjustment needed to ready the equipment/system for continuance of tests. A log of all such adjustments shall be kept giving date and time, equipment, module, circuit, adjustments, reasons, test result before and after adjustment etc. Fresh acceptance tests shall be conducted after the readjustments have been completed.

4.2 Pre Factory Acceptance Testing (FAT)

The vendor on his own exactly in line with approved FAT / IFAT shall conduct pre-factory acceptance testing and test reports along with photographs for the same shall be forwarded to Owner/Engineer before start of IFAT/FAT.
Pre factory acceptance tests shall be carried out after review and approval of IFAT/FAT procedure/documents as per requirements.

4.3 FACTORY ACCEPTANCE TESTING (FAT):

Factory acceptance tests shall be carried out after review and approval of FAT procedure/documents as per tender requirements and review of Pre-Factory acceptance results & shall be conducted at the OEM's facilities.

The factory acceptance testing shall be conducted in the presence of the representative Owner. The tests shall be carried out on all individual systems/items including those supplied by Sub-vendors. After completion of FAT, factory acceptance certificates shall be issued. The FAT shall include but not be limited to:

(i) Equipment Testing:

- Mechanical checks to the equipment for dimensions, inner and outer supports, finishing, welds, hinges, terminal boards, connectors, cables, painting etc.
- Electrical checks including internal wiring, external connections to other equipment etc.
- Check for assuring compliance with standards mentioned in the specifications.
- Individual check on each module/sub-assembly as applicable
- Checks on power consumption and heat dissipation characteristics of various equipment.
- Functional testing covering the features & functions of new systems/equipment along-with its associated items
- Any other test not included in FAT document but relevant to the project as desired by the Owner/Engineer at the time of factory acceptance testing.

(ii) System Integration Testing:

Functional and performance test of the all supplied systems/equipment under their respective integrated setup to provide required facilities/functionalities as per tender requirement shall be conducted as approved procedure of IGGL/MECON. The details of integrated setup will be finalized after the award of contract.

Following equipment shall be included as a minimum for FAT (by owner / Consultant) at Integration centre:-
All MPLS –TP equipment along with NMS.

4.4 Integrated Factory Acceptance Testing (IFAT)

The vendor shall conduct integrated factory acceptance testing (IFAT).

Separate IFAT shall be conducted for Telecom System and RTU System. The IFAT for Telecom System shall be conducted at the integration centre of the Telecom Vendor and IFAT for RTU System shall be conducted at the integration centre of the RTU Vendor or at any other integration centre proposed by the bidder. The IFAT for solar system can be conducted at integration centre of Telecom vendor or RTU vendor or entirely at another location proposed by the bidder and same shall be finalized during detail engineering.

In addition to the above, inspection of all other electrical system equipment shall be carried out as per the QAP / documents approved during detail engineering.

Integrated Factory acceptance tests shall be carried out after review and approval of IFAT procedure/documents as per requirements and review of PRE-Factory acceptance results.

The integrated factory acceptance testing shall be conducted in the presence of the Owner/Consultant. All OEM representative as required shall be present during inspection.

For IFAT of the Telecom system, following equipment shall be included as a minimum for IFAT and shall be available at the IFAT facility during IFAT:-

I. All MPLS- TP equipment fully wired in rack/ junction boxalong with NMS and workstation
II. All CCTV cameras.
III. All Telephones with all Telephones Gateways, Acoustic Booth, Howler and Beacon
IV. All Test Instruments
V. All consoles
VI. All the Racks/ junction box in fully wired condition
VII. Cables
VIII. Any other equipment not mentioned above but supplied by the bidder

For IFAT of the RTU system, following equipment shall be included as a minimum for IFAT and shall be available at the IFAT facility during IFAT:-

I. All RTU fully wired in the junction box
II. All the Racks/ junction box in fully wired condition
III. Cables
IV. Any other equipment not mentioned above but supplied by the bidder

For IFAT of the Solar Power Supply System, following equipment shall be included as a minimum for IFAT and shall be available at the IFAT facility during IFAT:-

I. All PV panels
II. All Solar charge controllers fully wired with junction box
III. All batteriesfully wired with junction box
IV. All SMPS
V. Cables and connectors
VI. Any other equipment not mentioned above but supplied by the bidder

All the above mentioned items shall be available during IFAT at the place of conduction of IFAT. It is the responsibility of the contractor to ensure that all the items are available at the testing facility location before raising the call for IFAT.
For IFAT, all the MPLS –TP , RTU and servers shall be installed and wired in the respective racks/ junction box. The pre-iFAT testing shall be conducted by the contractor in the wired racks/ junction box itself and the reports along with photographs shall be submitted to IGGL/ MECON for review before raising call for IFAT.

5. INSTALLATION, TESTING AND COMMISSIONING:

5.1 Installation

1) After successful completion of integrated factory acceptance testing (IFAT) of new equipment and associated items, they shall be sent to site for installation. Any equipment/associated item without factory acceptance certificates shall not be acceptable at site.

2) IGGL/MECON will provide dark fibre and space for installation and commissioning of new equipment along with associated systems/equipment at sites.

3) For the installation of supplied new equipment & associated items etc at site(s), the vendor shall carry out the following site preparation works as a minimum:

- Installation & fixing of equipment rack / equipment (as per availably) for housing new equipment & associated items along with restoration of floors or walls after masonry or drilling works, as required.
- Installation of suitable type of cable trays / conduits as required for routing, distribution & extension of various cables. These cable trays/conduits shall be installed / mounted suitably in vertical or horizontal planes keeping in view of the aesthetics of equipment room.
- At locationsof Type-1 MPLS-TP equipment and Type-1 RTU,power will provide in the electrical rooms adjacent to telecom rooms. Vendor shall supply, install, test & commission panel meeting the technical specification of tender document, at these un-manned locations in electrical rooms. Vendor shall carryout all required activity related to laying, routing, conducting, termination, dressing, saddling, hole-through in walls, labeling etc for extension of power cable from electrical rooms to telecom rooms at all sites. At all such locations, for extension of power, power cable of minimum **2 core 4sq.mm** armoured power cable (Cu) shall be used by the vendor.
- AC power at server locations, Power from Power Distribution Board to vendor supplied equipment & associated systems should be extended using minimum 4 sq.mm armoured power cable.
- All types of power cable termination and earth cable termination shall be carried out using copper lugs.
- New earthing pit and earthing shall be provided.
- Each system/equipment sub-rack shall be provided with Anti static wrist warp.
- Suitable gland shall be provided for all cabling.
- All types of cables shall be labelled on both ends for the identification.

4) Remote & Centralized Management of vendor supplied new Telecom equipment & associated telecom systems shall be provided at respective sites. For the same, the necessary supply, installation & commissioning of NMS system(s) [Hardware & Software] shall be carried out by the vendor at sites (within Telecom room) along with the extension & integration of management channel between MPLS – TP equipment at pipeline stations and NMS locations (at Sites). This job shall involve all the required cabling, routing, fixing, termination of new transmission equipment & NMS system(s) at site & required network integrating locations.

5) Before taking up the installation of new equipment & associated systems, the same shall be checked for completeness as per the specifications of the same as required for a particular station. Installation shall be carried out in accordance with the installation manuals and approved installation drawings in the best workmanship.

6) Vendor shall provide suitable numbers of manpower of required skills & technical expertise at his own cost for completing the work within the stipulated time frame.

7) Vendor shall bring all installation tools, accessories, special tools, spares parts etc. at his own cost as required for the successful completion of the job. Vendor shall include all installation materials required for proper installation of the new equipment & associated systems. These shall include but not be limited to, all connectors, inter-bay and inter equipment cables, power supply cables and connectors, power distribution boxes, anchoring bolts, nuts, screws, washers, main distribution frames, junction boxes etc.

8) The installation of equipment shall be done as to present neat and clean appearance in accordance with approved installation document drawings. All inter bay, power supply and other cables shall be routed through cable trays. No cable shall be visible. All through wall openings, trenches etc. shall be properly sealed by proper sealing compound (such as filo-foam) to prevent the entry of rodents, insects and foreign materials. Plaster of Paris (POP) shall not be used for sealing and shall not be acceptable.

9) If during installation and commissioning, any maintenance is undertaken, the maintenance spares supplied with new equipment & associated systems shall not be used for the maintenance. Vendor shall arrange his own spare parts for such activities till the system has been finally accepted by the Owner. A detailed report & log of all such maintenances shall be made available by the vendor to Owner/Engineer and shall include cause of faults and maintenance details.

10) A detailed time schedule for the activities to be undertaken shall be submitted by Vendor to Owner/Engineer to enable their representatives to be associated with the job.

5.2 Pre-Commissioning

1) Upon completion of the installation/erection of equipment, they shall be jointly inspected by Vendor &IGGL/ MECON representatives before start-up operations are undertaken. The correctness and completeness of the installation as per manufacturer's manual & approved installation documents shall be gauged leading to pre-commissioning activities at site.

2) Vendor shall carryout necessary provisioning/configuration/integration of newly installed equipment/systems as per site-wise equipped configuration detailed at desired sites/locations and their integration with respective existing system.

3) During pre-commissioning, if any fault occurs to any new equipment/associated system/item, vendor shall identify the same and provide report/history of all faults to the Owner.

4) During installation and pre-commissioning of the new equipment & associated systems, vendor shall have enough number of commissioning spares so that the installation is not held up because of non-availability of commissioning spares. Vendor shall ensure that the spares meant for operation and maintenance is not used during installation and commissioning.

5.3 SITE ACCEPTANCE TEST (SAT)

1. On completion of Pre-commissioning & integration of new equipment, the Site Acceptance Testing (SAT) shall be conducted by the vendor for the new equipment & network as per approved SAT procedure under the presence of Owner/Engineer.
2. SAT shall be conducted separately for each station on pro-rate basis. Based on the readiness of the system, SAT shall be conducted for each station separately.

For carrying out test/inspections & measurements during SAT, The vendor shall arrange all required calibrated test equipment / instruments, tools / tackles and skilled, trained & competent manpower.

SAT shall include but not be limited the following:

- Checks for proper installation as per the approved installation drawings for each equipment & associated systems/ items.

- Functional testing covering the features & functions of new equipment along-with its associated systems/ items to meet site specific requirements.
- Testing of supplied Spares modules / cards
- Any other test not included in SAT document but relevant for site operation

5.4 NETWORK STABILITY TEST

Upon completion of the site acceptance testing (SAT) of equipment & facilities at site, Network Stability Test will be conducted for a continuous period of 72 hours.

5.5 TRIAL RUN:

Upon successful completion of the Network Stability Test, vendor shall keep the all the supplied equipment & facilities commissioned for 30 days for 'TRIAL RUN' to monitor them for 30 days.

During this period, vendor shall provide all specialist Engineers & Technicians including experts at all NMS locations, so as to maintain the total log, incidents, failures & for assisting site engineer & for total co-ordination. However, the normal operation and maintenance of the system shall be performed by the personnel of the Owner trained for the purpose.

If during 'Trial run' any defect is noted in the system, the vendor shall rectify, replace the same to the satisfaction of IGGL. The decision to repeat the final test or restart the 'Trial' shall be of IGGL depending upon the severity of the defect.

During trial run, if any fault occurs to any equipment of system, vendor shall identify and rectify the same and provide report, history of all faults to the Owner.
Ideally, during the Trial run, no shutdown of the system due to failure of equipment should happen. A record of all failures shall be kept for each manned/unmanned station and the availability of the system shall be calculated and accordingly, results shall be submitted by the vendor to IGGL.

If the system fails to come up to the guaranteed performance, the Vendor, within a period of thirty (30) days shall take any and all corrective measures and resubmit the system for another 'Trial Run'. All modifications, changes, corrective measures, labour etc. shall be at the cost of the Vendor. In case the date of completion for the second trial run exceeds the time schedule for the project, he shall be liable to pay liquidated damages. If the system fails to reach the guaranteed performance even after the second trial run, the Owner shall be free to take any action as he deems fit against the Vendor and to bring the system to the guaranteed performance with the help of third party at the expense of the vendor.

5.6 COMMISSIONNING:

The new supplied system and associated equipment/system of pipelines shall be considered to be commissioned and taken over, only after successful completion of their Trial run. However, the takeover by owner shall not be delayed for non completion of minor works and such jobs which do not affect the normal operation of the system, and such works/ jobs shall be completed by the vendor in accordance with the plan / schedule, which has been approved by the Engineer–In–charge. The date of successful completion of Trial run shall be treated as the 'Completion Date'/ 'Date of commissioning and handing over' for such purpose as application of contractual provisions such as 'Price reduction schedule for delayed completion' etc.

5.7 SPECIAL TOOLS AND TACKLES

Vendor shall arrange the special tools and tackles for the commissioning and maintenance of the complete supplied system.

6. WARRANTY, EXTENDED WARRANTY, POST WARRANTY MAINTENANCE

6.1 The system shall be guaranteed to give specified performance of 99.99% for a period of 24 months (two years) from the date of acceptance of the system. This warranty shall survive inspection of goods and acceptance of the system.

6.2 Bidder has to quote Extended Warranty **per month**. The Main warranty is for period of 24 months (two years) from the date of successful completion of trial run and acceptance of the system by the owner. All materials will be considered in custody of contractor with applicable conditions of warranty till successful completion of trial run and acceptance of system by owner / handing over of the complete system to the Client. After the completion of trial run and acceptance of system by owner / handing over of the complete system to the Client, Main warranty of the System (for 24 months) shall start.

6.3 However; bidder has to quote Extended Warranty per month. The Extended warranty shall be applicable for thecomplete scope of supply including mandatory spares and Test equipment. The extended warranty per month rate will be used to allow the contractor to provide and intact the main warranty for the delayed commissioning & handing over of system not attributed to contractor, so that the Main warranty (i.e. 24 months) is made available on successful completion of trial run/ acceptance of system by owner / handing over of system. After the completion of trial run/ acceptance of system by owner / handing over of the complete system to the Client, Main warranty of the System (for 24 months) shall start. All the clauses of warranty shall be applicable during extended warranty also.

6.4 In case if any work is not completed till 26 months from FOA; Extended warranty will start for all the supplied, commissioned system so that the main warranty is intact for 24 months from the date of acceptance of system after commissioning & handing over to IGGL. Date of successful completion of trail run shall be considered as the date for commissioning & handing over to IGGL.The extended warranty of the complete supplied system including all components of SCADA & APPS System, Telecommunication System, Electrical System etc. will start after 26 months from FOA and shall continue till the start of main warranty; payment of extended warranty shall be as per the rates quoted by the bidder

6.5 In case of delayed supply attributable to bidder extended warranty will start after adding delayed period of last supply to completion schedule for which cost of warranty/extended warranty is to be borne by bidder.

6.6 Start of extended warranty per month is to be intimated by the bidder and will be confirmed by the client / PMC.

6.7 The Extended warranty rates shall be for the complete scope of supply including mandatory spares and Test equipment.

6.8 Payments will be made monthly/quarterly as per SOR rate quoted by the bidder and will continue till hand over of the system. The Extended warranty rates shall be for complete scope of supply including mandatory spares and Test equipment and to be billed as per SOR.

6.9 Contractor’s engineers/ technicians, capable of trouble shooting & looking after the health of the system during the Warranty period/ Extended warranty, shall be made available on call basis all through the period of 24 months.

6.10 During the Warranty / Extended Warranty, the vendor shall use his own instrument, spares, man-hour, communication facilities, hardware, software, materials, etc. for the rectification of any problem.

6.11 **WARRANTY, EXTENDED WARRANTY:**

Contractor's engineers and technicians, capable of trouble shooting and looking after health of system during the warranty period, shall be made available, on call basis, all through the period.

Additionally the following shall also apply:

a) During the warranty, the vendor shall use his own instrument, spares, man-hour, communication facilities, hardware, software, materials, etc. for the rectification of any problem.

b) The "turnaround time" for the rectification of the problem shall be minimum. The owner envisages that the system, due to built in redundancies, shall always be operational. The owner shall be within his powers to impose penalty for complete break in communications system for more than the designed specifications. The same shall be discussed on award of work.
(Turnaround time: From the time of placement of first service call to vendor's representative until the system is restored fully to the satisfaction of the Owner.)

c) The vendor shall provide trained engineers and technicians on site during warranty maintenance.

d) The bidder shall be responsible for proper design, quality, workmanship & maintenance of all equipment, accessories etc. supplied by the bidder including all services, spares and consumables for a period of 24 months (warranty period) after taking over the system at site, for meeting the functionality and performance requirements of this contract. To fulfil the same, it shall be obligatory on the part of bidder to modify/upgrade, rectify any hardware problems in the system or replace any hardware from the supplied equipment and modify/upgrade, rectify the operating system software, Equipment software, other software, supply the required spares and consumables and attend to the troubleshooting & maintenance of the complete system, free of cost, during start up and on-line operation & maintenance of the system, within the Warranty period. Any modifications/ up gradation or replacement of any hardware & software during warranty shall not affect the performance & functionality of the system. In addition to this bidder will also have to carry out the updation/ change in setting based upon the input received from client or through their own analysis tools. To do corrections/ modifications/ diagnosis from remote, internet connection can be provided by client, if required.

e) Any modification in Supplied Type-1 MPLS-TP equipment and Type-2 MPLS-TP equipment including changes in cross connects, bandwidth allocation, network drawing, ethernet channelling plan etc. as required as per the site in-chargeincluding addition of future telecom equipment (supplied by same party or other contractor), addition of new nodes (for Type-2 MPLS-TP equipment), any modification in supplied RTU including addition of signals, changes in configurations etc. , as required to meet operational requirements, across all telecom & allied systems supplied by vendor, shall be carried out by the vendor during warranty & PWMC period without any cost implication to IGGL/MECON. In addition to this, during warranty and PWMC period, software patches, OS, firmware, OEM supplied licences, updation/up-gradation shall be carried out time to time to maintain the existing operating & application software to improve upon the performance of the supplied system under this tender. This software modification & upgradation as & when released by respective OEM shall be a part of the warranty and AMC period & in scope of bidder with no extra cost implications to IGGL/ MECON. The upgradation must support the equipment supplied by bidder

f) The repair work should not however exceed 7 days otherwise warranty period shall be suitably extended.

g) As part of warranty, half yearly visits (2 visits per year) for preventive maintenance as a minimum shall be made by the service engineer of the bidder by visiting all the sites (to be decided by client).

h) Bidder shall depute trained and qualified service engineer for any exigency to any of the sites with-in 72 hours of intimation to the bidder for attending any no. of break down maintenance calls. In case the problem cannot be rectified by bidder's engineers, then the experts of their sub-vendors (OEMs) shall be deputed to attend the problem.

i) All the charges for bidder's service engineer visit, OEM service engineer visit including service charge, travel, boarding & lodging etc. as and when required in case of site visit shall be included in scope of bidder and no payment shall be made by IGGL/ MECON for bidder's service engineer visit, OEM service engineer visit during warranty period

j) If any fault , failure is observed in any hardware or software (supplied by the bidder) any number of times during warranty period, it shall be rectified and replaced by the bidder during warranty period without any cost implication to IGGL/MECON

k) The BIDDER shall warrant that the software are in good working order, is free of viruses, operates and performs properly on the hardware and network infrastructure. During the warranty period the BIDDER shall provide the following support for the software at no extra cost to the company.

- Technical assistance or consultation in order to assist the Company in solving problems encountered in the course of using the software.
- Timely correction of errors/defects in the software and system documentation.
- Provision of new releases of the software and/or documentation which incorporate solutions to all errors and/ or defects encountered in the use of the software or improvements to the software introduced by the BIDDER.
- Any additional support normally provided by the BIDDER to his customers during a warranty period.

l) In addition to the above, bidder shall carry out preventive maintenance, breakdown maintenance and network monitoring of the complete supplied system at all stations. The brief description of works to be carried out for preventive maintenance, breakdown maintenance and network monitoring of the complete system has been mentioned here but the same is tentative and not exhaustive

(i) Periodical Preventive maintenance:

Periodical preventive maintenance works shall be carried out in accordance to a planned schedule drawn in consultation with M/s IGGL authorities as per their convenience. During the periodical preventive maintenance, competent/experienced service engineer shall workon 6-days a week basis, excluding Sundays and holidays for a period mutually agreeable to both IGGL and bidder in each quarter.

During each visit of preventive maintenance, the following activities shall be performed as a minimum

1. Cleaning of all Racks / Junction Boxes/ Systems / sub-system.
2. Cleaning of all PV panels
3. Ensure working of telephones
4. To ensure working of SCADA and RTU channels.
5. LAN, WAN and GPRS Network status monitoring
6. Taking backup of all systems installed at respective site.
7. To resolve the fault (If any).
8. To update FTC Layout - Used and Unused Fibers/ports details.
9. To ensure Cable labelling — On Patch cords, Signal cables, control cables, power cables, FTC, Telephone.
10. To ensure routing of all patch cords & telecom cables are up to date.
11. Cleaning of optical patch cords, optical ports & FTC ports — in order to reduce optical losses (If any).
12. Measurement of Optical powers (Tx & Rx) of MPLS-TP equipment (To ensure that Transmit & Received power are within acceptable range as per optical budget calculation)
13. Maintenance / checking of other applications.
14. Maintenance of CCTV System:

a. Checking & cleaning of edge devices
b. Operational checking of edge device as per configuration

15. Verification of electrical connections for their tightness, verification of earthing connections for their tightness
16. Verification of voltages for healthiness at various equipment end, carrying out general housekeeping/cleaning of the panels/equipment, checking all the indicating lamps, checking all the fuses, checking healthiness of all the contactors/relays, checking the printed circuit board for any discoloration /abnormal smell
17. Preparation & submission of preventive maintenance reports as per IGGL SOP / Formats / availability reports of all equipment

(ii) Breakdown maintenance:

a. Any breakdown of server systems, computer systems, Telecom Equipment, edge devices, Network Equipment and software will be attended by bidder's service engineer within 72 hours during any time round the clock and on all seven days of the week including Saturdays, Sundays and holidays till the problem gets sorted out.

b. In case the OEM expert services are required for attending the problem during breakdown maintenance, the expert engineers from vendor or other sub-vendors concerned shall report at the site within 72 HOURS from the time the problem is reported

(iii) In case the server /computer systems crashes, vendor shall take-up the restoration job by reloading and reconfiguration of O/S, database and other applications as supplied.

(iv) Network maintenance with all related network software / hardware, for the configuration is under the scope of this maintenance contract. This also shall include renewing/providing of fresh licenses for network security software for the entire network and also providing/maintaining the latest updates available for such software.

(v) If any module / card or equipment needs replacement, substitution by higher version due to defect / obsolescence / incompatibility etc. will be done by vendor free of cost and the equipment / system will be made operational. As a result of such replacement, the CPU / HDD / Memoryof higher version shall be supplied to make the system work to the satisfaction of operations team of M/s HPCL. However before doing this, vendor shall take clearance from M/s IGGL. Vendor shall ensure that the existing software remains compatible with new parts and necessary back-ups shall be taken in time.

(vi) In case of a major breakdown which cannot be readily rectified at site, the system shall be restored by providing a stand-by equipment. In such an event it shall be time (to be decided by IGGL). In case it is not possible to restore it within 8 weeks, the new equipment of the same version or higher version shall be supplied and system shall be restored by vendor. In case neither the original equipment is restored nor newer/higher grade of equipment is installed on a permanent basis, the same shall be considered as a break down for down time calculations.

m) Penalty Clause –

- Bidder to note that incase bidder fails to replace the faulty card/equipment within the time limit, after taking over of the faulty part from client, then a penalty of Rs 10000/- per day shall be levied for the days of delay from the expiry of time limit in receipt of replacement item at designated site or as defined in contract.
- Bidder to note that in case bidder delays to deploy service engineer at site within the time limit , then a penalty of Rs 10000/- per day shall be levied for the days of delay from the expiry of time limit.
- The penalty shall be deducted from the BG submitted by the bidder.

n) In case of failure of any equipment, replacement is send immediately within 15 days. It is advised that Vendor should keep sufficient spare for warranty support in its stores (designated store to be informed during detailed engineering).

o) If the replacement is not send within specified time then penalty at the rate as define above or as define in contract has to be imposed. In case bidder still not responds then same may be deducted from the CPBG as per the terms and condition of the contract. Also vendor to provide firmware upgrades and configurator software upgrade free of cost to IGGL within warranty/extended warranty period.

p) System Warranty including all services and spares for operation and maintenance of the system.

6.6 POST WARRANTY MAINTENANCE CONTRACT – Comprehensive for 5 years

a) The Vendor shall quote for providing post warranty maintenance for 5 years (comprehensive for all supplied equipment) after completion of warranty /extended warranty period and provide technical support for the

maintenance of the complete supplied system and associated system / subsystem including any repair / replacement of faulty cards/ equipment.

b) PWMC shall include all the works required at each station.

c) The service under Post Warranty Maintenance Contract , including repair/replacement of spare parts and services, shall broadly comprise of:
   a. 24 x 7 hr Technical Support for resolving issue /modification / upgradation of the system
   b. Repair/replacement of faulty parts.
   c. Emergency Service

   The bid shall be made lumpsum for 5 years (comprehensive) and the price validity shall be available for the entire period of contract. Payments shall be made quarterly.

d) The bidder shall include proposal at the time of bid for providing post warrantymaintenance after completion of warranty period and provide the total i.ecomprehensive maintenance of the complete supplied system and any other system/sub system which is part of this tender.

e) The proposal shall include service charge, travel, boarding & lodging etc., i.e., all charges of service engineer in case of site visit

f) The proposal shall include supply of maintenance spares, tools and tackle asrequired; travel, boarding & lodging of service engineer. The bid shall be made yearwise and the price validity shall be available for the entire period ofcontract.

g) In the event of any malfunction of the system hardware/ system software, experiencedservice engineer shall be made available at site within 72 hours on the receipt of suchinformation from owner.

h) Owner personnel will work on system day to day basis and wherever possible, ownershall inform the type of failure of hardware/ software to Bidder based on diagnosticavailable with the system. However bidder shall be fully responsible to attend andrectify the root cause and the failure at the shortest possible time.

i) As part of PWMC, half yearly visits (2 visits per year) for preventive maintenance as a minimum shall be made by the service engineer of the bidder by visiting all the sites(to be decided by client).

j) Bidder shall depute trained and qualified service engineer for any exigency to anyof the sites with-in 72 hours of intimation to the bidder for attending any no. of break down maintenance calls. In case the problem cannot be rectified by bidder's engineers, then the experts of their sub-vendors (OEMs) shall be deputed to attend the problem.

k) All the charges for bidder's service engineer visit, OEM service engineer visit including service charge, travel, boarding & lodging etc. as and when required in case of site visit shall be included in scope of bidder and no payment shall be made by IGGL/ MECON for bidder's service engineer visit, OEM service engineer visit during PWMC period.

l) If any fault, failure is observed in any hardware or software (supplied by the bidder) any number of times during post warranty period, it shall be rectified and replaced by the bidder during post warranty period without any cost implication to IGGL/MECON

m) Bidder may utilize the spare modules available with owner if necessary and availablewith owner at site, which are part of mandatory spares supplied with system as perthis tender. However if bidder desires, additional spares other than what is available asmandatory spares may be stored at client premises to meet the schedule ofrectification of fault during emergency/ maintenance.

n) Any modification in Supplied Type-1 MPLS-TP equipment and Type-2 MPLS-TP equipment including changes in cross connects, bandwidth allocation, network drawing, ethernet channelling plan etc. as required as per the site in-chargeincluding addition of future telecom equipment (supplied by same party or other contractor),

addition of new nodes (for Type-2 MPLS-TP equipment), any modification in supplied RTU including addition of signals, changes in configurations etc. , as required to meet operational requirements, across all telecom & allied systems supplied by vendor, shall be carried out by the vendor during warranty & PWMC period without any cost implication to IGGL/MECON. In addition to this, during warranty and PWMC period, software patches, OS, firmware, OEM supplied licences, updation/up-gradation shall be carried out time to time to maintain the existing operating & application software to improve upon the performance of the supplied system under this tender. This software modification & upgradation as & when released by respective OEM shall be a part of the warranty and AMC period & in scope of bidder with no extra cost implications to IGGL/ MECON. The upgradation must support the equipment supplied by bidder

o) In case any hardware/ software used from owner stock, it shall be replaced by bidderwithin 7 days with no cost to owner. Bidder shall maintain a record of all faults duringpost warranty period.In the event of any malfunction of the system hardware/ system software, vendor shall resolve and rectify the issue at the earliest. In case of failure of anyequipment, replacement has to be sent immediately within 7 days. This timelimit is counted from the date of intimation of fault to the vendor. It is advised that Vendor should keep sufficient spare for warranty support in its stores (designated store to be informed during detailed engineering). If the replacement is not sent withinspecified time, then penalty atthe rate of Rs 10000/- per day of the downtime after expiry of time limit or as defined in contract will be imposed.

p) The Vendor must note that all commissioning spares and the spares / consumables during warranty and comprehensive PWMC shall be supplied by the vendor free of cost.

q) The vendor shall ensure the upgradation of software, firmware as per the upgrade released by the respective equipment OEM during the Warranty Period & Post Warranty Maintenance Contract period without any extra cost to IGGL/ MECON. If for upgradation of software, firmware upgradation of hardware is required by bidder, then bidder shall upgrade the hardware as per the requirement without any extra cost to IGGL/ MECON during the Warranty Period & Post Warranty Maintenance Contract period

r) The service under Comprehensive Post Warranty Maintenance Agreement, includingsupply of spare parts and services, shall broadly comprise of:

(i) Periodic Maintenance
(ii) Breakdown Maintenance
(iii) Software Support

(i) Periodical preventive maintenance works shall be carried out in accordance to a planned schedule drawn in consultation with M/s IGGL authorities as per their convenience. During the periodical preventive maintenance, competent/experienced service engineer shall workon 6-days a week basis, excluding Sundays and holidays for a period mutually agreeable to both IGGL and bidder in each quarter.

During each visit of preventive maintenance, the following activities shall be performed as a minimum

1. Cleaning of all Racks / Junction Boxes/ Systems / sub-system.
2. Cleaning of all PV panels
3. Ensure working of telephones
4. To ensure working of SCADA and RTU channels.
5. LAN, WAN and GPRS Network status monitoring
6. Taking backup of all systems installed at respective site.
7. To resolve the fault (If any).
8. To update FTC Layout - Used and Unused Fibers/ports details.
9. To ensure Cable labelling — On Patch cords, Signal cables, control cables, power cables, FTC, Telephone.
10. To ensure routing of all patch cords & telecom cables are up to date.
11. Cleaning of optical patch cords, optical ports & FTC ports — in order to reduce optical losses (If any).
12. Measurement of Optical powers (Tx & Rx) of MPLS-TP equipment (To ensure that Transmit & Received power are within acceptable range as per optical budget calculation)
13. Maintenance / checking of other applications.

14. Maintenance of CCTV System:
a. Checking & cleaning of edge devices
b. Operational checking of edge device as per configuration
15. Verification of electrical connections for their tightness, verification of earthing connections for their tightness
16. Verification of voltages for healthiness at various equipment end, carrying out general housekeeping/cleaning of the panels/equipment, checking all the indicating lamps, checking all the fuses, checking healthiness of all the contactors/relays, checking the printed circuit board for any discoloration /abnormal smell
17. Preparation & submission of preventive maintenance reports as per IGGL SOP / Formats / availability reports of all equipment

(ii) Breakdown maintenance:
a. Any breakdown of server systems, computer systems, Telecom Equipment, edge devices, Network Equipment and software will be attended by bidder's service engineer within 72 hours during any time round the clock and on all seven days of the week including Saturdays, Sundays and holidays till the problem gets sorted out.
b. In case the OEM expert services are required for attending the problem during breakdown maintenance, the expert engineers from vendor or other sub-vendors concerned shall report at the site within 72 HOURS from the time the problem is reported

(iii) In case the server /computer systems crashes, vendor shall take-up the restoration job by reloading and reconfiguration of O/S, database and other applications as supplied.

(iv) Network maintenance with all related network software / hardware, for the configuration is under the scope of this maintenance contract. This also shall include renewing/providing of fresh licenses for network security software for the entire network and also providing/maintaining the latest updates available for such software.

(v) If any module / card or equipment needs replacement, substitution by higher version due to defect / obsolescence / incompatibility etc. will be done by vendor free of cost and the equipment / system will be made operational. As a result of such replacement, the CPU / HDD / Memoryof higher version shall be supplied to make the system work to the satisfaction of operations team of M/s HPCL. However before doing this, vendor shall take clearance from M/s IGGL. Vendor shall ensure that the existing software remains compatible with new parts and necessary back-ups shall be taken in time.

(vi) In case of a major breakdown which cannot be readily rectified at site, the system shall be restored by providing a stand-by equipment. In such an event it shall be time (to be decided by IGGL). In case it is not possible to restore it within 8 weeks, the new equipment of the same version or higher version shall be supplied and system shall be restored by vendor. In case neither the original equipment is restored nor newer/higher grade of equipment is installed on a permanent basis, the same shall be considered as a break down for down time calculations

Note:
1. Bidder to note that while carrying out the Post Warranty Maintenance Contractactivities, IGGL engineers shall be associated. On-job training of theseassociated engineers shall be covered under this scope.
2. This shall include all items being supplied by bidder, including any bought outitems but not limited to the following:
(i) Labour and materials, at no additional cost, to repair any system devicesand related equipment, networkdevices, printers procured under this bid.
(ii) Labour and materials, at no additional cost, to provide tests andadjustment to system devices including printers.
(iii) Regular check-ups to ensure that a correct procedure is established fordata base backup and archiving.

Software Maintenance/ Support:
Bidder to maintain the existing operating & application software to improveupon performance of the system. Software modification and up gradation, as &when required, shall also be covered under this scope at no extra cost

Penalty Clause –

- Bidder to note that in case bidder fails to replace the faulty card/equipment within the time limit, after taking over of the faulty part from IGGL, then a penalty of Rs 10000/- per day shall be levied for the days of delay from the expiry of time limit in receipt of replacement item at designated site or as defined in contract.
- Bidder to note that in case bidder delays to deploy service engineer at site within the time limit , then a penalty of Rs 10000/- per day shall be levied for the days of delay from the expiry of time limit.

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6.7 TECHNICAL SUPPORTS ON WARRANTY, EXTENDED WARRANTY, POST WARRANTY

The details of services to be provided under warranty shall include but not limited to the following:

a) TECHNICAL SUPPORT SERVICE

Technical Support Services that extends coverage for IGGL after handover of the system. This includes 24 hours x 7 days a week on line support. IGGL shall utilize this service by intimating the Vendor of its unique customer ID in case of any contingency and Vendor in turn provide telephonic support. Depending upon the severity of the issue, engineer shall be sent by Vendor to the site. Vendor shall have service backup facility.

b) DOCUMENTATION DELIVERY SERVICE

Under Documentation delivery service Vendor is required to provide engineering practices and Technical Bulletins for updates at free of cost. All the latest software upgrades and updates for complete system are also required to be providing under warranty.

7.0 2 YEARSMANUFACTURER'SRECOMMENDEDOPERATION&MAINTENANCESPARES

Vendorshallattachalistof2years recommended operation&maintenancesparesalong withtheunitratesonrespectivesubvendorsletterheads,whichwouldbe necessaryfor2yearstroublefreeoperationandmaintenanceofthesystem after PWMC. TheOwnershallbefreetoselecttheitemsofsparesandthequantityatthe timeofawardofcontractorduring the contractual period including PWMC.

2 year Operation & maintenance OEM suggestive spares, each module, with complete list, part no, unit rate shall be provided. The validity of rates shall upto contractual period including PWMC from date of commissioning / acceptance of complete work (i.e. 2 years warranty + 5 years PWMC- total 7 years) .

These spares are for the use of client after PWMC / or any breakdown during PWMC/ warranty / Extended warranty on replacement basis by the vendor on emergency.

Sparesshallbeprovidedfromthesamemanufacturingfacilities/locationfrom wheretherespectiveequipment,subsystemsareoffered.Unitratesforeach sparesrequiredforoperationandmaintenanceshall beprovided. Vendorshallprovidetheaddress,contactperson,fax,andtelephonenumber ofthemanufacturerofthespareparts.TheVendorshallwarrantthatspare parts for the systemwould be available for minimum of 10 years after warrantyperiodaftersystemcommissioning(takingover).Afterthisperiod if theVendordiscontinuestheproductionofspareparts,thenheshallgiveat least24monthsprior noticetosuchdiscontinuationsothatOwner mayorder therequirementsofsparesinone Lot.

8.0 SUBMISSION OF COMPLIANCE REPORT

Vendor shall submit clause by clause compliance to the requirement of specifications with cross reference to the document submitted in the bid. The compliance form has to be submitted. Each of the pages shall be stamped and signed by the authorized representative of the vendor. Any of the clauses neither responded nor appropriately cross referred as per the submitted document shall be treated as Not Complied and liable for rejection.

9.0 GENERAL INFORMATION FOR PROJECT EXECUTION

Vendor shall arrange sufficient manpower and material for installation and commissioning of the network at all location.

9.1 TEMPORARY POWER SUPPLY

Vendor shall arrange for the temporary power supply during installation, testing and commissioning of the network.

9.2 UTILITIES POWER SUPPLY AVAILABILITY:

Necessary surge protection devices of suitable rating shall be provided for all incoming supply and communication channel. Station wise tentative power and maximum allowable load at each station is indicated below. The vendor shall indicate actual power requirement for the offered system. Positive isolation shall be provided and is included in telecom vendor scope.

Cabling (shall be armoured FRLS) to all supplied system are in the bidder's scope.
Surge protection device has to be provided for all incoming power supply to telecom equipment and RTU.

Dedicated separate advanced maintenance Free Earthing along with dedicated earthing pit has to be provided by bidder. All works for construction of earth pits, including supply of each required item, is included in scope of the bidder. Minimum 2 nos. earth Pits each shall be provided at eachlocation forming a grid.

Bidder shall furnished power consumption details equipment wise / location wise at the time of detailed engineering. Bidder shall ensure that the power consumption of the equipment supplied by the bidder shall be within the maximum allowable load indicated below in the table..

Sl No	Station	Power Source	Power supply	Max. Allowable load (Watts)
1	Location of Installation of Type-1 MPLS-TP Equipment	UPS (Grid)	(+ -)48 V DC	700 Wfor Type-1 MPLS-TP Equipment
2	Location of Installation of Type-1 RTU	UPS (Grid)	(+ -)24V DC	200 Wfor Type-1 RTU

Note – Kindly note that bidder shall adhere to the power requirement specified above and power consumption of the provided system shall be within the stipulated power as defined above.

9.3 SUPPLY AND STORAGE OF EQUIPMENT

This shall include but not limited to supply and storage of equipment and all other items required for installation and commissioning of the network including the following:

- Storage of all the supplied equipment, including insurance, safety, surveillance etc. is the responsibility of the bidder till handing over of the system to client and same is included in scope of the bidder.
- The store has to be maintained for each state /regions of pipeline. Insurance,safety, surveillance etc. of all the supplied materials in the store is included in scope of the bidder.
- Transportation of equipment and all other components from locations of manufacturing to bidder's store and then to the locations of installation.
- Storage during transit & storage after installation till handing over to the Owner.

- Statutory clearances including clearances of Customs, Excise, Octroi and others, as required for all the supplied items.

- Responsibility of all the supplied material till handing over of the system to client is included in scope of the bidder. In case of any damage, theft etc. To the supplied material, same shall be replaced by the bidder without any cost implication to Client/ PMC.

9.4 SITE PREPARATION

This includes all electrical, civil works and site preparation activities at the equipment nodes along pipeline for installation and commissioning of the Telecommunication equipment

Preparation of Earthing Pit and providing Earthing for the equipment at the Equipment nodes.

ACCESSORIES / OTHER ASSOCIATED ITEMS

Procurement, supply and Installation of DDF/FDF / Telecom Equipment routine the fibres from FTC to FDF with a required length of Optical Fibre Cable and cabling between the Equipments and DDF's and all other items not indicated here but required for completion of the system shall be in the scope of the vendor.

Supply & Installation of necessary equipment, cables trays, cables & accessories to meet the overall system requirements along Natural Gas Pipeline, extension of telephone cables at respective sites, separate earthing & lighting protection of indoor telecom equipment at respective telecom locations etc.

Furniture (Executive chairs/Printer table) as required for various systems, sub-systems, equipment etc shall be supplied by the Vendor.

System integration including providing requisite interfaces and accessories to realize the complete system, which shall include but not limited to the following:

Integration of the optical transmission system with other subsystems, leased line network and the optical fibre cable (laid and terminated by other contractor), providing connectors, pigtails etc. to realize the complete optical fibre communication system in a redundant mode.

CCTV video surveillance system has to monitor the movement of personnel within the compound of all stations and any other unmanned station along the route as per requirement of the owner.

Integration of IP phones from all sites to the EPABX for enabling switching of call wherever required.

Leased lines as defined has to be provide and connected to OFC network for seamless integration.

Supply of the Technical Literature, Drawings and Documentation for the complete system is in the Vendors scope.

Supply & installation of DC power Distribution Box (DCDB) with (N+1) spare capacity of 48 VDC power feed / terminations if specified for future use and complete wiring from the distribution box to the respective telecom equipments at telecom station as per specifications in the vendor scope.

The vendor shall extend the power from Client's provided power point to the DCDB, to be installed in the equipment room using the armoured DC cable. For the same, the DCDB and armoured cable & glands shall be supplied and installed by the vendor.

Any item of goods/services not specifically mentioned, but considered essential for completion of the work in all respects shall be deemed to be included in the scope of work of the successful Vendor.

9.5 SOURCE OF SUPPLY:

The Vendor shall source the supply of different equipments/ accessories as per the list of Source of Supply enclosed in the last of specification.

9.6 SYSTEM PROVENESS:

The MPLS –TP system, CCTV cameras, phones, RTU and its equipment offered will be the extension of existing proven system and Vendor shall responsible to meet the Provenness (combined or separately) as define in the existing system.

9.7 CERTIFICATE FOR LOGISTICS SUPPORT

Vendor shall provide backup engineering, maintenance support and spare part supports for a period of ten (10 years) for the system being supplied.

10.0 PACKING:

All equipment shall be individually packed in suitable containers/crates designed to avoid damage to the equipment during transit and storage in accordance with best commercial practice and with the requirements of applicable specifications. The material used for packaging, wrapping, sealing, moisture resistant barriers, corrosion preventers, etc. shall be of recognized brands and shall conform to best standards in the areas in which the articles are packed. The packing shall protect the equipment from impact, vibration, rough handling, rain, dust damp, insects, rodents etc. Each container/crate shall be subjected to impact, vibration and other mechanical tests. Each container shall be clearly marked with the following information at prominent places.

CLIENT	IGGL
PROJECT	North East Gas Grid Pipeline (NEGG Pipeline) Project
DESCRIPTION	
SERIAL OF EQUIPMENT	
P O NO.	
ADDRESS	

All equipment shall be tested for damage after their receipt at respective sites. If any equipment, part, subsystem, component, accessory is found to be damaged during the transit, the same shall be replaced by the Vendor, free of all costs to the Owner. The vendor shall replace such item as shall be indicated to him within 30 days of receipt of information.

11.0 TRAINING:

There shall be at least two training courses, one at bidder's sub-contractor premises and another at site(s) when the system will be made operational. It shall be explicitly understood that owner's personnel shall be fully associated during engineering, installation, testing and commissioning activities and this opportunity shall be taken by Vendor to impart on the job training in addition to the two mentioned above.

Vendor shall provide comprehensive documentation, course materials, manuals, literature etc. as required for proper training of owner's personnel at his own cost. After the completion of the course, all such materials shall become the property of IGGL.

Training at bidder's sub-contractor/Factory Premises: Training on general functioning of supplied systems, card/module/sub-system wise details, system fault diagnosis / troubleshooting, upgradeability, add-on features and other relevant details shall be given at the factory site/vender premises at the expense of the Vendor. However, Travel & boarding charges of IGGL personnel during the training period at factory site/vender premises will be borne by IGGL.

Training at Site: Training to IGGL personnel on day-to-day operation, maintenance, local & remote monitoring, details of installed setup / configuration of equipment etc shall be provided at site.

Bidder shall train an agreed number of personnel of owner in all aspect of Telecommunication system. There shall be at least two training courses:
It shall be explicitly understood, however, that Owner's personnel shall be fully associated during Engineering, Installation, Testing and commissioning activities and this opportunity shall be taken by bidder to impart on-the-job training in addition to the two mentioned above. Bidder's offer shall exclude costs of transportation, lodging and boarding of the Trainees, which shall be arranged by the owner.

First Course: The bidders' quote shall include 10 days training at manufacturer's works/Integration Centre to be imparted by OEM of Type-2 MPLS –TP equipment with respective NMS and Type-2 RTU equipment. Number of owner's personnel shall be 5 persons each in two batches.

The first course to be conducted at the manufacturing facilities/Integration Centre shall be designed to train the trainees in all aspects of System Engineering, Equipment operation and functional details, theory of operation of equipment, trouble shooting and familiarization with the equipment at card and component level. All equipment used for training shall be identical to those supplied for site installation

Second course: The bidder quote shall include 6 days training at site for installed equipment. Training to be imparted by bidder and if required; OEM is also to be associated for training. Number of owner's personals shall be 5 persons each in two batches. The second course to be conducted at site, shall be mainly devoted to the operation of equipment and system including testing of equipment/sub-assembly, preventive breakdown, Trouble shooting and normal maintenance activities. The training imparted shall cover all aspects equipment incorporated in the system.

Bidder shall specify in his offer the types of courses he intends to impart, including but not limited to, the ones aforementioned.

Bidder shall provide comprehensive documentation, course material, manuals, literature etc. as required for proper training of personnel at his own cost. Consolidated and comprehensive documentation shall be available to each participant. After the completion of course, all such materials shall become the property of the owner. Bidder shall update the course material of manuals in case there are any changes owing to revisions/modifications in equipment/system specifications.

Bidder shall, Fifteen (15) days prior to start of training, send complete training program including details of each course, duration, subject matter, etc. The Owner/Engineer reserves their right to suggest any additions/deletion in the program, which shall be incorporated by the Bidder at no additional cost.

12.0 VENDOR DATA REQUIREMENT AND DOCUMENTATION

Documents shall be supplied as per Vendor Data Requirement. All documents shall be in English language only.

A) Documents to be submitted within One month.

- Project Schedule.
- Project Organization Chart.
- Quality Assurance program, Equipment & system test plans.
- Technical literature / data sheets / Information doc. of all major equipment to be supplied.
- Source of supply (SOS) with purchase order copy.
- Equipment schedule for various stations.
- Power Supply requirements at each station.
- Station-wise list of all equipments, components etc

B) **Documents to be submitted during detail engineering / Supply of materials:**

- System description, System configuration diagram & detail design concept for supplied system
- Link connectivity diagram and proposed channelling plan. Detailed Network diagram for NMS of MPLS –TP elements. Detail Link engineering calculation based on Optical fibre characteristics & hop length

- Details technical manual of each type of equipment containing circuit diagram and description.
- Complete wiring details
- Complete JB layout and rack layout
- Signal database for RTU
- Layout of equipments and space requirements for each station.
- List of special tools and tackles.
- Equipment interconnection diagram including details of various interfaces signalling protocols used at each stage.
- Power supply distribution, earthing arrangement and station wiring diagram.
- Cable layout drawings inside the building & requirement of all cable trays for each site.
- Installation manual giving manpower requirement, material requirement overall dimensions and weights of each equipment, installation procedure and commissioning.
- Tuning and field calibration procedure for each type of equipment.
- Supervisory configuration, alarm list, operate interface etc.
- Documents regarding accessories and other associated items.
- Maintenance manual of each type of equipment and for the entire telecommunication system.
- System description
- System configuration diagram
- Link Engineering of the network
- Link Connectivity diagram
- Station-wise Rack-layout
- Station-wise Bill of Material
- Station-wise Power requirement
- List of special tools and tackles
- List of mandatory spares
-

c) The following set of documents shall be supplied by the Vendor at all the manned stations and NMS centers (hard copy as well as soft copy).

- Details technical manual of each type of equipment containing circuit diagrams and description.
- Equipment schedule for various stations
- Equipment interconnection diagram including details of various interfaces, signaling protocols used at each stage.
- Layout of equipment and space requirements for each station.
- Cable layout drawings inside the buildings and requirement of all mounted cable trays for each site.
- Installation manual giving manpower requirement, material requirement overall dimensions and weights of each equipment, installation procedure and commissioning.
- Power supply distribution, earthing arrangement and station wiring diagram.
- Tuning and field calibration procedure for each type of equipment.
- Supervisory configuration, alarm list, operator interface etc.
- Maintenance manual of each type of equipment and for the entire telecommunication system.

d) The following set of documents shall be supplied by the Vendor at NMS centers (hard copy as well as soft copy).

- NMS Software (including Application and OS) in USB Pendrive/ CD / DVD media along with Licenses

The maintenance manual shall be divided into two sections as a minimum:

A) Preventive maintenance procedures

B) Trouble shooting procedures including failure analysis:

The section on repairs shall provide exhaustive information repairs including but not limited to removal, reinsertion of components and cards, repairs, adjustments, tuning, calibration, tools required for a particular operation, test points, including turn around time for repair and the details of the maintenance support service centre to be furnished in the bid and all other maintenance related details..

- Quality Assurance program, Equipment & system test plans.

- Expansion possibilities of the system without causing deterioration in the system performance.
- Any other data, document not specifically mentioned, but required for the satisfactory completion, operation and maintenance of the system shall be provided.
- Factory Acceptance test procedures.
- PRE-FAT test results

Documents to be supplied after FAT before start of installation:

- List of commissioning spares
- Site Acceptance Test procedures

Documents to be supplied after trial runs but before System commissioning (Final Acceptance of the System by Owner/Engineer):

STATIONS FOLDERS:

In addition to the six sets mentioned earlier, bidder shall supply 1 set of station folders at all telecom stations. The station folders shall include the following as a minimum:

Final system diagram description modification made as compared to system offered at bid stage, final wiring diagram system commissioning report, all the performance results of various equipments and for system as a whole for Test and Trial runs.

Details of the bandwidth available, details of hardware/ software required to utilize the bandwidth available along with details of the various cards, part nos. location from which the same can be procured with details of the contact person, fax, telephone nos. etc.

MAINTENANCE FOLDERS

In addition to the six sets mentioned earlier, bidder shall supply 1 set of maintenance folders at NOIDA projects sections. The maintenance folders shall include the following as a minimum:
Final modified equipment detailed catalogues, maintenance manual equipment tuning and calibration manual.

Circuit diagrams including component layout of all modules for each subsystem, equipment etc

STATION INVENTORY FOLDERS

In addition to the six sets mentioned earlier, bidder supply 1 set of station inventory folder at each telecom station. The station inventory folder shall include the following as a minimum (the exact quantity shall be documented and signed by bidder and countersigned by Owner/ Engineer.

- Station-wise list of all equipments, components etc.
- Spare part list.

The spare part list shall include the following as a minimum:

- List of spares available per station basis.
- Type of system (Optical, Microwave etc.)
- Name of equipment
- Description of Card
- Reference No.
- Name, Address & Contact Person of manufacturer & supplier
- Information regarding repair ability at factory/site.

Note:

In addition to the 2 sets hard copies, 6 sets of soft copies of the finalized document shall be provided in suitable portable SSD hard disks with password protection before system commissioning (final acceptance of the system of Owner/ Engineer) as AS BUILT FINAL DOCUMENTS.(contents: Contract PO, FDS, FAT/ IFAT, IC, SAT, Manuals, Warranty/Guarantee, Site dwgs etc)

13.0 COMPLETION PERIOD

As per bid documents; refer Vol I of II of bid documents.

14.0 EQUIPMENT QUALIFICATION CRITERIA (EQC)- TECHNICAL:

The Telecommunication System (Internet Protocal - IP based), RTU System and various sub items etc required forIGGLpipeline proposed to be supplied shall be proven, from the existing range of respective manufacturer and should have successfully tested, installed & commissioned.

15.0 TECHNICAL SPECIFICATION FOR TELECOMMUNICATION SYSTEM and Technical Specification of RTU (Enclosed separately)

16.0 ANNEXURES

Refer Index sheet

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Minimum Specification for NMS Server Hardware Configuration

The proposed MPLS-TP management system hardware shall provide high performance and high reliabilityServer supplied by a well-known proven Server Manufacturer (OEM).

The minimum requirement of each TYPE-2 MPLS-TP NMS Server is as follows:

Sr. No	Parameter	Minimum Requirement	Compliance /details	Remarks/ Comments
1	**Make**			
2	**Model**			
3	**Processor**	Intel latest Xeon processor , cores >=8, 64 bit, clock>=2.3 GHz, Turbo-boost, memory controller supporting DDR-4 2900 MHz or higher, minimum 2 memory channels, built-in graphics capable of supporting minimum resolution of 1920x1080p, 32bit colour resolution		
4	**Motherboard**	OEM Motherboard		
5	**Memory**	2*8 GB DDR4-2900 MHz RAM, expandable upto 32 GB		
6	**Hard Disk Drive & controller**	2*1 TB SSD (redundant, swappable) in RAID-1 configuration		
7	**Optical Drive**	Super Multi DVD writer, Min 16x		
8	**Graphics**	Integrated Intel Graphics		
9	**Audio**	Not required		
10	**Ethernet**	Intel X540-T2 1 GbE Dual Port Adapter		
11	**Slots**	Total : 4 (1) low profile PCI slot, (1) low profile PCI Express x1 slot, (2) low profile PCI Express x16 slots		
12	**Ports and Connectors**	(2) USB 3.0 (2) USB 2.0, (2) RJ-45, (1) VGA port/(1) DVI Port, (1) Display Port, (1) HDMI (optional)		
13	**Form Factor**	1U or 2U, Rack Mounted		
14	**Monitor**	Rack mounted KVM monitor (provided as part of respective server Rack)		
17	**Software**	Latest Windows Operating System (Server grade), Latest Microsoft office Suite , Anti Virus, Adobe Acrobat Pro or equivalent		
18	**Operating System**	Latest Windows operating system compatible with NMS software		
19	**Recovery Tool**	Restore CD		
20	**Drivers for different Operating systems**	Drivers should be freely available on OEM's web site		
21	**Power Supply**	Redundant Hot Swappable Power Supply		

Note : "Latest" is defined as the most recent configuration available at time of bid submission

Minimum Specification for MPLS-TP NMS Client Workstation Hardware Configuration

The hardware of the proposed NMS Client Workstation shall be high reliability personal computer (PC) supplied by a proven PC manufacturer.

The minimum requirement of each NMS Client shall be as follows:

Sr. No	Parameter	Minimum Requirement	Compliance /details	Remarks/ Comments
1	**Make**			
2	**Model**			
3	**Processor**	Intel latest Core-i7 processor , cores >=4, 64 bit, clock>=2.3 GHz, Turbo-boost, memory controller supporting DDR-4 2900 MHz or higher, minimum 2 memory channels, built-in graphics capable of supporting minimum resolution of 1920x1080p, 32bit colour resolution		
4	**Motherboard**	OEM Motherboard		
5	**Memory**	2*8 GB DDR4- min 2900MHz RAM expandable upto32 GB		
6	**Hard Disk Drive & controller**	1 TB SSD.		
7	**Optical Drive**	Super Multi DVD writer, Min 16x		
8	**Graphics**	Integrated Intel Graphics		
9	**Audio**	Integrated Realtek HD ALC221		
10	**Ethernet**	Intel X540-T2 1 GbE Dual Port Adapter		
11	**Slots**	Total : 4 (1) low profile PCI slot, (1) low profile PCI Express x1 slot, (2) low profile PCI Express x16 slots		
12	**Ports and Connectors**	**Front I/O:** (4) USB 3.0, headphone and microphone **Rear I/O:** (4) USB 3.0 (2) USB 2.0, (2) PS/2, (2) RJ-45, (1) Display Port, (1) VGA Port/ (1) DVI Port, (1) audio in, (1) audio out, (1) HDMI		
13	**Form Factor**	Tower		
14	**Monitor**	32 " Color with minimum FHD (1920 x 1080 @ 60 Hz) resolution. Input connector (1 VGA & 1 DVI)		
15	**Keyboard**	Wired keyboard		
16	**Mouse**	Wired 2 Button Scroll Mouse		
17	**Software**	Latest Windows Operating System , Latest Microsoft office Suite , Anti Virus, Latest Adobe Acrobat Pro or equivalent		
18	**Operating System**	Latest Windows operating system compatible with NMS software		
19	**Recovery Tool**	Restore CD		
20	**Drivers for different Operating systems**	Drivers should be freely available on OEM's web site		

Minimum Specification for EPABX NMS Server -

LAYER 2 ETHERNET SWITCH

The technical specifications of this type of Switches shall also include but not limited to the following:

(i) Operational Temperature: 0^0C to +40 ^{0}C
(ii) Humidity: 05 % to 95 % non-condensing
(iii) Input Power Supply: 220V AC [Maximum 500 watts] / 48V DC / 24V DC
(iv) 10/100/1000 Autosensing Ethernet ports (RJ45) :No of ports as per tender requirement (all ports equipped With PoE IEEE 802.3af Class 2)
(v) Should be IPV4, IPV6 Compliant from Day One
(vi) POE enabled

(vii) **Performance:**
- Should support non-blocking wire speed performance with minimum 50 Gbps switching bandwidth & minimum 10 Mpps forwarding rate;
- Should support minimum 1000 MAC address and minimum 500 VLAN.
- Should support Jumbo Frame, Port Mirroring, and Broadcast Storm Control etc.
- Should support Multicast

(viii) **Supported Standards:**
- IEEE 802.1D Spanning Tree Protocol
- IEEE 802.1p CoS Prioritization
- IEEE 802.1Q VLAN
- IEEE 802.1s
- IEEE 802.1w
- IEEE 802.1x/IEEE 802.1x-Rev.
- IEEE 802.3ad
- IEEE 802.3ae
- IEEE 802.3af
- IEEE 802.3x full duplex on 10BASE-T, 100BASE-TX, and 1000BASE-T ports
- IEEE 802.3 10BASE-T specification
- IEEE 802.3u 100BASE-TX specification
- IEEE 802.3ab 1000BASE-T specification
- IEEE 802.3z 1000BASE-X specification
- IEEE 802.3x Flow Control

(x) **Management Featured:**
- Supporting SNMPv1, v2 and v3
- Supporting IGMP v1 / v2 / v3 snooping to optimize Multicast Traffic
- Supporting Web Based and CLI based management
- Should have DHCP client
- Should support file upload using TFTP, FTP, SFTP, or SCP for faster configuration

(xi) Should have Monitoring & Trouble-shooting features enabled.
(xii) Should have appropriate Security Features enabled through: (i) detection of ARP floods, (ii) detection of packets with invalid Source / Destination IP Address or (iii) detection of multicast packets etc.

LAYER 3 ETHERNET SWITCH

The technical specifications of this type of Switches shall also include but not limited to the following:

(i) Operational Temperature: 0.0C to +40 0C
(ii) Humidity: 5 % to 95 % non-condensing
(iii) Input Power Supply: 230V AC / 48V DC [Maximum 500 watts] with redundant hot-swappable power- supply.
(iv) 10/100/1000 Bate-T Autosensing Ethernet ports (RJ45) :No. of ports as per tender requirement
(v) **Performance & Features:**

- Should support Wire speed non-blocking switching
- Should support non-blocking wire speed performance with minimum switching capacity of 100 Gbps& minimum 50 Mpps forwarding rate;
- Should be IPV4, IPV6 Compliant from Day One
- Should support minimum 1000 MAC address and minimum 500 VLAN;
- Should support Jumbo Frame, Port Mirroring, and Broadcast / Multicast/ Unicast Storm Control.
- Should support Multicast
- Should support LLDP-MED.
- Should support port-mirroring.
- Should support L-3 redundancy features (VRRP for IPV4 & IPV6)
- Should support both static and dynamic link aggregation & Load balancing
- Should support CoS&DiffServ.
- Should support Standard and Extended Access control list for both IPv4 / IPv6: Access control list with IP based ACL, MAC Based ACL and IP + MAC combination based ACL, time based ACL etc.
- Should be IPv4 / IPv6 ready (dual stack) supporting Static routing & Dynamic routing protocols (OSPF & BGP) for IPv4 and IPv6.
- Should support iSCSI connectivity.

(vi) **Supported Standards:**

- IEEE 802.1D Spanning Tree Protocol
- IEEE 802.1p CoS Prioritization
  IEEE 802.1Q VLAN
- IEEE 802.1s
- IEEE 802.1w
- IEEE 802.1x/IEEE 802.1x-Rev
- IEEE 802.3ad
- IEEE 802.3af
- IEEE 802.3x full duplex on 10BASE-T, 100BASE-TX, and 1000BASE-T ports
- IEEE 802.3 10BASE-T specification
- IEEE 802.3u 100BASE-TX specification
- IEEE 802.3ab 1000BASE-T specification
- IEEE 802.3ae
- IEEE 802.3z 1000BASE-X specification
- IEEE 802.3x Flow Control

(vii) Management Featured:

- Supporting SNMPv1, v2 and v3

- Supporting IGMP v1 / v2 / v3 snooping to optimize Multicast Traffic
  Supporting Web Based and CLI based management
- Should have DHCP client
- Should support file upload using TFTP, FTP, SFTP, or SCP for faster configuration

(ix) Should have Monitoring & Trouble-shooting features enabled.

(x) Should have appropriate Security Features enabled through: (i) detection of ARP floods, (ii) detection of packets with invalid Source / Destination IP Address or (iii) detection of multicast packets etc.

Router –

S.No.	Functionality/ Description	Minimum Specifications
1.	Interface Type	• Ethernet interfaces ports – Minimum (100/1000 MBPS) or 1G Fiber or a combination configurable as LAN/WAN ports (with SFP). Minimum 25% spare ports shall be available after all connections as per tender. Number of ports shall be as per tender • Min 2- Ports 1Gigabit WAN Ports (with SFP) • USB port – 01 No. for external storage required.
2.	Memory	• Min. Memory required :1 GB DRAM
3.	Features	• Router should have latest Version of Operating System and Management software. • The router should support Encryption : DES, 3DES, AES • Router should support encapsulations : Generic routing encapsulation (GRE), Ethernet, 802.1q VLAN, Point-to-Point Protocol (PPP), Multilink Point-to-Point Protocol (MLPPP), High-Level Data Link Control (HDLC). • The Router should have integrated Zone Based Firewall and Intrusion Prevention System features • Address translation : Network address & port address translation • Should support Layer2 and Layer3 VPN , IP sec and MPLS, Layer 2Tunneling Protocol Version 3 (L2TPv3) • Router should support static Routes, Routing Information Protocol (RIP), RIPv2, OSPFv2, OSPFv3, Border Gateway Protocol (BGP) , BGP4 , Intermediate System-to-Intermediate System (IS-IS) • Should support Multicast routing protocols : IGMP v1/v2/v3, PIM-SM, PIM-SS • Should support other IP Services : ACLs, DHCP, DNS, NAT .

S.No.	Functionality/ Description	Minimum Specifications
4.	Cables	• Router should be supplied with all power cables (Plugs as per Indian Standards) / console cable / adaptors / CDs etc.
5.	Power Supply	• Redundant Power supply card, 230 V AC + 10%

FIREWALL -

S.No.	Functionality/ Description	Minimum Specifications
6.	Interface Type	• Ethernet interfaces ports – Minimum (100/1000 MBPS) or 1G Fiber or a combination configurable as LAN/WAN ports (with SFP). Minimum 25% spare ports shall be available after all connections as per tender. Number of ports shall be as per tender • USB port – 01 No. for external storage required.
7.	Features	• Advanced Threat Protection (IPS, Advanced Malware Protection Service, Application Control) • IPS Throughput min 1.4 Gbps • NGFW Throughput 1 Gbps • Threat protection Throughput Min 900 Mbps • IPv4 Firewall Throughput (1518 / 512 / 64 byte, UDP) - 10 / 10 / 7 Gbps • Firewall Latency (64 byte, UDP) - 3.23 µs • Firewall Throughput (Packet per Second) - 10.5 Mpps • Concurrent Sessions (TCP) - 1.5 Million • New Sessions/Second (TCP) - 45 000 • Firewall Policies – 5000 • IPsec VPN Throughput (512 byte) - 6.5 Gbps • Gateway-to-Gateway IPsec VPN Tunnels – 200 • Client-to-Gateway IPsec VPN Tunnels – 2500 • SSL-VPN Throughput - 950 Mbps • Concurrent SSL-VPN Users (Recommended Maximum, Tunnel Mode) – 200 • SSL Inspection Throughput (IPS, avg HTTPS) - 715 Mbps • SSL Inspection CPS (IPS, avg. HTTPS) – 700 • SSL Inspection Concurrent Session (IPS, avg HTTPS) - 100 000 • Application Control Throughput (HTTP 64K) - 1.8 Gbps • CAPWAP Throughput (HTTP 64K) - 9 Gbps

S.No.	Functionality/ Description	Minimum Specifications
		• Virtual Domains – 10 • Firewall should have latest Version of Operating System and Management software.
8.	Cables	• Firewall should be supplied with all power cables (Plugs as per Indian Standards) / console cable / adaptors / CDs etc.
9.	Power Supply	• Redundant Power supply card, 230 V AC + 10%

Technical Specifications of CAT-6 cable (Armoured)

Armoured cable shall be provided inside control room building also

S.No.	Feature/ Description	Minimum Specifications
1.	Type	Cat 6 UTP FRPVC Armoured cable consists of 4 unshielded twisted pairs for transmission of high speed data, digital and analogue voice and video (RGB) signals on LANs. Supports Gigabit Ethernet (1000 baseT) standard. Operates at bandwidth of 250 MHz. Suitable for Indoor/ Outdoor and Direct Burial Applications.
2.	Structure	Construction – UTP
3.	No of Pairs	4 pairs
4.	Conductor	AWG – 23 AWG
5.	Conductor material	Solid bare copper
6.	Conductor dimension	0.5 ± 0.01 mm
7.	Insulation	Insulation material – HDPE
8.	Number colour (Strip marking)	1-2 White/Orange(Strip) & Orange 3-6 White/Green(Strip) & Green 4-5 White/Blue(Strip) & Blue 7-8 White/Brown(Strip) & Brown
9.	Cable Diameter	Outer diameter – 10.0 mm (Nominal)
10.	Inner diameter	5.60 mm (Nominal)
11.	Inner Sheath	Extruded PVC type FRLS Minimum thickness 0.2 mm
12.	Armouring	Galvanised Steel Wire, Nominal OD of each wire: 1.4+/-0.06 mm or Corrugated ECCS Tape
13.	Outer Sheath	Extruded PVC type, FR with anti termite and anti rodent properties Minimum thickness 1.24 mm
14.	Outer Sheath colour	Black
15.	Inner sheath colour	Natural
16.	Application :	Direct Burial Application Installation : Horizontal & Vertical Type. Better performance and extra headroom especially NEXT (Near End Cross Talk).
17.	Operating Temperature:	- 10°C to 75 °C
18.	Overall Diameter (in mm)	Bidder to specify

Specification For GI Cable Tray With Cover

Specification of GI Cable Tray with Cover

This shall be prefabricated hot dip galvanized sheet steel trays. Prefabricated hot dip galvanized sheet steel cable trays shall be used for maximum support span of 2000 mm unless design is approved for larger span. For requirements of larger than 750 mm width two trays shall be run side by side. Cable trays shall be suitable for a cable weight of 50 kg/meter running length of tray. Minimum thickness of sheet steel/galvanizing shall be 2mm/86 microns respectively.
Each cable tray shall be provided with suitable cover. The cover of the GI table tray shall be hot dipgalvanized sheet steel with dimensions suitable for different dimensions of GI cable tray.

Vertical supports for both the above type of trays shall be fabricated out of ISMC 100 and horizontal supports with 75 x 50 x 6 angle iron/ ISMC 75 or as approved by Engineer-in-Charge.

	DATASHEET	

Specification of Explosion Proof Junction Box

	EXPLOSION PROOF JUNCTION BOX AND CABLE GLANDS		
GENERAL	1.	Tag No.	To be decided during detailed engg
	2.	Quantity	*
	3.	Area / Unit	*
	4.	Location	To be decided during detailed engg
	5.	Make	As per Preferred vendor list
	6.	Model No.	*
	7.	Ordering Code	*
	8.	Operating temp	0 – 60 Deg C
	9.	Humidity	Upto 95% non condensing
	10.	Housing	Suitable for installation in hazardous area and explosion proof for Zone -1, Gr IIA, B, T6as per IEC 60079, and Weather Proof IP65 As per IEC 60529
SPECIFICATION	11.	Body	Die cast Aluminum Alloy (LM-6)
	12.	Screw	High Tensile steel, cadmium / nickel plated Stainless steel of grade
	13.	Washer	*
	14.	Cover	Detachable □Hinged ☑
	15.	Terminal	
		a) Type	Clip on type, locked at both ends (end cover & clamp for each row), suitable for 2.5 sq mm conductors
		b) Make	As per preferred vendor list
		c) Min. Conductor size	*
		d) Rating	*
	16.	Cable Gland	Suitable for hazardous area and explosion proof for Zone 1, Gr. II A and IIB, as per IEC 60079, each cable gland shall be provided with PVC hood
		Material of construction	Min Brass with Nickel Plating
		Type	Single Compression □ Double Compression ☑ Explosion Proof ☑

		Size	Suitable for Cable Dia
		Bushes	Neoprene
		Plugs, Cable Reducers/ Adapters	Required
SPECIFICATION		Material of Construction	Brass with Nickel Plating
		Plug, Cable Reducers/ Adapters Design	Suitable for hazardous area and explosion proof for Zone 1, Gr. II A and IIB, As per IEC 60079
	17.	Mounting	Surface ☑ Flush ☐
	18.	Finish &Colour	Smooth & scale free surface finish. Two coats of primer and two coats of final paint (lead free). Corrosion resistant Exterior: Opaline Green IS-5 Shade 275 Interior: Brilliant White Different exterior color code for intrinsically safe junction boxes shall be done (in comparison to all other junction boxes)
	19.	Earthing Terminal	2 external M6 size
	20.	Name Plate	Stainless Steel name plate shall be envisaged with following details: 1. Manufacturer's data 2. JB No. / Tag No. 3. Enclosure Class 4. Area Classification (for Ex. Proof JB) 5. CCOE / PESO & CMRI no with validity date
	21.	Warning Name Plate (for Ex. Proof JB only)	Following instruction shall be engraved on front cover: "Isolate power supply elsewhere before opening."
	22.	Area Classification	Zone-1 , Group II A& B
	23.	Approval	CCOE / PESO
	24.	Certification	As per EN 10204 3.1

Jb Nos	Type (Note-3)	Qty.	No. of Terminals	Cable Entry – Single Pair (Side)			Cable Entry – Multi Pair (Side)			Remarks
				No. of Cables Entry	Size	No. of Plugs	No. of Cables Entry	Size	No. of Plugs	

NOTES :

1. * Vendor to furnish
2. Certificate from CCOE / PESO to be furnished by vendor for offered model.
3. Cable entries shall be plugged with Ex'd" plugs incase not in use.
4. No. of threads to be engaged for plugs & cable glands shall be as per IS 2148. However min 5 threads shall be engaged.
5. No. of cable glands for each JBs shall be equal to the no. of cable entries for each JB + 25% spare. Apart from total no. of cable glands for JBs, additional nos. of ½" NPT cable glands shall also be provided for the field instruments. Where ever required, cable glands with CCOE certified reducers/adapters shall be supplied in case of cable size is less/more.
6. 25% spare terminals shall be considered.
7. Separate Junction Boxes shall be considered for Signal, Control & Power
8. Type – II: Weather & explosion proof.
9. Various components like rubber ring, metallic ring, metallic cone and the outer / inner nuts etc. shall be capable of adjusting to the indicated tolerances of cable dimensions.
10. Explosion Proof junction boxes for Power, signal, alarm and control shall have the following warning engraved/integrally cast on the cover: "Isolate power supply elsewhere before opening"
11. All terminals used in signal, alarm and control junction boxes shall be suitable for accepting minimum 2.5sq.mm copper conductor, Terminal used in power junction boxes / power supply distribution box shall be suitablefor accepting various conductor size of 4 Sq. mm to up to 150 sq. mm. Higher size of terminals shall be provided when indicated. Bus bar terminals shall be provided for conductor size 50 sq. mm and above. Suitable size of lugs shall be provided to suit conductor size specified.
12. Tubular lugs shall be used for cable termination.

	SIGNAL CABLE (SINGLE PAIR)		
GENERAL	1	Description	Signal Cable
	2	Type	Twisted, Screened & Armoured
	3	Size	1P
	4	Make	As per suggested vendor list
CONDUCTOR	1	Material	Annealed Tinned Electrolytic Copper IS: 8130 /84
	2	Size	1.5 Sq.mm
	3	No. of Strands/ Strand size mm	☑7/0.53☐7/0.43 ☐7/0.37☐7/0.30
	4	Shape of conductor	Stranded Circular
PRIMARY INSULATION	1	Material	☐PVC (PVC Type.A-IS:5831'84) ☑ PVC(PVCType.C-IS:5831'84) ☐FRLS PVC
	2	Type	☑Extruded ☐Wrapped
	3	Thickness(nom.)in mm	☐0.5 ☐0.6 ☑0.8 ☐1.1mm (Suitable for 1100V as per IS 1554 Part-I)
	4	Colour Scheme	Black & Blue*(Note:2)*
	5	No. of twists (pair)	Min.10 twist/meter
	6	Insulation Voltage Grade	1100V
INDIVIDUAL PAIR SHIELD	1	Material	Aluminium Mylar tape–black
	2	Type	Helical
	3	Thickness(nom.)in mm	☐0.05 ☑0.06 (Suitable for 1100V as per IS 1554 Part-I)
	4	Overlap	25%.
	5	Coverage	100%.
	6	Drain wire type / Size /No.of strands/Formation	Annealed tinned Copper/ 0.5 mm² / (7 strands/0.3 mm) / in contact with the shield
OVERALL SHIELD	1	Material	~ NA ~
	2	Type	~NA~
	3	Thickness(nom.)in mm	~NA~
	4	Overlap	~NA~
	5	Coverage	~NA~
	6	Drain wire type / Size /No.of strands/Formation	~ NA ~
INNER SHEATH	1	Material	☐PVC (PVC Type.ST1 - IS:5831'84) ☐HRPVC (PVC Type. ST2 -IS:5831'84) ☑FRLS PVC(PVC Type.ST2 - IS:5831'84)
	2	Type	☑Extruded ☐Wrapped
	3	Thickness (nom.) in mm	☑0.3 ☐1.0 ☐1.24 (Suitable for 1100V as per IS 1554 Part-I)
	4	Colour Scheme	Black *(Note:2)*

	5	Dia over sheath	*
ARMOUR	1	Material	☑Single layer Gal. round steel wire ☐Gal. flat steel strip confirming to IS:3975'79 & IS:1554-Part-I
	2	Size in mm	☑1.4 ☐4x0.8 (Suitable for 1100V as per IS 1554 Part-I)
	3	Dia over armour	*
OUTER SHEATH	1	Material	□ PVC (PVC Type.ST1 - IS:5831'84) □ HRPVC (PVC Type.ST2 -IS:5831'84) ☑ FRLS PVC (PVC Type.ST2 - IS:5831'84) with anti-termite and anti-rodent properties
	2	Type	☑Extruded
	3	Thickness(nom.) in mm	☐0.8 ☐1.0 ☑1.24 (Suitable for 1100V as per IS 1554 Part-I)
	4	Overall diameter	*
	5	Tolerance on overall diameter	± 2%
	6	Colour Scheme	Light Blue*(Note:2)*
	7	Rip cord	Non-metallic under inner sheath and armour
ELECTRICAL PARAMETERS	1	Conductor Resistance (max)	* at 20 Deg.C
	2	Drain wire resistance with shield	* at 20 Deg.C
	3	Insulation Resistance of cable	* at 20 Deg.C
	4	Mutual capacitance: core-core	* at 1 khz
	5	Mutual capacitance: core-screen	* at1 khz
	6	Mutual inductance	*
	7	L/R ratio	*
	6	High Voltage Test	*
TEST & INSPECTION	1	General	According to IS:1554 (PartI)'88
	2	Insulation	IS:5831'84 exceptinsulation resistance. Voltage/sparktestBS:5308(Part-II)'86
	3	Armour	IS:3975 '79
	4	Armour galvanisation	IS:2633
FRLS PROPERTY	1	Oxygen index	Oxygen index of 29 at 27 (± 2) deg C According to ASTM D 2863
	2	Temp. index	According to ASTM D 2863
	3	HCL emission	According toIEC-754-1
	4	Smoke density	According to ASTM D 2843
	5	Flame retardant test	According to IEC-332-PartIII cat.A
OTHERS	1	Drum length /No. of drums	*
	2	Total length	*
	3	Meter marking	*
	4	Possible variation in length	±5% for length < 5 km ±2%forlength >5 km

Notes:

1. '*' = Vendor to specify
2. Core identification shall be as per IS:1554 (Part I)
3. A durable marking to be provided on the surface of the cable at regular intervals not exceeding 625mm.The marking shall include manufacturer's name, conductor material, size, pairs, insulation material etc. as per IS:1554 (Part1)

	SIGNAL CABLE (MULTI PAIR)		
GENERAL	1	Description	Signal Cable
	2	Type	Twisted, Screened & Armoured
	3	Size (pair)	2 /4 / 6 / 8 /10 /12
	4	Make	As per suggested vendor list
CONDUCTOR	1	Material	Annealed Tinned Electrolytic Copper IS: 8130 '84
	2	Size	1.5 Sq.mm
	3	No. of Strands/ Strand size mm	☑7/0.53 ☐7/0.43 ☐7/0.37 ☐7/0.30
	4	Shape of conductor	Stranded Circular
PRIMARY INSULATION	1	Material	☐PVC (PVC Type.A-IS:5831'84) ☑HRPVC(PVCType.C-IS:5831'84) ☐FRLS PVC
	2	Type	☑Extruded ☐Wrapped
	3	Thickness(nom.)in mm	☐0.5 ☐0.6 ☑0.8 ☐1.1mm (Suitable for 1100VasperIS 1554Part-I)
	4	Colour Scheme	Black & Blue*(Note:2)*
	5	No. of twists (pair)	Min.10 twists/meter
	6	Insulation Voltage Grade	1100V
INDIVIDUAL PAIR SHIELD	1	Material	Aluminium Mylar tape–black
	2	Type	Helical
	3	Thickness (nom.) in mm	☐0.05 ☑0.06(Suitable for 1100V as per IS 1554 Part 1)
	4	Overlap	25%.
	5	Coverage	100%.
	6	Drain wire type / Size /No. of strands/Formation	Annealed tinned copper/0.5 mm² / 7 strands / in contact with the shield
OVERALL SHIELD	1	Material	Aluminium Mylar tape–black
	2	Type	Helical
	3	Thickness(nom.)in mm	☐0.05 ☑0.075 (Suitable for 1100V as per IS 1554 Part 1)
	4	Overlap	25%.
	5	Coverage	100%.
	6	Drain wire type / Size /No. of strands/Formation	Annealed tinned copper/0.5 mm² / 7 strands / in contact with the shield
INNER SHEATH	1	Material	☐PVC (PVC Type.ST1 - IS:5831'84) ☐HRPVC (PVC Type. ST2 -IS:5831'84) ☑FRLS PVC (PVC Type.ST2 -IS:5831'84)
	2	Type	☑Extruded ☐Wrapped
	3	Thickness (nom) in mm	☑0.3 ☐1.0 ☐1.24(Suitable for 1100V as per IS1554 Part1)

	4	Colour Scheme	Black *(Note:2)*
	5	Dia over sheath	*
ARMOUR	1	Material	Single layer Gal. round steel wire or Gal. flat steel strip confirming to IS:3975'79
	2	Size in mm	☐1.4 or ☐4x0.8 as per IS1554
	3	Dia over armour	*
OUTER SHEATH	1	Material	☐PVC (PVC Type.ST1 - IS:5831'84) ☐HRPVC (PVC Type.ST2 -IS:5831'84) ☑FRLS PVC (PVC Type.ST2 -IS:5831'84) with anti-termite and anti-rodent properties
	2	Type	☑Extruded
	3	Thickness (nom.) in mm	☐0.8 ☐1.0 ☑1.24(Suitable for 1100V as per IS1554 Part1) Thickness shall vary with no. of pairs as per IS1554
	4	Overall diameter	*
	5	Tolerance on overall diameter	± 2%
	6	Colour Scheme	Light Blue*(Note:2)*
	7	Rip cord	Non-metallic under inner sheath
ELECTRICAL PARAMETERS	1	Conductor Resistance (max)	* at 20 Deg.C
	2	Drain wire resistance with shield	* at 20 Deg.C
	3	Insulation Resistance of cable	* at 20 Deg.C
	4	Mutual capacitance: core-core	* at 1 khz
	5	Mutual capacitance: core-screen	* at 1 khz
	6	Mutual inductance	*
	7	L/R ratio	*
	6	High Voltage Test	*
TEST & INSPECTION	1	General	According to IS:1554 (Part I)'88
	2	Insulation	IS:5831'84 except insulation resistance. Voltage/spark test BS:5308 (Part-II)'86
	3	Armour	IS:3975 '79
	4	Armour galvanisation	IS:2633
FRLS PROPERTY	1	Oxygen index	Oxygen index of 29 at 27 (± 2) deg C According to ASTM D 2863
	2	Temp. index	According to ASTM D 2863
	3	HCL emission	According to IEC-754-1
	4	Smoke density	According to ASTM D 2843
	5	Flame retardant test	According to IEC-332-PartIII cat.A
OTHERS	1	Drum length /No. of drums	*
	2	Total length	*
	3	Meter marking	*

	4	Possible variation in length	±5% for length < 5 km ±2%forlength >5 km

Notes:

1. '*' = Vendor to specify
2. Core identification shall be as per IS:1554 (Part I)
3. A durable marking to be provided on the surface of the cable at regular intervals not exceeding 625mm.Themarking shall include manufacturer's name, conductor material, size, pairs, insulation material etc. as per IS:1554 (Part1)

		TWO CORE CABLE	
GENERAL	1	Description	Control Cable/ Power Cable
	2	Type	PVC insulated, Armoured
	3	Size	2C
	4	Make	As per suggested vendor list
CONDUCTOR	1	Material	Annealed Tinned Electrolytic Copper IS: 8130 '84
	2	Size	1.5 Sq.mm
	3	No. of Strands	☑7
	4	Shape of conductor	Stranded Circular
PRIMARY INSULATION	1	Material	☐PVC (PVC Type.A-IS:5831'84) ☑HRPVC(PVCType.C-IS:5831'84) ☐FRLS PVC
	2	Type	☑Extruded ☐Wrapped
	3	Thickness(nom.) in mm	☐0.5 ☑0.8 ☐1.1mm (Suitable for 1100V as per IS 1554 Part-I)
	4	Colour Scheme	Black *(Note:2)*
	5	No. of twists(pair)	~NA~
	6	Insulation Voltage Grade	1100V
INDIVIDUAL PAIR SHIELD	1	Material	~ NA ~
	2	Type	~NA~
	3	Thickness(nom.)in mm	~NA~
	4	Overlap	~NA~
	5	Coverage	~NA~
	6	Drain wire type / Size /No. of strands/ Formation	~ NA ~
OVERALL SHIELD	1	Material	Aluminium Mylar tape–black
	2	Type	Helical
	3	Thickness(nom.) in mm	☐0.05 ☑0.075(Suitable for 1100V as per IS 1554 Part 1)
	4	Overlap	25%.
	5	Coverage	100%.
	6	Drain wire type / Size /No. of strands/Formation	Annealed tinned copper/0.5 mm^2 / 7 strands / in contact with the shield
INNER SHEATH	1	Material	☐PVC (PVC Type.ST1 - IS:5831'84) ☐HRPVC (PVC Type. ST2 -IS:5831'84) ☑FRLS PVC (PVC Type. ST2 -IS:5831'84)
	2	Type	☑Extruded ☐Wrapped
	3	Thickness(nom.) in mm	☑0.3 ☐1.0 ☐1.24 (Suitable for1100V as per IS1554 Part1)
	4	Colour Scheme	Black *(Note:2)*
	5	Dia over sheath	*

ARMOUR	1	Material	☑Single layer Gal. round steel wire ☐Gal. flat steel strip confirming to IS:3975'79
	2	Size in mm	☑1.4 ☐4x0.8
	3	Dia over armour	*
OUTER SHEATH	1	Material	☐PVC (PVC Type.ST1 - IS:5831'84) ☐HRPVC (PVC Type.ST2 -IS:5831'84) ☑FRLS PVC (PVC Type. ST2 -IS:5831'84) with anti-termite and anti-rodent properties
	2	Type	☑Extruded
	3	Thickness(nom.) in mm	☐0.8 ☐1.0 ☑1.24 (Suitable for 1100V as per IS1554 Part1)
	4	Overall diameter	*
	5	Tolerance on overall diameter	± 2%
	6	Colour Scheme	Black *(Note:2)*
	7	Rip cord	Non-metallic under inner sheath
ELECTRICAL PARAMETERS	1	Conductor Resistance (max)	* at 20 Deg.C
	2	Drain wire resistance with shield	* at 20 Deg.C
	3	Insulation Resistance of cable	* at 20 Deg.C
	4	Mutual capacitance: core-core	* at 1 khz
	5	Mutual capacitance: core-screen	* at 1 khz
	6	Mutual inductance	*
	7	L/R ratio	*
	6	High Voltage Test	*
TEST & INSPECTION	1	General	According to IS:1554 (Part I) '88
	2	Insulation	IS:5831'84 except insulation resistance. Voltage/ spark test BS:5308(Part-II)'86
	3	Armour	IS:3975 '79
	4	Armour galvanisation	IS:2633
FRLS PROPERTY	1	Oxygen index	Oxygen index of 29 at 27 (± 2) deg C According to ASTM D 2863
	2	Temp. index	According to ASTM D 2863
	3	HCL emission	According to IEC-754-1
	4	Smoke density	According to ASTM D 2843
	5	Flame retardant test	According to IEC-332-PartIII cat.A
OTHERS	1	Drum length /No. of drums	*
	2	Total length	*
	3	Meter marking	*
	4	Possible variation in length	±5% for length < 5 km ±2%forlength >5 km

Notes:

1. '*' = Vendor to specify
2. Core identification shall be as per IS:1554 (Part I)
3. A durable marking to be provided on the surface of the cable at regular intervals not exceeding 625mm. The marking shall include manufacturer's name, conductor material, size, pairs, insulation material etc. as per IS:1554 (Part1)

		TWO CORE CABLE	
GENERAL	1	Description	Control Cable/ Power Cable
	2	Type	PVC insulated, Armoured
	3	Size	2C
	4	Make	As per suggested vendor list
CONDUCTOR	1	Material	Annealed Electrolytic Copper IS: 8130 '84
	2	Size	2.5/ 4/ 6 Sq.mm
	3	No. of Strands	☑7
	4	Shape of conductor	Stranded Circular
PRIMARY INSULATION	1	Material	☐PVC (PVC Type.A-IS:5831'84) ☑HRPVC(PVCType.C-IS:5831'84) ☐FRLS PVC
	2	Type	☑Extruded ☐Wrapped
	3	Thickness(nom.) in mm	☐0.5 ☑0.8 ☐1.1mm (Suitable for 1100V as per IS 1554 Part-I)
	4	Colour Scheme	Black *(Note:2)*
	5	No. of twists (pair)	~NA~
	6	Insulation Voltage Grade	1100V
INDIVIDUAL PAIR SHIELD	1	Material	~ NA ~
	2	Type	~NA~
	3	Thickness(nom.)in mm	~NA~
	4	Overlap	~NA~
	5	Coverage	~NA~
	6	Drain wire type / Size /No.of strands/Formation	~ NA ~
OVERALL SHIELD	1	Material	Aluminium Mylar tape–black
	2	Type	Helical
	3	Thickness(nom.)in mm	☐0.05☑0.075(Suitablefor1100VasperIS 1554 Part 1)
	4	Overlap	25%.
	5	Coverage	100%.
	6	Drain wire type / Size /No. of strands/ Formation	Annealed tinned copper/0.5 mm^2 / 7 strands / in contact with the shield
INNER SHEATH	1	Material	☐PVC (PVC Type.ST1 - IS:5831'84) ☐HRPVC (PVC Type. ST2 -IS:5831'84) ☑FRLS PVC (PVC Type. ST2 -IS:5831'84)
	2	Type	☑Extruded ☐Wrapped
	3	Thickness(nom.)in mm	☑0.3 ☐1.0 ☐1.24 (Suitable for1100Vas per IS1554 Part1)
	4	Colour Scheme	Black *(Note:2)*
	5	Dia over sheath	*

	4	Colour Scheme	Black *(Note:2)*
	5	Dia over sheath	*
ARMOUR	1	Material	☑Single layer Gal. round steel wire (for ≤10C) ☑Gal. flat steel strip confirming to IS:3975'79 (Suitable for1100Vas per IS1554 Part1)
	2	Size in mm	☑1.4 ☑4x0.8 (Suitable for1100Vas per IS1554 Part1)
	3	Dia over armour	*
OUTER SHEATH	1	Material	☐PVC (PVC Type.ST1 - IS:5831'84) ☐HRPVC (PVC Type.ST2 -IS:5831'84) ☑FRLS PVC (PVC Type.ST2 -IS:5831'84) with anti-termite and anti-rodent properties
	2	Type	☑Extruded
	3	Thickness(nom.) in mm	☐0.8 ☐1.0 ☑1.24 (Suitable for 1100V as per IS1554 Part1) thickness shall vary with no. of cores, as per IS 1554
	4	Overall diameter	*
	5	Tolerance on overall diameter	± 2%
	6	Colour Scheme	Black *(Note:2)*
	7	Rip cord	Non-metallic under inner sheath
ELECTRICAL PARAMETERS	1	Conductor Resistance (max)	* at 20 Deg.C
	2	Drain wire resistance with shield	* at 20 Deg.C
	3	Insulation Resistance of cable	* at 20 Deg.C
	4	Mutual capacitance: core-core	* at 1 khz
	5	Mutual capacitance: core-screen	* at 1 khz
	6	Mutual inductance	*
	7	L/R ratio	*
	6	High Voltage Test	*
TEST & INSPECTI ON	1	General	According to IS:1554 (Part I)'88
	2	Insulation	IS:5831'84 except insulation resistance. Voltage/sparktestBS:5308(Part-II)'86
	3	Armour	IS:3975 '79
	4	Armour galvanisation	IS:2633
FRLS PROPERT Y	1	Oxygen index	According to ASTM D 2863
	2	Temp. index	According to ASTM D 2863
	3	HCL emission	According to IEC-754-1
	4	Smoke density	According to ASTM D 2843
	5	Flame retardant test	According to IEC-332-PartIIIcat.A
OTH	1	Drum length /No. of drums	*
	2	Total length	*
	3	Meter marking	*

	4	Possible variation in length	±5% for length < 5 km ±2%forlength >5 km

Notes:

1. '*' = Vendor to specify
2. Core identification shall be asperIS:1554 (PartI)
3. A durable marking to be provided on the surface of the cable at regular intervals not exceeding 625mm.The marking shall include manufacturer's name, conductor material, size, pairs, insulation material etc. as per IS:1554 (Part1).

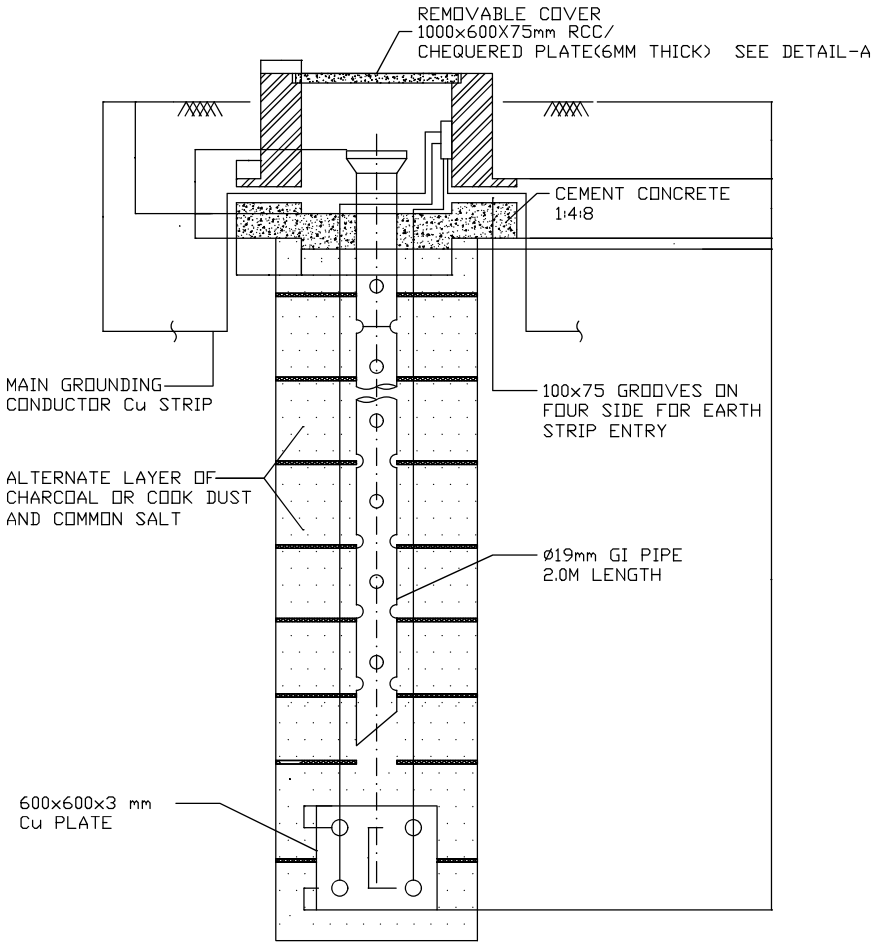
		ONE CORE CABLE	
GENERAL	1	Description	Earthing
	2	Type	PVC insulated, Armoured
	3	Size	1C
	4	Make	As per suggested vendorlist
CONDUCTOR	1	Material	Annealed Electrolytic Copper IS: 8130 '84
	2	Size	4/ 10Sq.mm
	3	No. of Strands	☑7
	4	Shape of conductor	Stranded Circular
PRIMARY INSULATION	1	Material	☐PVC (PVC Type.A-IS:5831'84) ☑HRPVC(PVCType.C-IS:5831'84)/ XLPE ☐FRLS PVC
	2	Type	☑Extruded ☐Wrapped
	3	Thickness(nom.) in mm	☐0.5 ☑0.8 ☐1.1mm (Suitable for 1100V as per IS 1554 Part-I)
	4	Colour Scheme	Black *(Note:2)*
	5	No. of twists (pair)	~NA~
	6	Insulation Voltage Grade	1100V
INDIVIDUAL PAIR SHIELD	1	Material	~ NA ~
	2	Type	~NA~
	3	Thickness(nom.)in mm	~NA~
	4	Overlap	~NA~
	5	Coverage	~NA~
	6	Drain wire type / Size /No.of strands/Formation	~ NA ~
OVERALL SHIELD	1	Material	~NA~
	2	Type	~NA~
	3	Thickness(nom.)in mm	~NA~
	4	Overlap	~NA~
	5	Coverage	~NA~
	6	Drain wire type / Size /No. of strands/Formation	~NA~
INNER SHEATH	1	Material	☐PVC (PVC Type.ST1 - IS:5831'84) ☐HRPVC (PVC Type. ST2 -IS:5831'84) ☑FRLS PVC (PVC Type. ST2 -IS:5831'84)
	2	Type	☑Extruded ☐Wrapped
	3	Thickness(nom.) in mm	☐0.3 ☐1.0 ☐1.24 (Suitable for 1100V as per IS1554 Part 1)
	4	Colour Scheme	Black *(Note:2)*
	5	Dia over sheath	*

	4	Colour Scheme	Black *(Note:2)*
	5	Dia over sheath	*
ARMOUR	1	Material	☑Single layer Gal. round steel wire (for ≤10C) ☑Gal. flat steel strip confirming to IS:3975'79 (Suitable for 1100V as per IS1554 Part1)
	2	Size in mm	☑1.4 ☑4x0.8 (Suitable for 1100V as per IS1554 Part1)
	3	Dia over armour	*
OUTER SHEATH	1	Material	☐PVC (PVC Type.ST1 - IS:5831'84) ☐HRPVC (PVC Type.ST2 -IS:5831'84) ☑FRLS PVC (PVC Type.ST2 -IS:5831'84) with anti-termite and anti-rodent properties
	2	Type	☑Extruded
	3	Thickness(nom.)in mm	☐0.8☐1.0☑1.24 (Suitable for1100Vas per IS1554 Part1) thickness shall vary with no.ofcores,asperIS1554
	4	Overall diameter	*
	5	Tolerance on overall diameter	± 2%
	6	Colour Scheme	Black *(Note:2)*
	7	Rip cord	Non-metallic under inner sheath and armour
ELECTRICAL PARAMETERS	1	Conductor Resistance (max)	* at 20 Deg.C
	2	Drain wire resistance with shield	* at 20 Deg.C
	3	Insulation Resistance of cable	* at 20 Deg.C
	4	Mutual capacitance: core-core	* at1 khz
	5	Mutual capacitance: core-screen	* at1 khz
	6	Mutual inductance	*
	7	L/R ratio	*
	6	High Voltage Test	*
TEST & INSPECTI ON	1	General	According to IS:1554 (Part I)'88
	2	Insulation	IS:5831'84 except insulation resistance. Voltage/spark test BS:5308(Part-II)'86
	3	Armour	IS:3975 '79
	4	Armour galvanisation	IS:2633
FRLS PROPERT Y	1	Oxygen index	According to ASTM D 2863
	2	Temp. index	According to ASTM D 2863
	3	HCL emission	According to IEC-754-1
	4	Smoke density	According to ASTM D 2843
	5	Flame retardant test	According to IEC-332-PartIII cat.A
OTH	1	Drum length /No. of drums	*
	2	Total length	*
	3	Meter marking	*

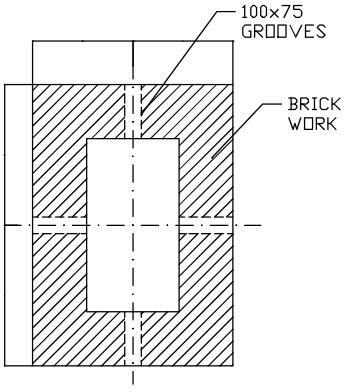
	4	Possible variation in length	±5% for length < 5 km ±2%forlength >5 km

Notes:

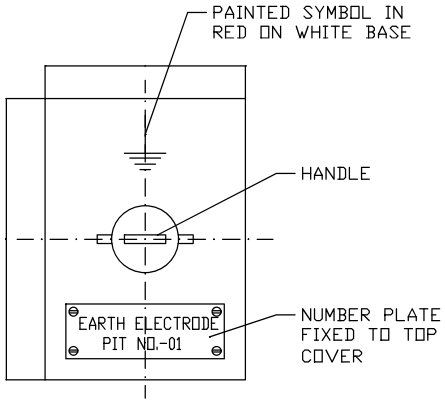
1. '*' = Vendor to specify
2. Core identification shall be as per IS:1554 (Part I)
3. A durable marking to be provided on the surface of the cable at regular intervals not exceeding 625mm.The marking shall include manufacturer's name, conductor material, size, pairs, insulation material etc. as per IS:1554 (Part1).



COPPER PLATE ELECTRODE WITH TREATED EARTH PIT



DETAIL-B



DETAIL-A

REV NO	DATE	ZONE	DESCRIPTIONS	BY	APPRD	REFERENCES	DRG. NO.
			REVISIONS				

SECTION: ELECTRICAL				
	NAME	DATE	CHKD	DATE
DSGN	C.B.	31.05.23	A.M.	
DRWN	B.G			
APPROVED P.SRIVASTAVA				

COPPER PLATE EARTH PIT DETAILS

मेकॉन लिमिटेड

MECON LIMITED

SCALE : N.T.S.	EDITION	REV
DRG.NO MEC/05/E9/TS-14/SD/03/02	1	0

TECHNICALSPECIFICATION

FOR

Type-1 RTUPANEL&ACCESSORIES

TS.No.:MEC/05/E5/T/TS/PANEL/001A

MECONLIMITED

DELHI-110092

SPECIFICATIONS
FOR
PANEL & ACCESSORIES

GENERAL

Site of Installation

1. Plant and Location	:	As per MR
2. Client	:	IGGL
3. Consultant	:	MECONLIMITED.
4. Location of panel	:	Control Room and accessories.
5. Floor	:	(By client)
6. Air Conditioning	:	Yes (By client)
7. Control Panels Quantity	:	As per MR

Scope of Work:

a) Supply of RTU Panel (free standing, cubicle type) along with all accessories like Lamps, MCBs, Relays, Barriers/ Isolators, Selector Switch, Signal Multipliers (SDC),etc. as per this Technical specification.

b) Quantities of control panel accessories (Push Buttons, Lamps, Relays, Zener Barriers, and SDC Cards etc.) shall be as per the Technical Requirements during drawing approval/detail engineering.

c) Panel Dimensions:

Height–2115mm (including 100mm base channel and 15 mm anti-vibration pad)
Width – 800mm , Depth – 800 mm

d) Mountingheights (tentative, final shall be decided during detail eng.) :

i)Miniatureandsubminiature items(3rows)	Bottomrow	1100mm
	Middlerow	1350mm
	Top row	1600mm

PANELCONSTRUCTION

1.	Type	:	Self-supported, FreeStanding, enclosed cubicle andNon-graphic.
2.	Panel Manufacturing Standard		IEC 62208 Mechanical protection impact – IEC 62262, IK-08
A	Corrosion Protection		To be provided
B	Panel Certification		TUV/BV/UL/other third party
C	Load Bearing Capacity		Minimum 1000 Kg
D	Life of panel		20 Years
3.	Lighting	:	Requiredforinsidepanelwithdoorswitch on each side of door.
4.	Ventilation	:	2 nos. Fan (6”) on top side of rear door Requiredwithlouvers and filter unitbackedbywireflyscreen&fan.FanFailurealarmrequired. Also, 2 nos. Louvers with filter unit shall be provided on front and rear doors
5.	Doors	:	CRCA door in the front and Rear of the Panel with locking arrangement. Both Doors shall be provided with minimum 3-Point Ergofoam type Lock or similar with key and handle
6.	Doorwidth	:	Each max. of 800mm and shall suit width of the panel. Panelwidthisindicativeonly.Thesizesshallbesufficient to accommodatetherequiredhardwarespecifiedin MR.
7.	CableEntry	:	Bottom,CableGlandsshallbedoublecompressiontypefor external armoured cables. All unused entries shall be plugged.
8.	Receptacles	:	Requiredfor incomer supply.
9.	Painting	:	The finishshallincludesandblasting,grinding,chemical cleaning,surfacefinishingby suitablefilterandtwocoatsof highgradelacquerwithwetsandingbetweencoats..Two coatsof paintin panelcolourshallbegivenforNon-glossy highstainfinish. ROHS shall be complied Panelfacefinalcolourshallbe of the following: a) SiemensGrey (RAL7035) b) PanelinternalshallhaveafinishcolorofSiemensGrey (RAL7035) c) ChannelBaseshallhaveafinishcolorofblack
	ChannelBase	:	100X50X6MM,MSmaterial

10.	TagPlates	:	Front of Panel Instrument Tagplates shall be black laminated plastic with white core. Tag plate shall be providedontherearofthepanelalso.
11.	NamePlates	:	Nameplates shall be black laminated plastic with white core. It shall include project details. It shall be provided on Front Side of Panel.
12.	Laptop Tray	:	Tray for Placement of Laptop shall be provided inside the panel

13Dimensions&MaterialofConstruction

a)	Paneldimension	:	2115 (mm) H (including 100 mm base + 15 mm anti-vibrationpad)x800(mm)Wx800(mm)D with modular construction
b)	ControlPanel	:	1.5mmthickCRCAsteel
c)	Side&Topplates	:	1.5 mmthickCRCAsteel
d)	Doorpanel	:	2 mmthickCRCAsteel, Single doorinthefront and rear
e)	Cableglandplate	:	3mmthickCRCAsteel
f)	Mounting Plate	:	3 mmthick or as decided during detail eng.
g)	AnchorBoltSize	:	Byvendor
h)	LiftingEyeBolt	:	Required
i)	AntiVibrationPad	:	Required(15mmthickrubberpad).
j)	Laptop Tray	:	3mmthickCRCAsteel. Paint of Laptop tray shall be same as panel.
k)	Cable Routing	:	All cables inside the panel shall be router through proper covered PVC duct of suitable sizes. The same shall be provided as decided during detail engineering.
l)	Equipment Arrangement	:	The MCBs for incomer power supply and distribution supply shall be provided at the top of the Panel. RTU shall be mounted Approx. in the middle at the approachable height TBs shall be arranged vertically in the RTU for AI, AO, DI and DO. MCBs and Power TBs shall be provided with acrylic sheet cover for safety. All MCBs shall be provided with Micro-switch
m)	Gasket	:	PU Foam

Note:

***Panelshallbeelectricallyisolatedfrombaseframe.**

12 WIRING

a) Type : Generalpurpose,Intrinsicallysafe

b) Wiringdetails

24V DCWiring(Incomer)	:	2C x 4.0 mm²copperconductor
230VACWiring(NonUPS): 24V		3C x 4.0 mm²copperconductor
DCWiring(Inside)	:	2C x 2.5 mm²copperconductor
Cabinet power distribution		

c) SignalWiring

ExternaltoCabinet	:	1.0mm²twintwistedindividualshieldedoverall shieldedwithoveralldrainPVCinsulatedarmoured
Insidethecabinet	:	Multistrandedmin.1.0mm²copperconductorPVC insulatedtwintwistedandshielded.
Electrical Earth	:	Multistrandedmin.4.0mm²copperconductor PVC insulated
Instrument Earth	:	Multistrandedmin.4.0mm²copperconductor PVC insulated

d) **Terminal type** : Screw Type/ Screw-less push-in type terminal blocks (TB)

Terminalsizefor signal : Suitableformin.2.5mm²size conductor

Terminalsizeforpowerdist.: Suitableformin.4.0mm²sizeconductorandhigher asperactualcablesizes.

f) **PowerIndicationLamps** : To be provided for incomer power supply and 24V DC power supply

SPECIFICATIONSFORACCESSORIES

1. MCB

Make	:As per Vendor List
Qty.	:Asrequired+20%spare
	All MCBs shall be provided with Micro-switch

2. Lamps

Type	:LEDClusteredType
Voltage	:Asrequired
Make/ModelNo.	:As per Vendor list
Quantity	:Asrequired

3 Relays

Type	:Pluginrelays
ContactType	:Potentialfreecontact
ContactNo.	:1NO.+1NC
Rating	:24VDC,5.0A
Make/ModelNo.	:As per vendor list.
Quantity	:Asrequired+20%spare

4. Panel Light

Type	:LEDLight for front and Rear
Voltage	:Asrequired
Make/ModelNo. Quantity	: As per Standard :For front and Rear Door switch shall be provided at front and rear doors. It shall have 2 nos SPDT contact. One for connection of light and one for connection to RTU DI channel

Different colour codification shall be followed for various types of wiring. The suggested wiring colour code is:

SN	Description	Wire Colour	Wire Size	TB Colour
		INCOMER		
1	230V AC PHASE	RED	2.5 mm2	RED
2	230V AC NEUTRAL	BLACK	2.5 mm2	BLACK
3	ELECTRICAL EARTH	GREEN	6 mm2	GREEN
4	24V DC POSITIVE	RED	4 mm2	RED
5	24V DC NEGATIVE	BLACK	4 mm2	BLACK
		INTERNAL DISTRIBUTION		
4	24V DC POSITIVE	YELLOW	2.5 mm2	YELLOW
5	24V DC NEGATIVE	WHITE	2.5 mm2	GREY
6	INSTRUMENT EARTH	GREEN WITH YELLOW STRIPS	6 mm2	GREEN
		INPUT/OUTPUT		
6	DIGITAL INPUT (+ve)	BLUE	1.5 mm2	BLUE
	DIGITAL INPUT (-ve)	BLACK	1.5 mm2	BLUE
7	DIGITAL OUTPUT/ POTENTIAL FREE (+ve)	ORANGE	1.5 mm2	BLACK
	DIGITAL OUTPUT/ POTENTIAL FREE (-ve)	BLACK	1.5 mm2	BLACK
8	ANALOG INPUT +ve	GREY	1.0 mm2	YELLOW
	ANALOG INPUT –ve	WHITE	1.0 mm2	YELLOW
10	ANALOG OUTPUT +ve	BROWN	1.0 mm2	YELLOW
	ANALOG OUTPUT –ve	WHITE	1.0 mm2	YELLOW

Terminal Block

1. Make to be specified
2. Fused Type TBs to be provided for each channel of AI, AO, DI and DO signals with Blow – out indicator
3. Separate color TB for different signal type
   a. Red – AO
   b. Yellow – AI
   c. Blue – DI
   d. Black – DO
   e. Grey – Serial
4. TB for other types of connections
   a. Red – Phase
   b. Black – Neutral
   c. Green – Earth
5. 25% spare TBs to be provisioned (for signal as well as bus bar)

Minimum & Mandatory Specification for Terminal Block		
Sr.No.	**Discription**	**Requirement**
1	Connection method	Screw type terminal blocks (TB)
2	Insulating material	Vendor to provide
3	Flammability rating according to UL 94	V0
4	Visual indication for wire Connection making & breaking	Required
5	Double shorting facility	Required
6	Marking Facility	Marking should be on Center & both side of TB .
7	TB Wire size	Wire size required + Lug Zize
8	Special tool requirement	Should not required

SPD Specs

Make : MTL / Phoenix Contact

Main **Incomer**

Minimum Specification For Power supply	**Technical Parameter 48 V DC**	**Technical Parameter 230V**
Nominal voltage Un	48V DC (TN-S)	230 V AC (TN-S)
Maximum continuous operating voltage Uc	60 V AC 60 V DC	264 V AC 230 V DC
Nominal discharge current In (8/20) µs (L-N)	1 kA	3 kA
Rated load current IL	26 A (30 °C)	--
Combination wave UOC	2 kV	6 kV
Voltage protection level Up (L-N)	≤ 0.25 kV	≤ 1.35 kV
Voltage protection level Up (N-PE)	≤ 0.65 kV	≤ 1.5 kV
Response time tA (L-N)	≤ 25 ns	≤ 25 ns
TOV behavior at UT (L-N)	100 V AC (5 s / withstand mode) 100 V AC (120 min / withstand mode)	440 V AC (5 s / withstand mode) 440 V AC (120 min / withstand mode)
Surge protection fault message	Optical, remote indicator contact	Optical, remote indicator contact
Ambient temperature (operation)	-40 °C ... 80 °C	-40 °C ... 80 °C
Degree of protection	IP20	IP20
Standards/regulations	IEC 61643-11 2011 EN 61643-11 2012	IEC 61643-11 2011 EN 61643-11 2012
Approvals	KEMA, UL Recognized	KEMA, UL Recognized

Ethernet SPD

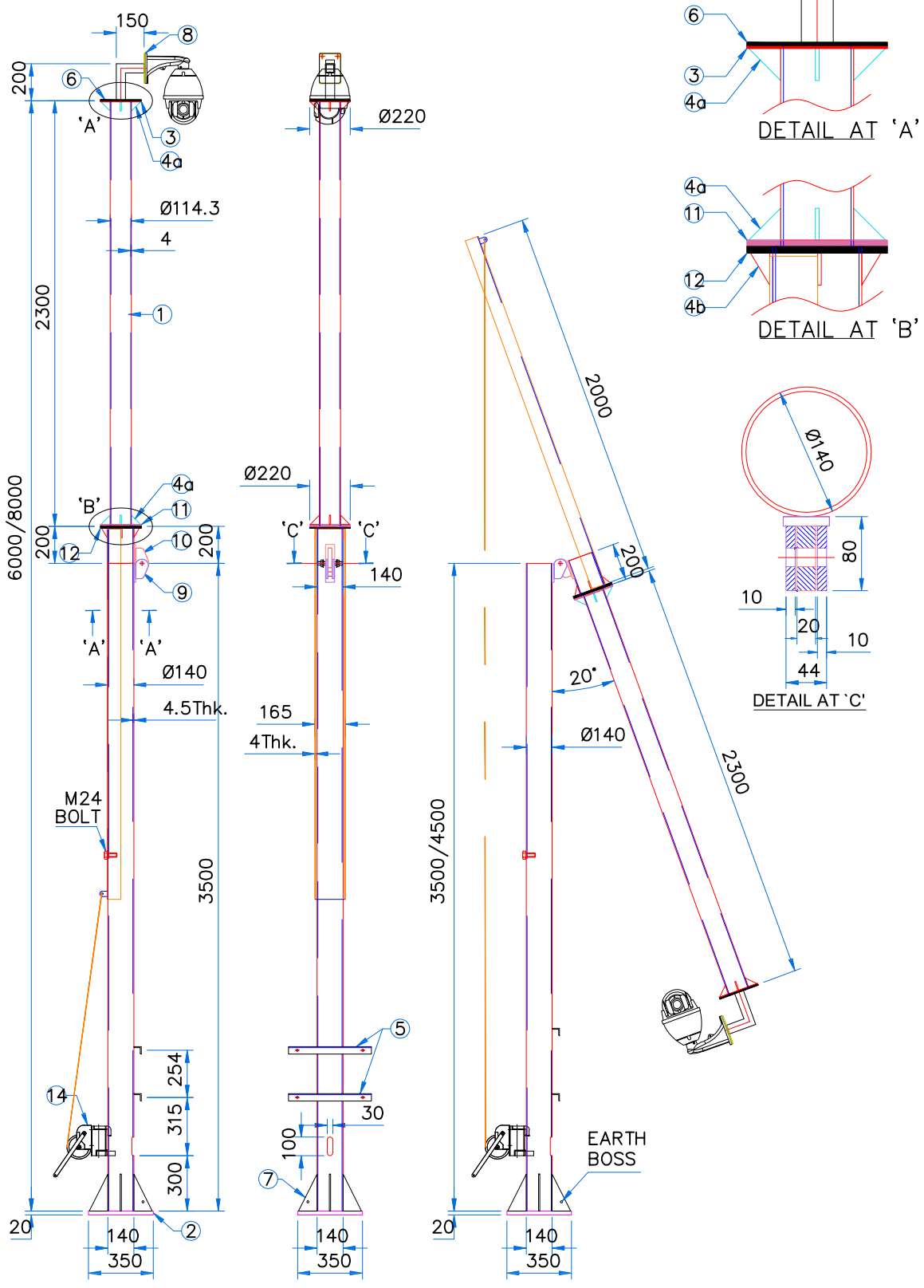
SPD Specification for Ethernet Port, MODBUS TCP/ IP Port	Technical Parameter
Maximum continuous operating voltage UC	≤ 3.3 V DC
Maximum continuous voltage UC (wire-wire)	≤ 3.3 V DC (± 60 V DC/PoE+)
Maximum continuous voltage UC (wire-ground)	≤ 180 V DC
Nominal current IN	≤ 1.5 A (25°C)
Operating effective current IC at UC	≤ 1 µA
Nominal discharge surge current In (8/20) µs (Core-Core)	100 A
Nominal discharge surge current In (8/20) µs (Core-Earth)	2 kA (per signal pair)
Total surge current (8/20) µs	10 kA
Nominal pulse current Ian (10/700) µs (Core-Core)	≤ 40 A
Output voltage limitation at 1 kV/µs (Core-Core) spike	≤ 85 V (PoE)
Residual voltage at In, (conductor-conductor)	≤ 15 V ≤ 100 V (PoE)
Protection level UP (Core-Core)	≤ 9 V (B2 (1 kV/25 A)) ≤ 100 V (B2 (1 kV/25 A) - PoE) ≤ 15 V (500 V/100 A)
Protection level UP (Core-Earth)	≤ 600 V ≤ 700 V (C2 (4 kV/2 kA))
Response time tA (Core-Core)	≤ 1 ns
Standards/regulations	IEC 61643-21 EN 50173-1 ISO/IEC 11801-Am.1
Approvals	UL Listed, GOST

Serial (RS485)

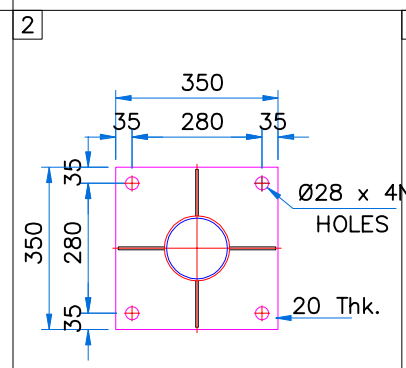
SPD Specification for RS-485	Technical Parameter
IEC category	C1 C2 C3 D1
Nominal voltage UN	12 V DC
Max. operating voltage Umax	14 V DC
Nominal current IN	450 mA (45°C)
Response time :	≤ 500 ns
Operating Temperature range	-40 °C ... 85 °C
Degree of protection	IP20
Total surge current (8/20) µs	20 KA
Nominal discharge surge current In (8/20) µs (Core-Core)	10 kA (Core to core) 10 kA (Core to Earth)
Lightning Impulse current	2.5 kA per path
output voltage limitation at 1 kV/µs (Core-Core) spike	≤ 55 V
Output voltage limitation at 1 kV/µs (Core-Earth) spike	≤ 55 V
Voltage protection level Up (core-core)	≤ 80 V (C1 - 1 kV/500 A)
Voltage protection level Up (core-ground)	≤ 85 V (C1 - 1 kV/500 A)
Certificates / Approvals	UL Listed / GL / EAC / EAC

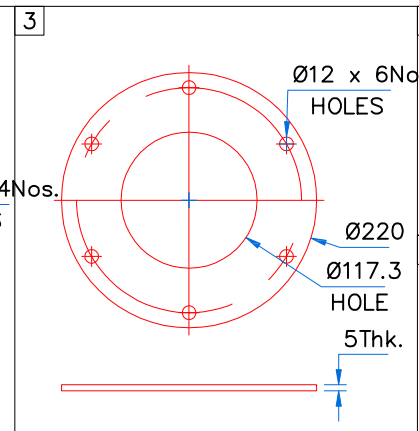
6/8 METER CCTV POLE FOR CAMERA

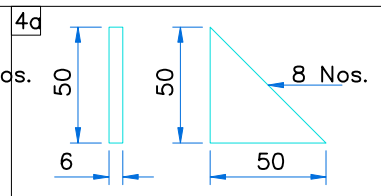
MOUNTING ARRANGEMENT

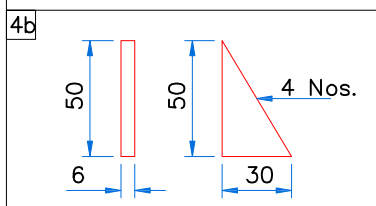


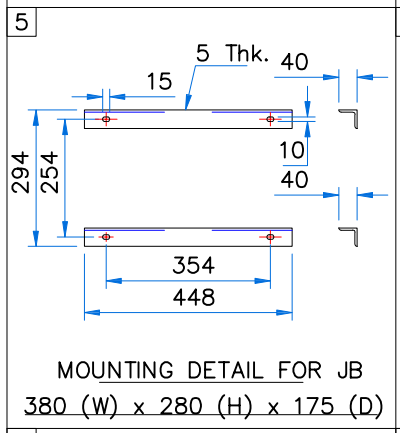
POLE ACCESSORIES

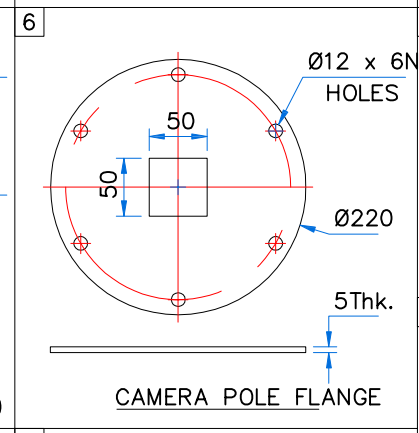


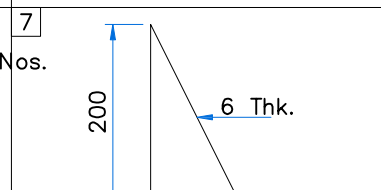


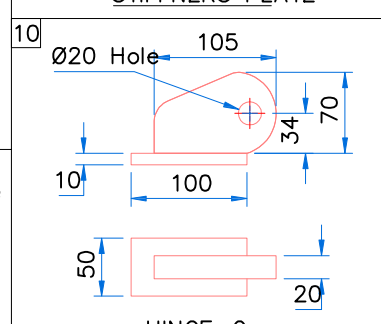


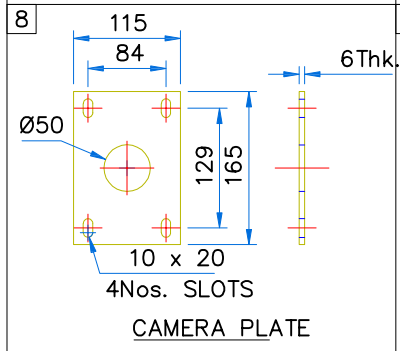


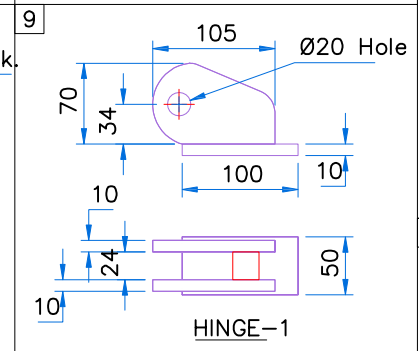


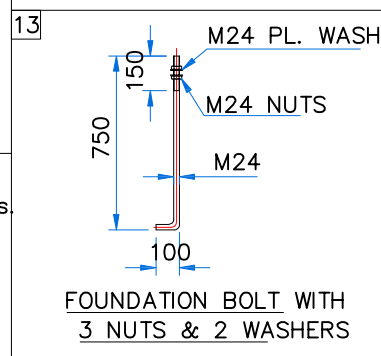


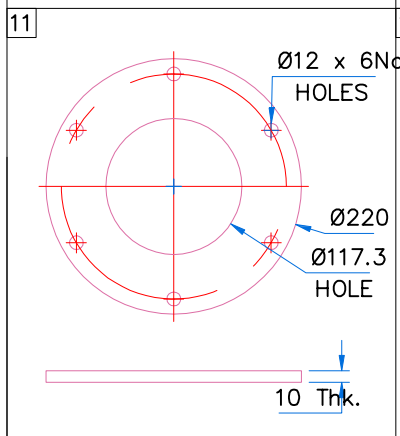


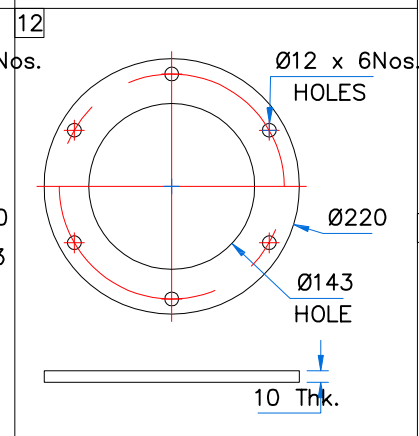


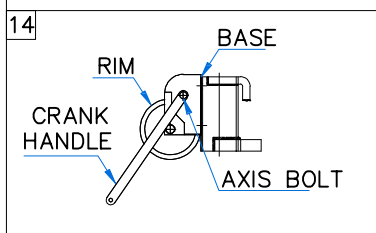












ALL DIMENSIONS ARE IN MM

ABBREVIATIONS:

CCTV : CLOSED CIRCUIT TELEVISION
IP : INTERNET PROTOCOL
PTZ : PAN TILT ZOOM
MS : MILD STEEL

BILL OF MATERIALS PER POLE

ITEM	DESCRIPTION	QTY.
1	6/8 METER TILT DOWN POLE	01
2	BASE PLATE	01
3	TOP POLE FLANGE–1	01
4	STIFFENERS PLATE	
4a	STIFFENERS PLATE	08
4b	STIFFENERS PLATE	04
5	JUNCTION BOX MOUNTING PLATE	01
6	CAMERA POLE FLANGE	01
7	STIFFENERS PLATE	04
8	CAMERA PLATE	01
9	HINGE–1	02
10	HINGE–2	01
11	TOP POLE FLANGE–2	01
12	BOTTOM POLE FLANGE	01
13	M24 L–FOUNDATION BOLTS (M24 x 750)	04
14	WINCH WITH ROPE	01

FOR TENDER PURPOSE ONLY

HINDUSTAN PETROLEUM CORPORATION LIMITED

मेकॉन लिमिटेड

MECON LIMITED

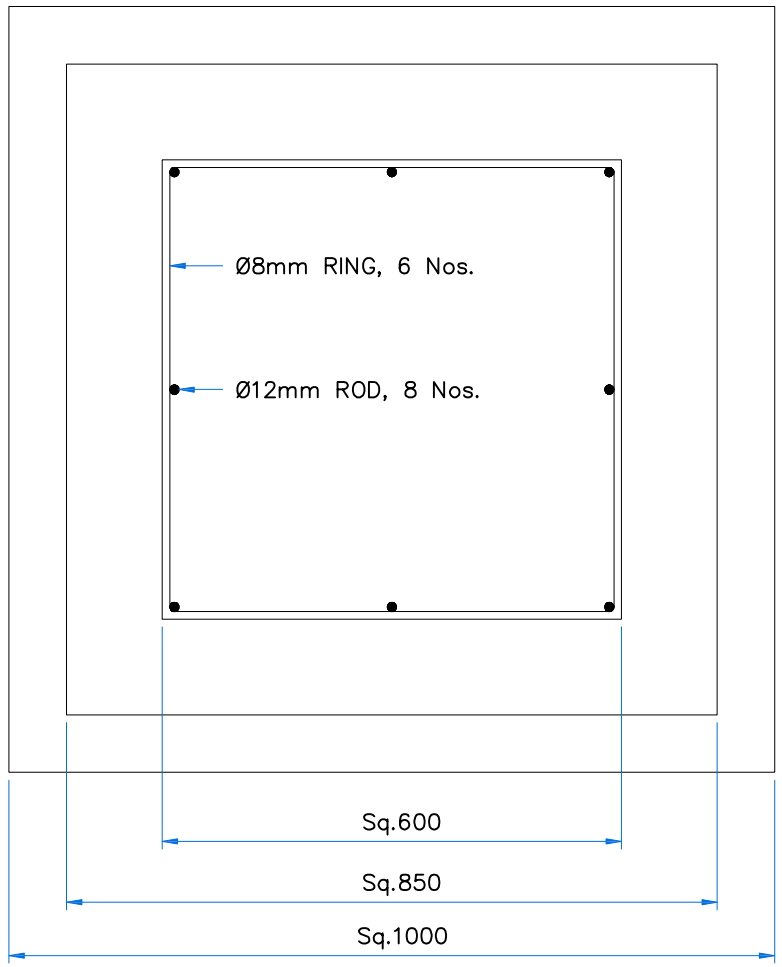
SECTION	INST. & PROC.		HALDIA – PANAGARH PIPELINE PROJECT (HPPL)
LOCATION	DELHI		
DESIGNED	RATNADEEP	FEB, '24	TYPICAL POLE DRAWING FOR CAMERA(IS/ NON–IS)
DRAWN	RATNADEEP	FEB, 24	
CHECKED	PANKAJ SRIVASTAVA	FEB, '24	
VERIFIED			
APPROVED	PANKAJ SRIVASTAVA		SCALE – NTS; SHEET 1 OF 2; REV. 0
	DATE	JAN, '24	DRG.No. MEC/05/ES/071N/1/97/111

NOTES: –

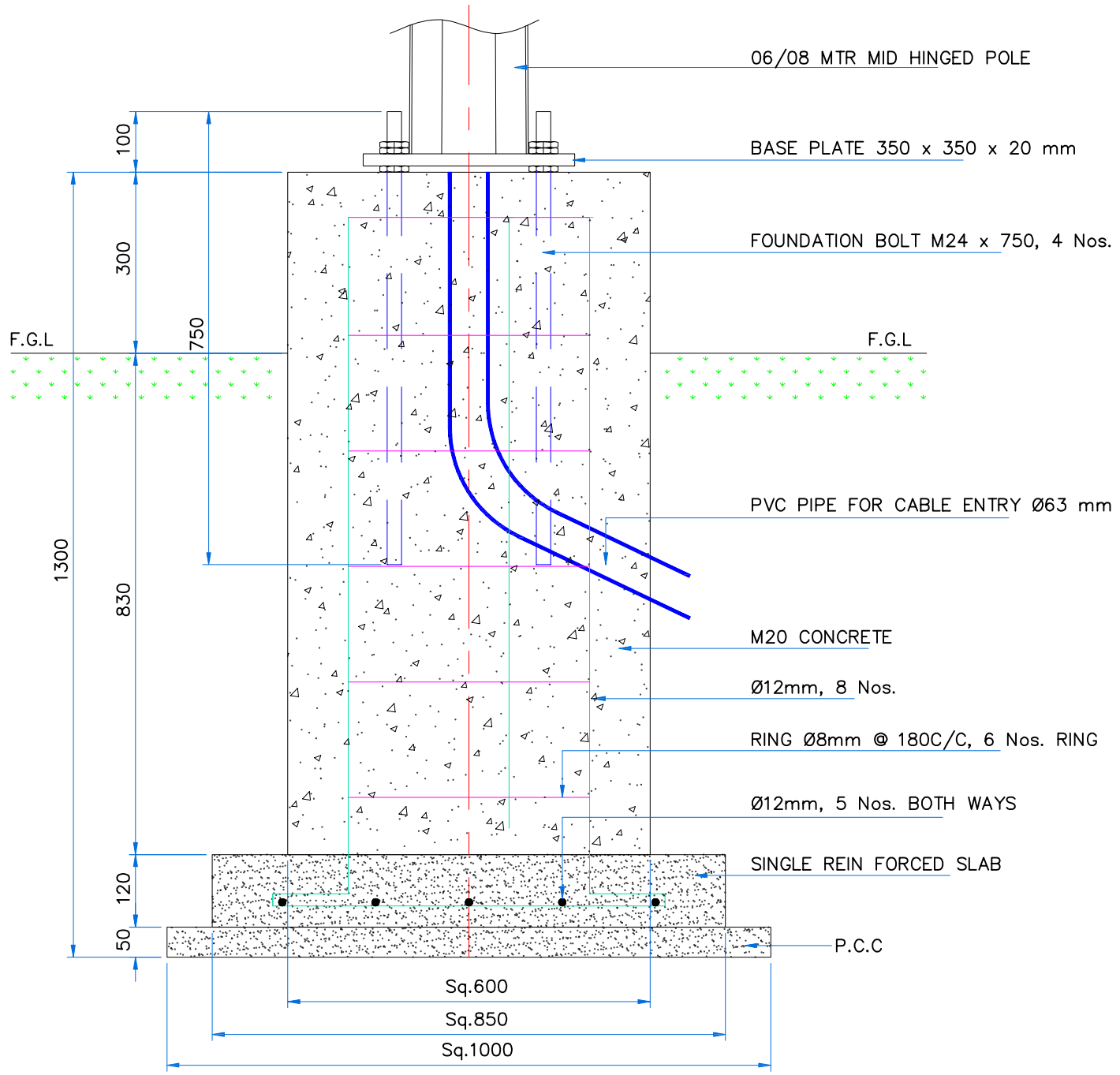
1. THIS DRAWING SHALL BE READ IN CONJUCTION WITH PJS & TS. ANY ITEM NOT INDICATED HERE BUT COVERED IN TENDER SHALL BE PROVIDED
2. POLE FINISHING TYPE WILL BE HOT DIP GALVANIZED.
3. THIS DRAWING IS INDICATIVE ONLY. ACTUAL DRAWING SHALL BE SUBMITTED BY SUCCESSFUL BIDDER INCLUDING ALL SYSTEM AS PER THE TENDER DURING DETAIL ENGINEERING FOR APPROVAL
4. THE QUANTITY OF EACH ITEM SHALL BE PROVIDED AS PER THE TENDER. ETHERNET SWITCHES SHALL BE PROVIDED AS PER THE TENDER.

6/8 METER POLE FOUNDATION DETAILS

ALL DIMENSIONS ARE IN MM



TOP VIEW



FRONT VIEW

NOTES: –

1. THIS DRAWING SHALL BE READ IN CONJUCTION WITH PJS & TS. ANY ITEM NOT INDICATED HERE BUT COVERED IN TENDER SHALL BE PROVIDED
2. POLE FINISHING TYPE WILL BE HOT DIP GALVANIZED.
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APPROVED	DATE	JAN, '24	DRG.No. MEC/05/E3/Q7TN/1/97/111

LIST OF VENDORS FOR BOUGHT-OUT ITEMS

I) CABLES

1) M/s ASSOCIATED CABLES
2) M/s ASSOCIATED FLEXIBLES
3) M/s DELTON Cables Ltd, India
4) M/s BROOK
5) M/s KEI Industries Ltd INDIA
6) M/s Suyog Electricals Ltd, India
7) M/s Thermo Cables Ltd
8) M/s Udey Pyrocables Pvt Ltd, India
9) M/s Cords Cables, India

II) RTU:

1) ABB
2) YOKOGAWA
3) SCHNEIDER
4) PHOENIX
5) SYNERGY
6) EMERSON

III) PUSH BUTTONS/LAMPS:

7) L&T
8) SIEMENS

IV) MCB'S:

1) HAVELL'S
2) L&T
3) SIEMENS
4) ABB
5) SCHNEIDER

V) POWER SUPPLY CONVERTERS (DC-DC, AC-DC)

1) PHOENIX CONTACT
2) OMRON
3) MEANWELL
4) WAGO

VI) TELECOM, RTU and Server PANEL

1) M/s BCH
2) M/s RITTAL
3) M/s Pyrotech
4) M/s Positronics Pvt. Ltd.

VII) Consoles and Printer Table

1) M/s BCH
2) M/s RITTAL
3) M/s Pyrotech
4) M/s Positronics Pvt. Ltd.

VIII) Ethernet Switches and Routers

1) M/s Hirchmann
2) M/s Moxa
3) Cisco
4) M/s Phoenix
5) M/s Nortel
6) M/s Juniper

IX) Relay

1) PHOENIX CONTACT
2) OMRON
3) OEN
4) WAGO

X) UTP/Communication Cable

1) M/s AMP
2) M/s Morex
3) M/s DELTON Cables Ltd, India
4) M/s LAPP
5) BIRLA
6) CORDS

XI) Terminal Blocks

1) M/s Elmex
2) M/s Wago
3) M/s Phoenix
4) M/s Connectwell

XI) Barriers

1) M/s MTL
2) M/s P&F

3) M/s Phoenix

XII) Junction Box

1) M/s Balliga
2) M/s FCG
3) M/s Ex-protecta
4) M/s Sudhir Switchgear
5) M/s Flexpro

Note-1

For procuring bought out items from vendors other than those listed above, the same may be acceptable subject to the following: -

a) The vendor/ supplier of bought out item(s) is a regular and reputed manufacturer/ supplier of said item(s) for intended services and the sizes being offered is in their regular manufacturing/ supply range.
b) The vendor/ supplier should not be in the Holiday list of any PSU or government entity.
c) Should have supplied at least 50% of required quantity or minimum 1 number whichever is higher of maximum size and rating of item(s) as required for intended services.

The bidder should enclose documentary evidences i.e. PO copies, Inspection Certificate etc. for the above, along with their bids. However, the decision of IGGL/ MECON to accept/ reject the items from vendors other than those listed above shall be final and binding to the bidder.

Note-2

The bidder is not required to enclose documentary evidences (PO copies, Inspection Certificate etc.) along with their offer, however in case of successful bidder these documents shall be required to be submitted by them within 30 days from date of Placement of Order.

TECHNICAL SPECIFICATION

FOR

TELECOMMUNICATION SYSTEMS

SPECIFICATION NO.: MEC/05/E5/T/TS-097M

PREPARED & ISSUED BY

INSTRUMENTATION & PROCESS CONTROL

(OIL & GAS SBU)

MECON LIMITED

(A Govt. of India Undertaking)

DELHI - 110092

Table of Contents

1.0 INTRODUCTION

1.1 OFC based MPLS-TP telecom equipment, Telephones, CCTV Cameras have been envisaged for IGGL Feeder Line Telecommunication requirements. Detailed scope will be as defined in Material Requisitions (MR) & Particular Job Specification (PJS) of the bid.

1.2 The purpose of this specification is to define the outline requirement of Telecommunication Equipments.

1.3 In case of any conflict between the specifications, enclosed data sheets, enclosed attachments, related codes and standards etc. , the most stringent of all shall be followed.

1.4 Vendor shall be responsible for selection of the correct system to meet the purchaser's specifications at the time of bid. In case of any modification / change in selected equipment model at a later date to meet the Purchaser's Specifications, the same shall be done by the vendor without any price and delivery implications.

2.0 TECHNICAL SPECIFICATIONS OF TELECOMMUNICATION EQUIPMENTS:

2.1 ENVIRONMENTAL SPECIFICATIONS

All equipment shall be capable of maintaining the guaranteed performance with operational lifetime of 15 years minimum when operating continuously under the following environmental conditions:

1.	Temperature	Operate: (Except EPABX, Test Instruments Ethernet Tester, Ethernet switch, Router, IT hardware) : 0^0C to + 50^0 C (guaranteed) & up to + 55^0 C (degraded) (For EPABX, Test Instruments Ethernet Tester, Ethernet switch, Router, IT hardware) 0^0 to + 40^0 C (guaranteed) Storage : -10^0 C to +55^0 C
2.	Humidity	At any relative humidity up to 95% within the temperature range
3.	Altitude	At any altitude up to 800m above sea level.
4.	Sand and Dust	The housing to be supplied along with the equipment should be in such a way that entry for dust, insect / rodent is totally prohibited.
5.	Tropicalisation	Shall be fully tropicalised with all cards & conformal coated with lacquer.
6.	Shock and vibration	Shall withstand transportation and handling by air, sea and road under packed conditions.
7.	Salt, fog and mould	Shall withstand continuous usages in Marine growth environment.
8.	Electromagnetic	Shall meet the requirements as per IEC Compatibility-801.

General Design Criteria:

Generally, all hardware, software and firmware upgrades required within the designated periods shall be supported without the requirement for a completeoverhaul or upgrade for any of the telecommunications equipment. The design of the systems and subcomponents shall facilitate upgrades to the hardware and software to ensure that the systems continue to be operational throughout their planned service life.

All equipment shall be considered against any End of Life (EoL) notices issued by the Vendor / Manufacturer. All associated end of service, end of support and end of spares notices shall also be considered when determining the maximum design life of the equipment. Industry standard practice shall be followed as far as is practicable. This shall apply to equipment sizes, mounting methods, electrical and optical interfaces, terminations, cable entries and all other relevant criteria.
All equipment shall be new and selected from its manufacturer's standard product line. Specially modified or adapted equipment and/or modules shall not be used. Similarly, bespoke equipment and software shall be avoided unless specifically requested by Owner.

Material Selection:

All materials shall be as detailed in this specification and other reference documents and standards mentioned in this document. All materials shall be new and free of defects and identifiable against their certification. All outdoor equipment's like cameras, media converters, power supplies etc. shall be of industrial grade suitable to work minimum up to 50 Deg.

2.2 SYSTEM / NETWORK DESIGN & ENGINEERING AND SITE-SURVEY:

The vendor shall be fully responsible and shall carryout detailed system/network design, engineering, procurement, integration and commissioning of systems/sub-systems for a fully functional and operational system during bidding and project execution for implementation of new telecom systems for IGGL feeder line pipeline to provide Voice, SCADA,CCTV, communication facilities required for pipeline operation, which shall include but not limited to the following:

i. Design & engineering of system/network would include/consider the following as a minimum:

- Study of proposed system (in PJS & TS), network topology & facilities.
- Gathering information through site-survey for complete system/network design & detailed engineering to meet the overall system availability objectives.
- Detailed design & engineering of MPLS-TP network involving MPLS-TP equipment, its NMS, DCN systems, etc taking in to consideration of the followings as a minimum:

➢ Optical link loss of network hops, guaranteed "End of Life (EOL)" parameters of optical Transmitter / Receiver of the offered MPLS-TP equipment and additional future optical link margin of 6 dB.

➢ Site-wise availability of space & power.

➢ Provision of station-wise equipped configuration of equipment.

➢ Provision of reliable connectivity for Pipeline Voice (for Watchman & Maintenance), SCADA &CCTV System facilities.

- New MPLS-TP network topology/architecture of feeder line pipelines.

- Seamless Integration of the vendor supplied MPLS-TP system/equipment with regard to Network management & Network Synchronization.

- Setting up of MPLS-TP link under feeder line MPLS-TP network. The MPLS-TP Type-2 Equipment at each station shall function in redundant configuration (i.e., 2 equipment installed in each station shall be configured such that they shall be in redundant configuration. In event of failure of one equipment, all communication shall continue through other equipment).

  MPLS-TP link will be formed connecting designated MPLS-TP Equipment, with traffic interfaces as as required based on bidder's design. Bidder shall submit the design during the detail engineering for approval. The design approved during detail engineering shall be implemented. For the same, necessary provisioning of optical amplifiers, boosters, optical DCN equipment, attenuators, dispersion compensation etc as required to provide future optical link margin of 6 dB (plus 2dB noise margin) as a minimum shall be included in bidder's scope. All these optical amplifiers, boosters and any other active opto-electronic units, which will be installed along with new MPLS-TP equipment (at those designated locations) for setting up MPLS-TP link, shall be from same OEM (or OEM accepted) of MPLS-TP equipment.

- Detailed design / engineering of all other supplies to meet the tender requirement.

ii. The vendor shall carryout site survey / inspection as required for design, engineering, installation, integration & commissioning of equipment at site by deploying its competent technical manpower and test/measuring equipment / instruments, tools & tackles. The mentioned site survey & inspection, measurements need to be undertaken following standard test / measurement procedures using calibrated test/measuring equipment / instrument by the vendor.

iii. The vendor shall prepare and submit the Network Design Basis document meeting IGGL's telecom facilities requirement immediately after the award of contract for approval of IGGL/ MECON. As part of network design basis document, the engineering & design details like: Hop-wise Optical link engineering /budget calculations, MPLS-TP equipment setup for providing Voice, SCADA ,CCTV system space & power requirements for all supplied items, network synchronization, local & remote network management provisions, integration / interfacing to existing telecom system/network, station-wise equipment/cabling lay-out plan, system/network availability calculations, etc are to be provided as a minimum.

The vendor shall be fully responsible for detailed engineering and design of the proposed system. The vendor shall design the network in a scalable fashion so as to support the future bandwidth and service needs. The vendor shall provide full details of the network design & engineering (all parameters) in the proposal with regard to following in line with Specifications, requirements & Design guidelines, given elsewhere in this document.

- Optical Link Engineering Hop-wise
- Network Management of MPLS-TP Node elements
- SCADA polling over IP based channel
- Network Synchronization

The network shall be configured, equipped & integrated to ensure smooth & efficient operation of SCADA system including facilities like Voice, Data and CCTV Surveillance system.

2.3 DESIGN GUIDELINES FOR TELECOMUNICATION EQUIPMENTS:

1. The system design shall be flexible enough to meet future expansion program up to the maximum capacity of each system and sub-system without deteriorating the performance of the system.

2. In general, specifications provided throughout this document shall apply. In case of conflict more stringent specifications shall override specifications given elsewhere and decision of the Owner/Engineer in all such cases shall be final.

3. The optical and multiplexing equipment should be able to work continuously in non air-conditioned environment (guaranteed performance) under prevailing environmental conditions of the sites.

4. All venting, cooling shall be natural. However, in case of equipment internal forced cooling with suitable dust filters may be used, if required.

5. All equipment shall have sufficient number of alarms and supervisory indications and shall be provided with self-diagnostic facilities.

6. The equipment shall be fully based on solid-state technology. The system hardware shall be modular to have flexibility to meet any demand for expansion or modification with minimum changes.

7. All equipment shall be immune to EMI, RFI interferences generated by any nearby source & shall meet the latest international standards in this regard.

8. The equipment shall be capable of functioning with minimum maintenance and shall be preferred to have no requirement of any preventive maintenance.

9. All PCBs used shall be glass epoxy type and shall not chip owing to repeated soldering/de-soldering. The PCBs shall not warp on any account.

10. All wiring-including field interconnection wiring shall be cabled and clamped to the chassis. The wiring shall follow standard color-code. All patch cords shall be provided with connectors matching to the cable used and shall have identification markings.

11. All sub-assemblies or modules, switches and controls and the circuit components shall be so mounted as to permit their replacement without appreciable disturbance to other components.

12. If the vendor is not using distributed power supply system on individual module basis then the Power Supply cards shall be duplicated (1+1). However, one standalone power supply card shall be able to run the system for its entire lifetime & there shall be sharing of load between the two power supply cards under normal conditions.

13. Racks/ JBs for all the equipment of individual system, sub-system shall be provided from the reputed manufacturers only and they shall adhere to all the quality norms.

14. The equipment construction should be such that it does not allow ingress or entry of rodents, insects, and dust. For this, equipment should be suitably sealed from all sides, top and bottom.

15. All the special tools and tackles, etc. shall be procured and supplied as a package with its carrying cases, accessories (interconnecting cables, connectors, lamps, batteries, fuses etc.) for their respective manufacturer.

16. Termination for all used interfaces shall be provided with 100% spares capacity.

17. All equipment racks, JBs, housings shall be provided with antistatic wristbands.

18. The nodes (stations) should be hitless i.e. removing or inserting plug-in-units must not affect the existing traffic on the other unit.

19. The configuration of the nodes should be easily expanded by adding plug-in-units and modifying software settings

20. It is required that the laser transmitter is automatically shut down when the incoming signal is missing.

21. Upon completion of OFC laying and termination activities by the OFC laying Contractor, the vendor shall take over the OFC link after testing jointly with the laying contractor or Client's nominated agency, witnessed by CLIENT/ Consultant in line with the approved OFC Hop Test procedure. In case of any issues observed during testing, the bidder shall provide the location wise details wherein the cables are faulty for OFC laying vendor to carryout rectification. Bidder shall ensure OFC testing and have the faults rectified to satisfaction by OFC laying bidder.

22. Vendor shall be totally responsible for the completion of the project. Owner/Engineer reserves the right to modify, revise and alter the specifications of equipments and systems prior to acceptance of any bid by the bidder. System requirements may be modified after selection of successful vendor to meet operational requirements not envisaged at the time of selection of Vendor.

23. In case at the time of implementation there is any change in the network design & configuration to meet the owner's operational requirements, the vendor shall undertake all the activities such as design, manufacturer, supply, Installation, etc. of additional equipment hardware and software for which additional financial implication, if any, shall be approved by the owner on the basis of sufficient details and justifications being provided by the vendor.

24. If during the course of execution of the work any discrepancy or inconsistency, error or omission in any of the provisions of the contract is discovered, the same shall be referred to the Owner/Engineer who shall give his decision in the matter and issue instruction directing the manner in which the work is to be carried out. The decision of the Owner/Engineer shall be final and conclusive and the Vendor shall carry out the work in accordance thereof at no additional cost to IGGL/ MECON.

25. The Vendor to give full documentary proof of satisfactory worked of the system.

26. The supplier shall provide link engineering for the configuration offered, taking fibre distance to be 5% higher than the physical distances indicated in the network drawing. Following are the guidelines for the link engineering calculations for pipeline.

A	Attenuation in fibre	0.22 dB/Km for 1550 nm or 0.37 dB/Km for 1310 nm
B	Splice loss	0.1dB per splice and splices at every 2km in building the OFC link in each span/Hop
C	Connector Loss	0.5 dB per connector for 4 connectors per link
D	Required Future Margin	6 dB per link
E	Cable plant Repair margin	2 dB per link

Vendor to provide details of link budget calculations as part of his bid, for each hop with end of life worst-case figures as per ITU-T. Operating wavelength (optical) shall be 1550 nm. Bidder shall consider only SFP's with 1550 nm wavelength in this project compatible with G.652D fiber for interfacing with main G.652D cable supplied by others.

2.4 ENGINEERING REQUIREMENTS

The equipment shall be fully solid state and adopt state of the art technology. The equipment shall be compact and in composite construction and light weight. The manufacturer shall furnish the actual dimensions and weight of the equipment.

All connectors shall be reliable and of standard type of ensure failure free operation over long periods and under specified environmental conditions. All connectors and the cable used shall be of low lost type and suitably shielded.

- Fans are DC operated.
- MTBF for fan is better than 60,000 hours.

The plug-in units shall be suitable type to allow their removal/insertion while the equipment is in energized condition. The mechanical design and construction of each card/unit shall be inherently robust and rigid under all conditions of operation, adjustment, replacement and storage.

Each sub-assembly shall be clearly marked with schematic reference to show its function, so that it is identifiable from the layout diagram in the handbook. Each terminal block and individual tags shall be numbered suitably with clear identification code and shall correspond to the associated wiring drawings.

All controls, switched, indicators, etc. shall be clearly marked to show their circuit diagrams and functions.

2.5 MAINTENANCE REQUIREMENTS

Maintenance philosophy is to replace faulty units/subsystems after quick online analysis through monitoring sockets and alarm indications. The actual repair will be undertaken at centralized repair centres. The corrective measures at site shall involve replacement of fault units/subsystems.

The equipment shall have easy access for servicing and maintenance. Extension of degraded paths to test access point for diagnostic work after traffic is switched over to the healthy path should be provided.

Suitable alarms shall be provided for identification of faults in the system and faulty units. Suitable potential free contacts should be provided for extension of summary alarms.

As and when bugs found/determined in the software, the manufacturer will provide patches/firmware replacement if involved free of cost till end of PWMC period. Modified documentation (hard copies and soft copies) wherever applicable shall also be supplied free of cost. Ratings and types of fuses used are to be indicated by the supplier.

2.6 POWER SUPPLY

The power supply provided for telecommunication system at respective station as define load refer the respective clause of Particular Job specification. Vendor shall select the equipment accordingly. Any AC to DC or DC to DC or DC to AC converter for other voltage if required will be in Vendor's scope.

Nominal power supply is with a variation over the range of 10 %, the equipment shall operate over this range without any degradation in performance.

The power consumption shall be minimal. The actual power consumption has to be furnished by the manufacturer during detailed engineering.

The derived DC voltages in the equipment shall have protection against over voltage, short circuit and overload.

2.7 EQUIPMENT SAFETY AND PROTECTION REQUIREMENTS

The equipment shall have a terminal for grounding the rack. Protection against short circuit/open circuit in the accessible points shall be provided.

All switched/controls on front panel shall have suitable safeguards against accidental operations. The equipment shall be adequately safeguarded to prevent entry of dust, insects and lizards.

- OPTICAL SAFETY REQUIREMENTS

All optical interfaces should comply to optical safety standards as mentioned elsewhere in the technical specification.

- OPERATING PERSONNEL SAFETY REQUIREMENTS

The operating personnel should be protected against shock hazards as per IS-8437 (1993) “Guide on the effects of current passing through the human body” (equivalent to IEC publication 479-1-1984).

2.8 ELECTROMAGNETIC COMPATIBILITY (EMC)

The equipment shall conform to the EMC requirements as per the following standards and limits indicated therein:

Conducted and Radiated Emissions – To comply with class A [for low capacity (below 34 Mbps data rate)] of C ISPR 22 (1993). “Limits and methods of measurement of radio disturbance characteristics of information Technology Equipment”.

All equipment shall be designed to prevent the emission of and susceptibility to Radio Frequency Interference (RFI) and Electromagnetic Interference (EMI). Equipment shall not be unduly affected by emissions from nearby equipment, nor shall the equipment itself produce emissions which would affect other equipment nearby. Emissions shall not initiate unpredictable or undesirable actions or responses, measurement errors, communication faults etc. All equipment shall comply with all local regulations and codes in connection with Electromagnetic Compatibility. All equipment shall conform to the recommendations of IEC 61000.

Electrostatic Discharge

To comply with IEC 1000-4-2 “Testing and measurement techniques of Electrostatic discharge immunity test” under following test levels

- Contact discharge level 2 (+ 4 KV)
- Air Discharge level 3 (+ 8 KV)

Fast transient common mode burst

To comply with IEC 100-4-4 "Testing and measurement techniques of electrical fast transient/burst immunity test" under level 2 (1 KV for DC power lines: 1 KV for signal control lines)

Immunity

IEC 1000-4-3 "Radiated RF electromagnetic field immunity test" Under Test level 2(Test field strength of 3 V/m)

Surges Common and differential mode

To comply with IEC-4-6 "Immunity to conducted disturbances" indicated by radio frequency field."

2.9 EARTHING SYSTEM

Earthpit shall be constructed by bidder as per requirement and is included in the scope.

The Bidder shall ensure that all requirements for system earth and earth bonding are considered and included in the system cabinets. Bidder's earthing arrangement in cabinets should be in accordance with electrical standards. Each cabinet shall be provided with earth bus bars with their frames. All lugs/strips shall be properly secured to the electrical earthing bus with an earthing wire of suitable size. All system grounds of various cards and equipment's, shields of instrument cables shall be connected to system ground bus which is electrically isolated from the AC mains earthing bus.
All doors, swing frame and removable cabinets shall be provided with earth studs, which shall be strapped to the main frame using flexible braided copper wire. Screens for cables from other control cabinets shall be connected in the system. Screens for inter system cables shall be connected at one end only. Each cabinet, marshalling unit, local panel or junction box shall have a separate earth bar or 10mm earthing stud. Telecom/Clean Earth-Cable screens shall be run continuously from each telecom equipment through the junction box to the telecom earth bus bar in the centrally mounted telecom equipment room. The screen shall be earthed at the equipment room only and tied back and insulated at the device. Each telecom earth bar must be insulated from steel or any other earth system. All field instruments / junction boxes shall be bonded to earth using 2.5mm^2 minimum conductor size earth cable. The cable shall be terminated to an external earth stud on the field device and terminated to the nearest structural steel member with a suitable nut and bolt arrangement. Earth cable insulation shall be colored green / yellow. Shielded copper wires shall be provided for earthing system.
Bidder shall provide 48V DC and 240V AC earthing in separate bus bars in cabinet for cabinet requiring both 48V DC and 240V AC. AC and DC earthing isolation shall be done in such cabinets.

- Standard: IS 3043-1966 or equivalent BIS & IEC standard
- The earthing material to be used shall be Electrolytic Copper having the material specifications confirming to the IS standards.
- Copper earth strips shall be used to connect two earth pits of a station to form a grid. The dimension of the Earthing strip, which shall be connected between 2 Earth pits or the earthing distributor to form a grid, shall not be less than 25 mm (W) X 5 mm (Thk)
- Minimum 1Cx 10 sq mm armoured cable shall be laid from the earth pit to the Telecom Panel for earthing. 2 runs of cable shall be laid from earth pit to the Telecom Panel for earthing.
- The earthing pit should have water-pouring facility.
- Earthing resistance should be less than 2 ohms or should be suitable for the equipment to which the earthing is extended.
- Approval shall be taken for all drawings and the distributions up to equipment as per the directions of Engineers In charge.

3.0 TECHNICAL SPECIFICATION OF TELECOMMUNICATIONS EQUIPMENTS

3.1 Type-1 MPLS-TP (MPLS-TP (10G)) Equipment

1. The system shall support the following ITU-T recommendations for MPLS-TP

- G.8110.1/Y.1370.1 Architecture of MPLS-TP Layer Network
- G.8113.1/Y.1372.1 Alternative mechanisms for Operations, Administration and Maintenance in MPLS-TP networks using the tools defined in G.8013/Y.1371
- G.8113.2/Y.1372.1 Operations, Administration and Maintenance mechanisms for MPLS-TP networks using the tools defined for MPLS
- G.8121/Y.1371 Characteristics of MPLS-TP Network Equipment Functional Blocks
- G.8121.1/Y.1371.1 Characteristics of MPLS-TP equipment functional blocks Supporting G.8113.1/Y.1372.1
- G.8121.2/Y.1371.2 Characteristics of MPLS-TP equipment functional blocks Supporting G.8113.2/Y.1372.2
- G.8151/Y.1374 Management aspects of the MPLS-TP network element
- G.8261 G.8161 Timing and Synchronization aspects in Packet Networks
- G.8262 Timing characteristics of synchronous Ethernet equipment slave clock (EEC)
- G.8264 The Recommendation specifies the Synchronization Status Message protocol and formats for use with Synchronous Ethernet

2. The system shall support the following IETF standards for MPLS-TP:

- RFC 3031 Multiprotocol Label Switching Architecture
- RFC 3032 MPLS Label Stack Encoding
- RFC 3270 Multi-Protocol Label Switching(MPLS) Support of Differentiated Services
- RFC 3916 Requirements for Pseudo-Wire Emulation Edge-to-Edge (PWE3)
- RFC 3985 Pseudo Wire Emulation Edge-to-Edge(PWE3) Architecture
- RFC 4197 Requirements for Edge-to-Edge Emulation of Time Division Multiplexed (TDM) Circuits over Packet Switching Networks
- RFC4377 Operations and management (OAM)requirements for multi-protocol label switched (MPLS) networks
- RFC 4378 A framework for multi-protocol label switching(MPLS) operations and management (OAM)
- RFC 4446 IANA Allocations for Pseudo wire Edge to Edge Emulation (PWE3)
- RFC 4553 Structure-Agnostic Time Division Multiplexing(TDM) over Packet (SAToP)

3. The MPLS-TP System should be a carrier grade multi-service platform and should be able to support whole new breed of functionalities for efficiently aggregating, switching and managing a mix of global services ranging from applicable optical MPLS-TP services and Layer-2 Ethernet services.

4. The MPLS-TP System should be equipped with a fully non–blocking Switch Matrix.The Equipment shall be connection-oriented packet switching model with traffic engineering capabilities that allow deterministic control of the use of network resources. It shall support traffic engineered point to point (P2P), point to multipoint (P2MP) and Multipoint to Multipoint (MP2MP) transport path.

5. The MPLS-TP system shall have location wise uptime report generation and the same shall be

interfaced with SCADA system for viewing node failure alarm, critical alarms (MPLS-TP server failure, power supply failure, cross connect failure, Optical and Ethernet Card Failure) along with MPLS-TP uptime reports. Bidder shall provide all hardware, software, protocol converters like SNMP to OPC, licenses, cables required for interfacing with SCADA system. Bidder to note that SCADA system works on OPC protocol. Bidder shall co-ordinate with SCADA vendor for any type of interface requirements

6. Reports on uptime and downtime of nodes, servers, equipment shall be available.

7. MPLS-TP equipment is expected to operate at Layer-1 through Layer-2 of the seven layer OSI model. The basic function of the equipment is to add/drop various traffic from multiples ports (TDM (E-1/STM-1) / Ethernet / GigE), aggregate and transport across the network. The WAN side would allow support for carrier class protection, OAM and scalability similar to the existing SDH/SONET network as well as support for point-to-point, point-to-multipoint and multipoint-to-multipoint traffic.

8. In the MPLS-TP network, the services should be conveyed end-to-end through service tunnels over the underlying transport network. In the service tunnel the services (e.g., TDM, and Ethernet) are to be encapsulated and isolated from the transport layer (e.g., MPLS labels). In MPLS-TP, legacy TDM traffic should be emulated and encapsulated into Pseudo-Wire (PW) service tunnels to be transported over the carrier Ethernet network. The service tunnel should be configurable in a flexible way based on requirement

9. The underlying transport technology shall be able to establish transport paths within the MPLS-TP network and enable the transport paths to carry the service tunnels. The transport path shall be defined as end-to-end path as connectionless transport in principle can't fulfill carrier-grade requirements.

10. The MPLS-TP equipment shall collect various traffic with or without VLAN tag as per IEEE 802.1Q, aggregate and switch the same and shall hand over the 802.1ad traffic to other MPLS-TP equipment in the network for aggregation and transport through multiples of GigE or 10 GE interfaces.

11. The Equipment shall support packet transport network solution by using PW service tunnel and MPLS-TP transport technology. , TDM and Ethernet traffic are emulated into Pseudo-wires and PW label is added for service identification. End-to-end transport path LSP is created based on MPLS-TP standard (ongoing) and multiple PWs are transported over the same LSP end-to-end in both directions.

12. In order to support traffic engineered point-to-point MPLS-TP circuits it shall support all the MPLS-TP specific requirements specified in the following RFCs. No explicit support for control plane protocols is required. NMS Support shall be mandatory.

    RFC 3031
    RFC 3032:
    RFC 3443
    RFC 5462
    RFC 5586
    RFC 5860

RFC 5960
RFC 6370
RFC 6378
RFC 6423
RFC 6426
RFC 6428

13. In order to support traffic-engineered Pseudo Wire Emulations (PWE) over MPLS-TP, the system shall support the following RFCs. The compliance for these RFCs is required to the extent of supporting MPLS-TP and PWE. No explicit support for control plane protocols is required. NMS support shall be mandatory.

    RFC 4446
    RFC 4385
    RFC 4448
    RFC 5659
    RFC 5994
    RFC 6073

14. The MPLS-TP network shall have advanced functionality like ability to create Ethernet Layer 2 VPN(channels) such as point-to-point, point-to-multipoint as well as multipoint-to-multipoint.to isolate various kind of traffic into their own logical virtual network.

15. The switching fabric plane of the MPLS-TP equipment shall be bidirectional and non-blocking. The MPLS-TP equipment shall support a wire speed L2 switching capabilities under full load condition.

16. The equipment shall support Fast Ethernet electrical interface, Gigabit Ethernet (electrical & optical) & 10 Gigabit Ethernet interfaces meeting IEEE and ITU-T Standards.

17. All port should be Auto and Manual configurable to set parameters like: Rate/Bandwidth, Half/Full Duplex, etc.

18. It shall be possible to monitor transmit and receive power on all optical interface ports on the Equipment. The MPLS-TP equipment shall support built in power diagnostics to monitor optical SFP/SFP+/XFP ports, system diagnostics to detect hardware failures.

19. All the SFP/SFP+/XFP should be with two port i.e one is TX port to transmit the signal, and the other one is RX port to receive signals.

20. The equipment shall support legacy E1 (TDM) interface in compliance to ITU G.704 to carry Transparent E1 traffic over Packet using Pseudo wire emulation.

21. The equipment shall support legacy STM1 (channelized) & STM1/4 (virtual container over Packet) SDH optical interface & shall carry over Circuit emulation services (TDM to Packet).

22. The equipment shall support all Ethernet interface to be configurable as user network interface (UNI) and network interface (NNI).

23. It shall be possible to manually configure end-to-end MPLS-TP tunnels through EMS. It shall be possible to create co-routed bidirectional path from EMS as specified.

24. It shall support the creation of L2VPN solutions using statically configured PWs and tunnels as per RFC 4664

25. It shall be possible to provide 1:1 Linear Protection as per RFC 6378.

26. Customer ELAN traffic shall be transported over a co-routed bidirectional P2MP MPLS-TP tunnel to allow Traffic Engineered multicast traffic

27. It shall support GAL/G-ACH as defined in RFC 5586 5462The offered Equipment shall use SFP modules for all Optical Interfaces.

28. The Equipment should support statically configured minimum 200 LSP (label Switched Packet) and 1000 PWs (Pseudo wires).

29. It shall be possible to rate limit the traffic in MPLS-TP tunnels at minimum 64 kbps granularity.

30. It shall be possible to configure end-to-end MPLS-TP tunnels & PWs EMS/NMS

31. Provision for suitable potential free contacts should be provided for extension of external alarms to NMS.

32. In case of the primary OFC failure, the SCADA system & minimum two voice channel shall beoperational through leased line. The switching from primary OFC to leased line shall be automatic

33. It shall support LAG as per IEEE 802.3ad, allowing configurations of static LAG on client ports.(Link Aggregation feature)

34. In order to support traffic engineered MPLS-TP circuits it shall support all the MPLS-TP specific requirements specified in the following RFCs.
    - RFC 2205, 3031, 3985 MPLS Pseudo wire Emulation Edge-to-Edge(PWE3)
    - RFC 3916, 4446,4448 Pseudo wires
    - RFC 5654 MPLS-Transport Profile(TP)
    - LSP Static provisioning
    - 1:1 Tunnel protection
    - LSP BFD via GAL/G-ACH
    - VPLS (Virtual Private LAN Service)and

- Hierarchical VPLS(H-VPLS)
- MPLS Performance Monitoring
- LSP Ping
- LSP Trace route
- PW Ping
- PW Trace route
- RFC 5085 LSP Ping and Trace route extensions to work over Pseudo wires
- Queuing for MPLS-TP tunnel

35. **EQUIPMENT PROTECTION**

- All the traffic affecting common and control units shall be 1+1 protected, which essentially includes Switch Matrix, Synchronization/Timing Unit and Power Supply modules. Any other Controller hardware should also be protected in case its failure disrupts/affects traffic. For replacement of any faulty Controller hardware in the equipment with good one, removal/insertion of plug-in units shall be possible in energized/ powered on condition of the equipment and shall not affect the operational traffic.

- For a particular type of MPLS-TP equipment, each type of protected common & control hardware units/modules shall be of same type/model.

- The Controller Module/Card (say “Management Controller”) responsible for local & remote management from NMS and for storing NE management data/information (like: ID, Address, DCN information etc) of MPLS-TP equipment shall preferably be 1+1 protected.

- In case, the said Management Controller is not 1+1 protected and its fault resolution by the replacement of faulty controller with spare one (having default/no configuration) in the energized / live / in-service condition of the equipment is traffic affecting, the vendor shall facilitate Maintenance base locations with suitable facilities, systems, sub-systems etc for configuration/programming of spare Management Controller module, so that the configured spare module can be put into operation in place of faulty one in the affected equipment without affecting/disrupting its traffic.

- The 1 + 1 configuration shall be achieved by providing dual redundant aggregate, switch matrix, and power supply cards configured in hot standby configuration, without any single point of failure

- All the cards, modules of the MPLS-TP equipment shall be Hot-swappable including the switching matrix, power supply card, Fans etc.

- The Equipment shall support sub 50ms 1:1 bi-directional linear protection in line with applicable ITU-T/IEEE standards as mentioned below. For all the modes of protection, automatic switching shall take place within 50 ms of expiration of any manually selected hold-off time. The switching time shall be measured from the

time a network failure is detected by the single Carrier Ethernet equipment untilcompletion of all switching actions.

a) 1:1 liner Protection
b) Sub 50 ms failover
c) Active/Standby LACP LAG
d) Static LAG without LACP
e) Rapid Spanning Tree Protocol /Multi-service transport Protocol (RSTP/MSTP)

36. NETWORK TOPOLOGY

The MPLS-TP equipment should support various network topologies as listed below:

- Multiple Rings
- Star
- Meshed-rings
- Rings
- Point-to-Point
- Linear Chains.
- dual homing

The equipment should support all possible topology requirements and should be capable of being configured as a Terminal, ADM, Regen or Digital cross-connect [DXC]. The Regen and Add-Drop Multiplexer [ADM] should be expandable to equip multiple tributary / line interfaces.

37. TRAFFIC INTERFACE SUPPORT

The equipment shall support Fast Ethernet electrical interface, Gigabit Ethernet (electrical & optical) & 10 Gigabit Ethernet interfaces meeting IEEE and ITU-T Standards.

All port should be Auto and Manual configurable to set parameters like:

- Rate/Bandwidth, Half/Full Duplex, etc.
- It shall be possible to monitor transmit and receive power on all optical interface ports on the Equipment.
- Equipment shall have standard pluggable SFPs/SFP+s/ XFPs minimum for all optical interfaces.
- All the SFP/SFP+/XFP should be with two port i.e one is TX port to transmit the signal, and the other one is RX port to receive signals.
- Support legacy E1 (TDM) interface in compliance to ITU G.704 to carry Transparent E1/PDH traffic over Packet using Pseudo wire emulation.
- Support legacy STM1 (channelized) & STM1/4/16 (virtual container over Packet) SDH optical interface & shall carry over Circuit emulation services (TDM to Packet).
- All Ethernet interface shall be configurable as client interface (UNI) and network interface (NNI).
- The Equipment shall support jumbo frame of 9600 Bytes (minimum).
- Devices shall support full throughput for the entire mentioned interface

38. Services:

The Equipment shall support the following services within metro domain as well as the intercity traffic links:

- MEF defined E-LINE services, including the Ethernet Transparent services
- MEF defined E-LAN services
- Support legacy E1 TDM services over pseudo wire for connectivity and traditional voice services.

39. QoS Support

The Equipment shall support traffic classification based on the following:

- Source Interface
- VLAN ID
- 802.1p priority bits
- Differentiated Services Code Point (DSCP)/ Telecommunications Optimization Services (TOS) (RFC 5462)
- The Equipment shall support marking of 802.1P, DSCP, EXP/TOS, bits.
- It shall be possible to classify the micro-flow at the ingress.
- The Equipment shall support rate-limiting per class (or flow) in steps of 64kbps for less than 1 Mbps and at 1 Mbps for 1-100Mbps and at 100 Mbps granularity for 100-1000 Mbps. It shall be possible to define Committed Information Rate (CIR) and an Excess Information Rate (EIR) for each flow in steps of 64kbps.
- The Equipment shall support following burst sizes: 16K, 32K, 64K, 128K and256k Bytes.
- The Equipment shall support Single rate policer, two rate three colour metering (trTCM) as per RFC 2698 and RFC 4115 and colour blind single rate policer and trTCM based metering. There shall be an option to trust the colour of the incoming packet.
- Traffic shaping at egress shall be done on per MPLS-TP Tunnel basis.
- The Equipment shall support 8 class of service per flow.
- The Equipment shall support following scheduling scheme:
- Strict priority (SP)
- SP + Weighted Round Robin (SP + WRR) Interface type
- The Equipment shall support congestion avoidance mechanism like WRED and
- Tail Drop.

40. Operation Administration and Maintenance

- The Equipment shall support Performance monitoring as per ITU-T EthOAM (Y.1731)..
- The Equipment shall support OAM feature as per IEEE 802.1ag or based on Proactive continuity and connectivity verification. It shall also support Proactive continuity Verification, Continuity Check and Remote Defect Indication as per RFC

6428.

- It shall be possible to enable/disable IEEE 802.1ag on a per port basis for non MPLS-TP tunnels for the purpose of monitoring the traffic. It shall support Client failure indication as specified in RFC 5860.
- Remote network monitoring (RMON) performance management shall be supported based on port.
- The system shall support IEEE 802.1ag for detection, verification and isolation of connectivity failures.
- The equipment shall support MPLS-TP OAM as per ITU-T G.8113.1 standards based on ITU-T Y.1731 or ITU-T G.8113.2 based on Bidirectional Forwarding Detection (BFD)including CC (continuity check), RDI (Remote Defect Indication, AIS (Alarm Indication signal), LM (Packet Loss measurement), DM (Delay measurement, LB(OAM loopback), LT(Link trace)
- The system shall provide the capability to diagnose and determine the location of any fault within the network.
- Vendor shall supply service traffic statistic function to be easy to user bandwidth calculation.
- Vendor shall supply service traffic statistic function to be easy to user bandwidth calculation.
- LSP End-to-End Monitoring shall be supported.
- PW Monitoring shall be supported.
- Per-node MEP shall be supported.
- Per-node MIP shall be supported.

41. Security

- Port Mirroring: It shall also be possible to mirror a particular service from a particular port or on per SVLAN/PW basis to a probe port.
- Broadcast Storm control: It shall be possible to control multicast, broadcast traffic on per tunnel basis. Frames shall be dropped once the per-second counter goes beyond the configured limit.
- Access Control List (ACL): It shall support ACLs to prevent unauthorized access. It shall be possible to deny traffic based on the following:
- Source Interface type
- Source/ destination MAC
- VLAN ID.

42. **Circuit Emulation**

- The equipment shall support E1/STM-1 circuit emulation mechanism.
- It shall support minimum 2* STM-16 channelized ports Circuit Emulation Services Over MPLS as per PWE3 standard to aggregate the TDM PW from the edge and access CEN. The offered equipment shall support STM-16 CES as per the tender requirement, however, the ports shall be provided as per the traffic interfaces

requirement provided in the tender. The support for STM-16 CES shall be available in the equipment at the time of actual supply of the equipment

- It shall support minimum 16* E1 Interface.
- It shall support minimum STM1 or STM4 interface as well
- It shall support Structure-Agnostic Time Division Multiplexing (TDM) over Packet (SAToP) which is defined by IETF RFC 4553

43. **INTERFACE SUPPORT**

Interface support for the Equipment:

- The equipment shall support the following IEEE standards and ITU-T Standards interfaces.
- 10/100/1000BaseT, 1000BaseSX, 1000BaseL.
- 10GBASE-SR,10GBASE-LR and 10GBASE-ER
- The MPLS-TP Equipment shall support full duplex capabilities on all Ethernet ports
- E1 Interface
- Equipment shall have capability to carry STM1, STM4 and STM16 TDM traffic as well.
- It shall be possible to use all optical interfaces as either client interface and/or network interface
- Each port shall be configurable for any direction of transmission.
- The Equipmentshallsupportjumboframeof9kBytes. The Maximum transmission unit (MTU) shall be configurable from 64 Bytes to 9kBytes.
- The Equipment shall support MDI-X based auto-uplink feature.
- It shall be possible to monitor transmit and receive power on all optical interface ports on the Equipment.
- The Equipment shall be based on commercially available pluggable (SFP/SFP+/XFP) optics for all optical interfaces.
- Equipment should support STM1/STM4/STM16 capacity worth 5G TDM traffic over MPLS TP.

44. **Packet Switching Fabric**

- The equipment shall support fully centralized redundant switching matrix.
- Equipment shall have minimum 200G packet fabric bi-directional (full duplex) fully non-blocking centralized switch matrix.
- Physical Layer Features Equipment shall have fullduplex capabilities on all Ethernet ports.
- Equipment shall not have any single point of failure.

45. Forwarding and learning Support

- The Equipment shall support IEEE-802.3-2002 standard.
- The Equipment shall have unique MAC address.
- It shall be possible to override Equipment MAC address via user configuration
- The Equipment shall support minimum 128K MAC address
- The Equipment shall support the minimum 1K number of statically configured bidirectional LSPs.
- The Equipment shall support Ethernet PW as specified by RFC 3985 and RFC 4385. It shall support Ethernet PW as specified by RFC 4448. The equipment shall support minimum 2K number of bi directional Ethernet PW entries.
- All static entries shall NOT be aged.
- The Equipment shall support Hardware based aging of MAC Address
- It shall be possible to maintain static multicast entries in a separate multicast table.
- Equipment shall support minimum 512 Multicast groups with minimum 2KMembers per group.
- The Equipment shall support update of Multicast table using IGMPv1, v2, v3 snooping.
- The Equipment shall support minimum 256 number of VPLS/H-VPLS entries to provide MP2MP services in case of VPLS mode of operation.

46. VLAN Switching Requirements

- The Equipment shall have UNI (User Network Interface) and NNI (Network Node Interface). Typically, UNI would be configured in 802.1Q mode or Q-in-Q mode and NNI shall be in MPLS-TP (P2P) or VPLS/H-VPLS (MP2MP) mode. In order to simplify the operation of the product it is intended that no restriction be placed on UNI and NNI ports and all the ports shall be capable to support any mode of operation.
- Single tagged or 802.1Q Mode
- It shall be possible to configure all 4K VID on all ports and at the same time support all 4K VLANs simultaneously. The operator must be able to reuse the same VLAN-ID on a different port on the same switch and terminate it into a different PW.
- It shall be possible to accept untagged, priority tagged and C-tagged frame through an 802.1Q port.
- MPLS-TP RFC for Traffic Engineering or 802.1ad mode Requirements
- It shall support VLAN stacking as per IEEE 802.1ad.
- The Equipment shall have minimum of 4K S-VIDs. VIDs “0” and “FFFF” shall be reserved.
- It shall allow only S-tagged frame in 802.1ad ingress ports. It shall be possible to map the traffic to any PW (towards the WAN interface) based on SVLAN

- It shall be possible to set the priority bits in the S-VLAN priority based on the priority bits of C-tag of the incoming packet in 802.1ad mode. It shall be possible to map the priority to EXP/TC bit of the MPLS-TP tunnel towards the WAN interface.

47. **NETWORKPROTECTION**

- The equipment should be configurable for both protected as well as unprotected services. Offered MPLS-TP equipment shall also meet the requirement of traffic protection wherein the continuity of traffic between traffic end points with availability of any single continued path between those end points via new equipment over multiple segments.
- The equipment shall also support sub 50ms switching mechanisms for Layer-2 Ethernet traffic through implementation of schemes like RPR/ERPS etc.

48. **INTERFACEFEATURES AND CAPABILITY:**

a) Optical interfaces:

- The MPLS-TP equipment shall support applicable 10G and 1G optical interfaces in the same platform compliant with latest ITU-T MPLS-TP specifications.
- The MPLS-TP equipment shall support applicable STM 1/ 4/ 16 optical interfaces in the same platform compliant with latest ITU-T specifications
- The optical ports of offered MPLS-TP equipment shall have broadband / white-band receiver, which will accept and operate with corresponding MPLS-TP euipment over optical signal of both 1310 nm and 1550 nm wavelengths.
- For Optical MPLS-TP interface, which will be used for a link as indicated for which optical link loss has been provided mention below, the interface type (long-haul / short haul operating @ 1310 nm/1550 nm) will be determined considering the associated optical link loss**,** itsguaranteed “End of Life (EOL)” parameters of optical Transmitter / Receiver and additional future optical link margin of 6 dB. Other equipped optical MPLS-TP interfaces shall be of minimum Long-Haul (LH) type (@ 1550 nm).

b) Ethernet Interfaces & Services:

- The MPLS-TP equipment shall provide Fast Ethernet electrical interface and Gigabit Ethernet optical interface. The FE & GE ports shall be provided using Electrical (10/100/1000 Base-T, RJ-45 connector) & Optical interfaces (1000 Base LX @GbE SFP) respectively.
- 10Base-T, 100Base-Tx & 1000Base-LX shall be complied with IEEE 802.3, 802.3u & 802.3z respectively.
- All Ethernet interfaces shall support QoS functionality in compliance to IEEE 802.1p.

- The equipment shall provide Layer-2 Ethernet services for provisioning of Point to Point, Point to Multipoint and Multipoint to Multipoint LAN configuration (EPL, EVPL, EPLAN, EVPLAN), Layer 2 aggregation, VLAN tagging complying to IEEE & MEF standards.

- The equipment shall have IGMP Snooping features to effectively handle the multicast Layer-2 Ethernet traffic, so that the spread of the multicast data on layer 2 network can be prevented efficiently without choking the backbone capacity.

Packet Switching Fabric

- Bi-directional (full duplex) fully non-blocking switch matrix capacity shall support full through put for all the interfaces as per 8.11. Complete Switching Fabric should be 1+1 protected. If one switch matrix module fails, the complete switch matrix should switch to protection module. The equipment should be multi-service ready from day one

49. SYNCRONIZATION:

- It shall support adaptive timing where the clock is recovered from data in the PWE3 frame and the arrival time of the frame. Frequency accuracy of ±15ppb should be provided.
- The method of synchronization used shall meet traffic interface requirements as specified in G.813 Section 5 and G.823 Section 1.2.4 for Synchronization interface.
- It shall support SyncE as per ITU-T G.8261
- MPLS-TP equipment shall be able to synchronize from the respective new Synchronization sources to be supplied under this project. Vendor shall synchronize the new network by deriving the network clock. Other clocks as required shall be provided as per ITU – T recommendation.
- The equipment shall have required synchronization provision in line relevant ITU-T & IEEE standards like: ITU-T G.8262 SyncE, 1588v2, Internal Stratum Clock & External clock interface provisions etc.

50. MPLS-TP EQUIPMENT CONFIGURATION:

- **Equipment Capacity:** Category-wise Equipment Capacity in respect of providing maximum numbers of various type of traffic interfaces without addition / upgradation of common & control modules (like: Switch Matrix, Synchronization/Timing unit, and Power Supply modules etc) and sub-rack/motherboard of MPLS-TP equipment are as given below:

Equipment Type	Full Duplex Packet Switching Fabric (Gbps)	10 G (Optical) Line Interface (Minimum)	1 G (Optical) Line Interface (Minimum)	10/100/1000 Base-T (Fixed Electrical Interface) (Min)	10/100 Base-T (Fixed Electrical Interface) (Min)
Type-1 MPLS-TP (10G) at DT-Haldia and RT-	160	6	2	24	8

Panagarh					
Type-1 MPLS-TP (10G) at all other stations	160	6	2	16	16

- It shall be possible to equip the above-mentioned equipment with traffic interfaces up to the capacity mentioned in above table for carrying traffic up to the maximum interface rate/speed of individual traffic interfaces/ports in non-blocking manner.
- The requirement mentioned in equipment configuration of each type of are minimum interfaces required of each type. However, if higher number of interface of any type is required to meet the tender requirements, the same shall be provided as per the telecom network configuration design approved during detail engineering without any cost implication to IGGL/ MECON. Also, 25% spare shall be available for 10/100/1000 base-T (fixed) and 10/100 base-T (fixed) interfaces (with SFP/SFP+/XFP) after utilization of all ports as required as per approved telecom network configuration.
- For 10G and 1Goptical line interfaces, SFP/SFP+/XFP shall be provided only for the interfaces which shall be used for traffic interface as per the network requirement. For spare optical line interfaces, only spare ports shall be provided and SFP/SFP+/XFPs shall not be provided. The equipment shall be configured from day 1 such that it shall be possible to install and operate the required SFP/SFP+/XFP of maximum possible distance in the spare ports in the future without any need for hardware or software modification. However, for other interfaces (10/100/1000 base-T (fixed), 10/100base-T (fixed)), SFP/SFP+/XFP shall be provided from day 1 for each port as indicated in above table or as per the requirement based on approved Telecom network configuration drawing (whichever is higher).

Note 1:

All the MPLS-TP equipment in terms of supporting various interfaces shall be as per above as minimum in a single self or higher as per the present requirement suggested in proposed Telecommunication network Annexure – X; as required has to be considered while designing/ selecting the equipment.

- For a particular type of MPLS-TP equipment, each type of protected common & control hardware units/modules shall be of same type/model.
- Each type of optical & Ethernet interface shall be equipped using minimum two nos. of same type/model hardware modules/units in the offered equipment for all sites. However, there shall be minimum two nos. of Ethernet cards for the redundancy of SCADA LAN-A & LAN-B Ethernet interfaces.
- In case, it is not possible to equip the entire equipment in a single main-chassis; the use of only a single expansion-chassis, provided through extended system backplane, shall be permitted. There shall be neither cross-connections performed in the expansion–chassis nor any control-card housed therein.
- Patch Panel shall be considered for the Ethernet connection. The requirement of the patch panel shall be decided during detail engineering.
- Patch cord, as required, shall be provided.

- Ethernet Cable:

  Ethernet patch cable [Length = 20 meter (min.)] for all equipped Electrical & Optical Ethernet interfaces shall be provided

- **Equipped Configuration:** The equipment at various locations shall be equipped and configured as per the network requirementwith respect to traffic interfaces and Cross-connect switch-matrix.

- **Software / Firmware Version:** The software / firmware version of the MPLS-TP equipment shall be latest & proven one and shall be same for each type of offered models.

REMOTE & CENTRALIZED MANAGEMENT OF RESPECTIVE EQUIPMENT /NETWORK:

New equipment supplied & installed by the vendors shall be remotely managed from NMS systems in line with following:

1. **For Type-1 MPLP-TP (10G) network of pipelines:**

   The NMS Server shall be installed tentatively at RT-Panagarh. The NMS system shall have capabilities and configurations with regard to network management functions.

   The NMS Work stations are envisaged at the DT-Haldia and RT-Panagarh locations of HPPL

   Vendor shall plan and supply all necessary DCN hardware and software and implement DCN connectivity so as to have the manageability of all the supplied elements independently from NMS even during OFC link cut in HPPL pipeline network or in event of total collapse of any of the NMS system & its associated DCN infrastructure.

   Under multiple OFC cut conditions in a section, some of the network elements (NE) may get isolated from NMS systems. However, after restoration of link, all the active alarms of the isolated NEs shall be unloaded automatically in the active NMS.

   Accordingly, vendor shall plan and supply all necessary DCN hardware and software and implement DCN connectivity.

A) <u>SYSTEM DESCRIPTION:</u>

The Network Management Systems shall be for the ultimate capacity of the offered equipment.

The Network management system shall be of open architecture and the NMS shall have built-in supervisory facilities for monitoring the health of various stations automatically. Data from various stations shall be available at both the Network Management systems and shall monitor and control all stations.

Network management system should typically include:

(i) Automatic Fault Management:

(a) Conforms to ITU-T Rec. G.784
(b) Generation, recording and displaying of network alarm information and notifications with all details (type, occurrence, severity, probable cause and clearing etc.);
(c) Localization of alarm-raising anomalies / faults;
(d) Storing and processing of alarm information upto the unit/module level;
(e) Storing and processing of historical alarm log for minimum 30 days with all relevant details.

Fault Management

a) Alarm reporting interface Real time screen display, both graphical & textual for alarm occurring at any station (without need for logging into the particular station) i.e. in all the cases the alarms to be collected via the management interface automatically. In addition, nodes should have lamps and/or unit LEDs to show their alarm status.

b) The management system shall also provide audible alarms (with a provision to disable the same, as and when required by Owner), whenever a new alarm or event enters the management log. Reminder function sound or visible blinking shall be available whenever unacknowledged alarms are present in the system. Alarm export to a remote location should be possible in future (without any additional software). Suitable port for the same shall be provided. Bidder to provide details of all the above requirements.

c) Alarm categories:

- Critical
- Major
- Minor
- Warning
- Cleared

d) Other requirements:

- All details of the alarms shall be coming automatically and directly without any human intervention. All alarms (time, date of alarm, type of alarm, name of station, time, date of alarm reset) shall come discretely at the NMS, with all details, for each of the above categories (no summed alarms).
- The network management system shall provide fault reporting of data communication equipment/interfaces.

- Fault message storage: To be stored in a database
- Maximum number of records to be stored: Upper limit to be provided by bidder. When the database gets near to the maximum number of records set at the installation, an alarm should be produced for the user. In case database gets filled up, following should be available:
  - A tool for selectively deleting records is to be provided with the NMS. For backups, tools should be provided. Bidder to provide details.
  - In case the user does not delete / clear records, first in first out (FIFO) principle shall apply.

- The user interface should have separate alarm lists for new, acknowledged and cleared alarms. A separate dialogue should be available for analyzing the historical alarms.

(ii) Configuration Management:

(a) Conforms to ITU-T Rec. G.783 and G.784
(b) Creation of Network Element (NE) in Network Management / Network Editor domain;
(c) NE Configuration;
(d) Creation, updation, deletion and retrieval of the managed network topology data;
(e) Assignment of equipment protection w.r.t. the unit/modules and selection of protection switching;
(f) Configuration of various error/fault/alarm generation threshold;
(g) Configuration and management of NE / network synchronization;
(h) Configuration and management of NE's Cross-connect matrices, end-to-end PDH/SDH/Ethernet trails and assigning network resources to the trail, enabling/disabling of protection switching of trails;
(i) Configuration & management of features like: VCAT, LCAS, GFP etc.;
(j) Automatic End to End Ethernet Traffic management for EPL, EVPL, EPLAN, EVPLAN;
(k) Management of DCC configuration etc.
(l) It should be possible to read the configuration from the network elements with the NMS, do the desired changes and save them. It should be possible to read the configuration from the network elements into a file, make the desired changes into the file and restore the configuration into the network element, thus providing a way of saving the configuration of a network element in the NMS for backup purposes.

(iii) Performance Management:

(a) Conforms to ITU-T Recs. M.2100, M.2101, M.2120, G.783, G.784, G.821, G.826, G.828 and G.829;
(b) Continuous monitoring of performance of each trail over fix time period of 15 minutes and 24 hours. For bi-directional trail, the performance monitoring shall be performed separately for each direction by using concept of near-end and far- end to indicate the performance of each of the transport. For each trail, performance and availability event shall be monitored for NES (Near-end Error Second), NBBE (Near-end Background Block Error), NUAS (Near-end Unavailability Second), NSES (Near-end Severe Error Second), FES (Far-end Error Second), FBBE (Far-end Background Block Error), FSES (Far-end Severe Error Second), FUAS (Far-end Unavailable Second) etc and 15-minutes & 24-hours reports to be generated;
(c) Reporting of Ethernet link performance;
(d) Reporting the performance and availability history of any trail as required.
(e) The performance data should be available for each network element.

(iv) Security Management:

(a) Providing protection to network resources and services from unauthorized access through maintaining the user database which contains their password and their related authorization levels. Only the system administrator has the authorization to access and edit the user information;
(b) Allowing only the user with a correct username and a valid password to access and perform any management functions;
(c) Monitoring of the login and logout activities of the system and record such activities as a sequence event. Every login and logout activity shall be recorded in a log file with information such as username, login and logout time and successfulness of login attempt. The information in the log file shall be retrievable and browse-able by the system administrator;
(d) Creation of a new user group, a new user and assigning of limit rights to manage any particular NEs and any management capabilities to any specific user or user group as required, by the administrator;
(e) Aging of password and restriction of duplicate logon.

(v) Software management:

(a) Loading and installation of new system software or software patches with display of message regarding the progress, successful or failed operation;
(b) Local or Remote Software Download (with appropriate user authorization) through FTP / TFTPwith display of message regarding the progress, successful or failed operation;
(c) Managing different & multiple versions of software.

(vi) Inventory management:

(a) Showing inventory based on the available device inventory;
(b) Providing the complete view of the network elements and the interconnecting links;
(c) Keeping track on any change in the network inventory;
(d) Indicating absence/presence of any physical module/hardware and also indicating the usage of module.

The each Network Management System (NMS) setup/infrastructure at HPPLshall include but not limited to the following:

- NMS Server (Hardware, Firmware & Software)installed in NMS server rack, draw out type 17" foldable LCD monitor with Key-board, Mouse etc with configuration as a minimum.

- NMS Client Workstation (Hardware, Firmware & Software) along with 32-inch LED Monitor, Key-board, Mouse, etc. with configuration as a minimum shall be installed in Network Monitoring area (away from NMS server area).

- DCN equipment (Hardware, Firmware & Software), which will be installed in Equipment room / area of HPPLregion.

Bidder shall provide a Network Management System (NMS) to enable remote monitoring & control of telecom equipment. Server shall be provided at Panagarhand it shall act as Network Management Center (NMC). NMS shall be in Client-Server architecture. The Network Management System shall be of open architecture & the NMC shall have built-in supervisory facilities for monitoring the health of various stations automatically. Data from various stations shall be available at all the NMS client and shall monitor and control all stations. NMS Client shall be provided at Haldia and Panagarh.

All the databases in NMS Server should have disk mirroring/ standby configuration. External backup of Network Management databases through Hard Disks should also be provided (this should have both options of manual & scheduled backup). The restoration of the backed-up data to NMS server should be done from external backup media (Hard Disk) directly without any further conversion or transfer to other media.

In addition, the NMS should also provide alarms and indications automatically for the Clock Alarms (Bidder's scope shall include provision and installation of required sensors, cables all complete for the same) for Collection and data base storage in the Network Management System should be fully automatic. Operation of NMS should be pre-emptive (i.e. in case of any wrong operation, the system software shall not crash).

All the hardware of NMS systems should be provided from proven and reputed sources of industrial grade

All Type-1 MPLS-TP equipment shall be manageable through a single application Platform. Collection and data base storage in the NMS should be fully automatic. Operation for NMS should be pre-emptive (i.e. in case of any wrong operation the system software should not crash) and Should provide control and robustness for database backup and download by supporting database target verification to prevent the use of a wrong database.

This management platform will provide network topology view (graphical and textural) of all the Type-1 MPLS-TP elements and alarm log.

Management data (Q3 interface) shall be carried between Type-1 MPLS-TP nodes by the DCC (Data Communication Channel) bytes of Type-1 MPLS-TP.

NMS should comply to ITU-T recommendation (M-3010). Programming shall be in high level programming language. Latest field proven version should be supplied. A backup of the complete NMS software shall be provided in USB hard disk.

The management platform should have graphical user interface and the graphical view of the network elements should offer a quasi-photographic picture at the highest level, going down to block diagram views of the functional blocks i.e. the network management system shall graphically depict the entire network in a single global view.

From this view the following should be accessible.

a) The topology level- shall display in the main window and shall be the background for all other management views.
b) The NE shelf view –shall show the internal physical layout of the NE's i.e. the various cards installed in their slots.
c) Card internal view- shall show the various transmission objects within the card.

All functional operation shall be mouse performable.

Throughout all presentation layers, continuous alarm information should propagate. For all views and tasks, a context sensitive on line help should be provided. In addition, complete product documentation should be accessible via the online help system.

The routing protocol shall be dynamic and in accordance to ITU-T, ISO (ES-IS, ISIS)/ Q3/SNMP ver.2 standard protocols, required for Network management. Updates of routing tables should be automatic. Any network element should be accessible from any other point of the network.

Vendor to provide details of the NMS provided including details of hardware and software utilized and also how the network management can be expanded if the network grows (state addressing rules, action required limits of network (size, etc.).

B) Element Management

The number of manageable elements shall be at least 200 % more than as required for this project. However, bidder shall provide management software and node licenses for present requirement along with 25% spare. All software, licenses as required for the same shall be included as part of this project. In line with the above, bidder to also specify maximum number of manageable network elements for Type-1 MPLS-TP.

C) CONFIGURATION

It should be possible to read the configuration from the network elements into a file, make the desired changes in to the file and restore the configuration into the network element, thus providing a way of saving the configuration of a network in the NMS for backup purposes.

D) Backup

The NMS shall get data from the network elements automatically. In addition, backup mechanism should be available at NMS for fault data, performance data and configuration data. As long as power supply is available to the telecom rack, Network Management System should be able to communicate with the node through the management interface card, irrespective of failure of any other cards.

E) USER ACCESS

It should be possible to connect two NMS or one NMS and one local craft terminal (hand held service terminal /lap top computer) to the network at the same time.

The user name should define the access right for the system as per defined user privilege class.

The different user privileges available shall be as follow:

Allowed Action	Operator	Experienced user	Network Administrator	System Administrator
Display network file	Yes	Yes	Yes	Yes
Enable profile monitoring	No	Yes	Yes	Yes
Create new profile	No	Yes	Yes	Yes
Create new network maps	No	No	Yes	Yes
Create new network files	No	No	Yes	Yes
Purge historical alarms	No	Yes	Yes	Yes

Install communication drivers	No	No	No	Yes
Configure drivers	No	No	Yes	Yes

F) INTERFACE TO HIGHER LEVEL MANAGEMENT SYSTEM

Vendor is required to provide details of such interfaces.

G) FEATURES / FACILITIES:

1. End-to-end Trail creation for both TDM & Ethernet circuits by pointing the start of the trail to the end point of the trail automatically.

2. Multiple views of layered topology.
3. Unified management of different transport layers.

4. Multilayer service provisioning.

5. Evolving TMN functionalities including fault management (showing network alarm information), performance monitoring(collecting performance data for SDH such as RS termination, MS termination & high, low order path termination and Performance statistics), equipment configuration and administration (node installation, configuration, software download, dynamic end-to end path, and trail management), transmission and connectivity management, security management (assigning user rights, keeping log records, etc.) and system and authorization control features.

6. Open CORBA interfaces towards the TMN upwards.

7. The network management system should be capable of managing both the optical platform and transport network simultaneously through the versatile network manager. The comprehensive management system should provide maximum integration and full modularity.

8. The network management system should have free flow of management information between the Type-1 MPLS-TP and other complimentary access without regard to their source of manufacture. It should support data communication channel (DCC) hardware transparency and allow the creation of DCC path for the transfer of third party management information through the network element and sub networks. The NMS shall be provided with CORBA interface for Integration with the other vendor's NMS on a common platform.

9. The network management system should deliver end-to-end management.

10. The NMS Operating System (OS) should be based on either licensed UNIX or LINUX or MS-Windows with all Anti-Virus provisioning. The NMS software should be user friendly. During warranty period, the anti-virus software shall be upgraded/updated on regular basis in systems by the vendor without any cost implication to client.

11. The NMS should have the capability of managing minimum double the numbers of Type-1 MPLS-TP elements which would be implemented under this project without any software & hardware upgradation of supplied NMS system. Here, all network elements are to be considered to have been upgraded to its maximum capacity.

12. It should be in compliance to ITU-T recommendations.

13. The hardware should be provided from proven sources.

14. Printer interface support in the NMS shall be provided for printing the following as a minimum:

    i) Time, date and alarm
    ii) Type of alarm
    iii) Name of station
    iv) Time, date of alarm reset
    v) Severity, Status of alarm

15. Alarm reporting interfaces: Real time screen display, both graphical & textual for alarm occurring at any station without need for logging into the particular station.

16. The management system shall also provide audible alarms (with a provision to disable the same, as and when required by Owner), whenever a new alarm enters the management log. Reminder function sound visible blinking shall be available whenever unacknowledged alarms are present in the system. Alarm export to a remote location should be possible in future (without any additional software). Suitable port for the same shall be provided.

17. Alarm categories:

    - Critical
    - Major
    - Minor
    - Warning
    - Cleared or Acknowledged

18. All details of the alarms shall be coming automatically and directly without any human intervention. All alarms (time, date of alarm, Type of alarm. Name of Station, Time, date of alarm reset etc.) shall come discretely at the NMSs, with all details, for each of the above categories (no summed alarms).

    Fault message storage : To be stored in a database.

    Maximum number of records to be stored: Vendor to provide the upper limit of storage of records.

    House keeping of the database:

    When the database gets near to the maximum number of records set at the installation, an alarm should be produced for the user. In case database gets filled up, following should be available. A tool for selectively deleting records is to be provided with the NMS. For backups, tools should be provided. In case the user does not delete/clear records, first In first out (FIFO) principle shall apply.

    The user interface should have separate alarm lists for new, acknowledged and cleared alarms. A separate dialogue should be available for analyzing the historical alarms.

H) PERFORMANCE DATA

The performance data should be available for each network element.

Performance monitoring should be available according to ITU-T

Two separate records for last 15 minutes and 24 hour records shall be available. Performance monitoring shall be possible to set on all above functional blocks, including history records.

I) BACKUP

Back-up provision shall include but not limited to the following:

- Fault data
- Performance data
- Configuration data
- Cross-connection data
- NMS System data

J) TrafficInterfaces

Following Traffic interfaces as a minimum shall be configured in respective equipment-

• 100 Mbps point to point LAN (1+1) from Dispatch Station to receiving station for SCADA system.

• 20 Mbps point to point LAN (1+1) at each station on either direction for data transfer for RTU. This LAN shall be dropped at all SV and IP locations between Dispatch Station to Receiving station.

• 20 Mbps shared LAN (1+1) shall be configured from Dispatch Station to receiving station for providing HP LAN. This LAN shall be dropped at all SV and IP locations between Dispatch Station to Receiving station. LAN point to be provided in Telecom room at SV stations also for HPnet and others.

• 10 Mbps shared LAN (1+1) shall be configured from Dispatch Station to receiving station for NMS application. This shall be shared by the NMS server and workstations of MPLS-TP and EPABX.

• 100 Mbps shared LAN (1+1) shall be configured between Dispatch Station, IP station and receiving station for Interfacing with Type-2 MPLS-TP equipment

• Shared LAN for CCTV as per the bandwidth requirement of CCTV. Minimum CCTV LAN of 500 Mbps to be considered for CCTV system connecting main locations. At SV locations bandwidth shall be configured by bidder depending on the camera bandwidth.

• 20 Mbps LAN shall be configured from Dispatch Station to receiving station for station PLC networking application.

• 40 Mbps LAN for EPABX system

• 10 Mbps shared LAN (1+1) shall be provided from Dispatch Station to receiving station for STS application. This LAN shall be dropped at all SV locations and IP station between Dispatch Station to Receiving station and a LAN point each to be provided at security cabin and at telecom room of SV stations.

• Web LANof 10 Mbps to be dropped at all the locations. This LAN shall be dropped at all SV locations and IP station between Dispatch Station to Receiving station.

• 400 Mbps shared LAN (1+1) shall be provided from Dispatch Station to receiving station for PIDS application. This LAN shall be dropped at all SV locations and IP station between Dispatch Station to Receiving station as decided during detail engineering.

• 10 Mbps PAGA LANto be dropped at all the locations

• 2 Nos. of spare- 20 Mbps shared LAN (1+1) to be configured at all the locations including at all SV and IP stations for future use.

• 2 Nos. 50 Mbps shared LAN (point-to-multipoint) shall be configured between all the locations for future use.

• 50 Mbps shared LAN (1+1) shall be configured between the DT, IP and RT locations for SCADA RWS.

Above mentioned bandwidth requirement is tentative/ reference list however the same shall be increased or decreased during detailed engineering in consultation with Client/Consultant and Vendor to carry out the job as per requirement

EXPLOSION-PROOF PHONE

S. N.	Parameter	Technical Specification
1	Description	Intrinsically safe Explosion-proof analogue phone with all accessories i.e., Handsets, SS Cords, Glands, Inbuilt ringer etc. (entire filling must be in a single enclosure)
2	Housing material	Glass-fibre-reinforced polyester/Aluminium (LM6) alloy
3	Hardware	External: Stainless Steel; Internal: Brass-Nickel plated
4	Finish	Anti-corrosive Epoxy Power
5	Approval	PESO
6	Display	alphanumeric display
7	Keypad	Minimum No. of keys: 0 to 9, * , #, Flash, Redial
8	Dialling	DTMF and Pulse Mode switchable
9	Degree of protection	IP66
10	Impact Protection	IK09
11	Operating Temperature	0°C to +60°C
12	Ringing Sound Pressure Level	app 90 db(A) at 1 m distance
13	Line Voltage	~48VDC (EPABX line)
14	Telephone Book	Minimum 50 items (name and Phone number)
15	Temperature Classification	T6
16	Certified for use in Gas	I and IIA and IIB
17	Zone Classification	Zone-1 with PESO certificate
18	Intrinsically safe	Ex "i" / Exd /IIA /II B T6 protected
19	Mounting	Wall / column / structural
20	Handset cord	Stainless Steel spiral cord
21	Compatibility	Fully compatible with all EPABXs'Analog Telephone line
22	Cabling	Single pair Telephone Cable

3.5 **EXPLOSION PROOF TELEPHONES' ACQUSTIC BOOTHS**

General

The explosion proof telephones shall be housed in a full enclosure with explosion proof Howler &explosion proofflashing beacon (suitable for installation in Zone-1, Gr IIA/B, T6) acoustic booth installed outside the acoustic booth. The acoustic booth shall be full enclosure with Howler & flashing beacon type with doors. The acoustic booth shall house the explosion proof telephone set, including all accessories for fixing to the telephones set. These telephones shall be connected through EPABX at manned stations.

The acoustic booth will reduce noise level (≥ 15 dB) and protect the telephone. Location of these telephones shall be finalized during detailed engineering. Vendor's scope include supply of all materials, interface, cabling, power supply, trenching, back filling etc., all complete.

One galvanized cable tray shall be fixed on the steel pole to guide and protect cables. One hole shall be provided in the floor-mounted plate to facilitate entry of cables.

Specification:

Wiring, Cable glands, shall be included with the equipment. All cables outside the building shall be armoured type. All hardware such as nuts, bolts, washers etc. shall be cadmium plated or zinc passivated. All equipment shall be coated to ensure proper corrosion protection.

Acoustic booths shall have polyester powder coating of 60 um minimum in case of metal or should be made of FRP. Galvanization thickness for steel pillar and flash support shall be 80 um minimum.

All metallic parts which are not permanently protected against corrosion shall be protected with anti-corrosion painting. Vendor shall indicated the extent of noise reduction for the offered acoustic booths

3.6 OPTICAL FIBER PIGTAIL, CONNECTORS & OPTICAL PATCH CORDS TO BE USED IN THE FTC

The single mode fiber pigtails and connectors should meet the ITU-T recommendations G-652 D & G-655 as required.

Both connectors and cable should be robust and should withstand wear and tear due to frequent use, Connection and disconnection. Normal expected life should be 15 year or more. The patch cords provided shall be 20 mtr in length.

Optical Fiber Cable, Patch Cord connections & pigtails shall be fully compatible and matching to each other.

PARAMETERS OF CONNECTORS WITH PIGTAILS

Insertion Loss	:	Maximum 0.3db per connector plus fibre loss
Return Loss	:	Better than 40db
Temperature Dependency	:	< 0.3 db from -20 to +60
Change in connection Loss with passage of time at 60 ^{o}C for 100hrs	:	It should be < 0.3db
Change in connection loss due to vibration	:	< 0.05 db
Reproducibility of connection loss by repeated connection and disconnection for 500 times.	:	< 0.05 db
Change in connection loss in relation to	:	Loaded : -50db,

tensile Strength Unloaded : -30db

The specification of Jointing Closure,Jointing Pit, Marker, and make of electronic marker shall be provided to Vendor for rectification / restoration of damaged OFC if required.

a) Media Converter for Cameras (Transmitter & Receiver)

- Industrial Grade and Din rail mountable
- One fixed copper ports for 10/100Base-T and One SFP ports (100Base-X)
- Suitable for single mode fiber
- Operating temperature 0 to 50 °C (Transmitter)
- Operating temperature 0 to 40 °C (Receiver)

1 Nos. of 6 port Fiber patch panel (Din rail mountable) shall be provided with each media converter Transmitter and bidder shall quote the same along with media converter transmitter.

3.6.1 CAMERA SPECIFICATION

1) Weather Proof PTZ type

a. General

Camera shall be IP network based color day/night camera suitable for indoor & outdoor application to be installed in safe area with following minimum features:

- Networked dome camera for remote pan/tilt/zoom control with10/100 Mbps Ethernet with Cat -5e/6 cable.
  Pan Range: 360 degreesTilt Range : 0-90 Degree (w/o Auto-Flip)
- Motion MPEG-4 and H.264/ H.265 based hardware compression
- Direct IP based (without external converters, cards, etc)
- Compression: H.264/ H.265, 720p @25 frame/sec
- Backlight Compensation/EIS/AGC
- Progressive scan
- True Wide dynamic range (min. 100dB Gain)
- Power over Ethernet. Vendor shall provide power convertor required, if any
- On Board Analytics viz. Motion Detection, No Motion Detection, Sensitivity, Congestion, Dual Trip Wire, Object Classification, Tracking etc
- The housing shall be :
- Imager :1/3" Progressive Scan CMOS
- Supporting Protocols:IPv4/IPv6, TCP, UDP, ICMP, IGMP, HTTP, HTTPS, FTP, SMTP, DHCP, DNS, NTP, RTSP/RTP/RTCP, SNMP
- SNR:>=50db
- IR Cut Filter
- 100 Presets and 6 Tours
- Auto Iris with Manual Overide
- 180°/sec Pan Preset Speed and 100°/sec Tilt Preset Speed
- UPnP, DHCP, RTP, RTSP, NTP, IPv4, IPv6, SNMP, QoS, HTTP, HTTPS, SSL, SMTP, FTP, ONVIF
- DeFog
- Dual Video Stream support
- The cameras shall be fully IP based and shall not be offered along with encoders.
- SD card with memory shall be provided for storage of 7 day continuous recording

b. Connections

Network interface: IEEE802.3, 10/100 BaseT Ethernet networks (RJ45) for LAN/WAN, TCP, UDP, IGMP, SNMP, HTTP, RJ45

c. Video

Lens: Autofocus 30x Optical Zoom,
F1.6(W) to F4.5(T);
Focal length: 3.4 to 119mm
Zoom: min 30 x optical +min 12x digital
Pan: 360 degree (continuous rotation)
Tilt: 90 degree above horizontal & 90 degree vertically down or 0 to 180 degrees
Frame: 25 fps or better
Resolution: better Min. 2 MP (1920 * 1080)
Light sensitivity: 0.65 Lux color min., 0.01 Lux B/W min., 0.20 lux (Mono) light sensitivity
IR sensitive black/white video at night
Video compression: H.264/ H.265/ H.265+ (MPEG-4 Part 10)
Angle View:60° (Wide) to 1.7° (Tele) or better
Shutter Time:PAL: 1 - 1/10000s
Presets:64
Motion Detection:Available on the entire Camera Capture Frame
PTZ Cameras shall have 64 or more pre-defined positions, to be selected through suitable input command

d. Functions

- Backlight compensation
- Motion detection
- Scheduled and triggered event functionality with alarm notification
- Pre and post alarm buffer
- Digital time, date code embedded
- Password protection
- Other Features:Programmable Tours, Programmable Auto Pans, Privacy Zones/Video Blanking Sectors, E-flip/Auto-flip, EIS.
- Certifications:FCC or CE and BIS

e. IR Illuminator

IR illuminators shall be integral to the camera and shall be of following specification to be provided by vendor along with each camera:

- LED based for minimum 150 meters,
- Automatic Dawn/Dusk power on/off
- For outdoor application with power supply IP-66 protection
- Outdoor with temperature range up to 55°C,
- Minimum Requiment:Color Mode: 0Lux @ 50IRE, F1.6 Black & White: 0Lux @ 50IRE, F1.6, Vandal Protection Rating IK-10

f. Software : Latest, Compatible with Window Operating System

g. Operating condition
Outdoor with temperature range upto 55°C

a) IP-66/NEMA-4X and Vandal –resistant for hydrocarbon-safe area.

h. The camera shall be offered with the following accessories:

- Pole/Wall mounting accessories
- In case of OFC connection - IP-66 Junction box with media converters, power supply converter, local disconnection module, power and signal cable termination, glands etc., 6 port FTC
- Camera cable tail from junction box to camera (power and signal).
- Camera Cable tail from Ethernet switch to camera (power and Signal).
- Surge protection device.
- Power supply converters (if required separately)

2) FIXED TYPE

a. General

Camera shall be IP based network color camera suitable for indoor & outdoor application to be installed in safe area with following minimum features:

- Motion H.264, H.265 based hardware compression with built-in web server
- Direct IP based (without external converters, cards, etc)
- Zoom and auto focus
- Local Storage
- Power over Ethernet
- HDTV quality
- Intelligent video capabilities
- Housing:Vandal-resistant Housing IK-10
- Imager : 1/3" Progressive Scan CMOS
- Protocols: IPv4/IPv6, TCP, UDP, ICMP, IGMP, HTTP, HTTPS, FTP, SMTP, DHCP, DNS, NTP, RTSP/RTP/RTCP, SNMP
- Certification:FCC or CE and BIS

b. Connections

Network: 10/100 Mbps Ethernet with Cat-5e/Cat -6 cable
Video
Lens: Fixed, F1.4, f=3.0-12.0mm
Focus range: 0.3 m to infinity
Progressive scan CMOS
Light sensitivity: 0.65 lux color
IR Illuminator with sensitive black/white video at night (min 40 mtrs distance)
Frame: 25fps or better
Night View:0Lux
Day/night Mode feature:Yes [Configurable & Automatically selectable]
Maximum Resolution:1080P (1920×1080) @25fps
Zoom: min 20 x optical + min 10x digital

c. IR Illuminator

IR illuminators shall be integral to the camera and shall be of following specification to be provided by vendor along with each camera:

- LED based for minimum 150 meters,
- Automatic Dawn/Dusk power on/off
- For outdoor application with power supply IP-66 protection

- Outdoor with temperature range up to 55°C,
- Minimum Requiment:Color Mode: 0 Lux @ 50IRE, F1.6 Black & White: 0 Lux @ 50IRE, F1.6, Vandal Protection Rating IK-10

d. Functions

Built-in video motion detectionon the entire Camera Capture Frame
Scheduled and triggered event functionality with alarm notification
Pre and post alarm buffer
Digital time, date code embedded
Password protection for restricted camera access
Privacy Mask shall be Available
Power Supply:PoE IEEE 802.3af / 24V AC / 12V DC

e. Software
Latest Software, compatible with Windows Operating System

Operating condition

Outdoor with temperature range of 0-55°C

- Apart from above-mentioned minimum specifications, all types of cameras shall also comply the followings:
  (a) Camera Web server: The IP Camera will have a built in web server, making it accessible forconfiguration using a standard Internet browser.
  (b) Security: Password protected Web interface for administration.
  (c) Alarm: Must have 2opto-isolated alarm inputs and 1 relay outputs.

- If the cameras & software (VMS / VAS) are from different OEM, certificate from both the OEMs in regard to seamless integration & operation of the total system to be ensured.

f. The camera shall be offered with the following accessories:
- Pole/Wall mounting accessories
- IP-66 Junction box with media converters, power supply converter, local disconnection module, power and signal cable termination, glands etc.
- 6 Port FTC.
- Camera cable tail from junction box to camera (power and signal).
- Media converters.
- Surge protection device.
- Power supply converters
- Ceiling / Wall mount Accessories
- Camera Cable tail from Ethernet switch to camera (power and Signal).

g. Camera Housing & mount: The camera mount, power supply, housing, lens should be:

(a) Of the same make as that of camera or from OEM-approved firms and suitable for the model number offered as specified by the manufacturer and should be an integrated unit.
(b) Should support the weight of camera and accessories such as housing, pan & tilt head in any vertical or horizontal position etc.
(c) Outdoor PTZ Cameras shall be mounted on polls. All the associated items like Power-Adapters, Media-Converters etc for the particular camera shall be housed in Weather-proof/Intrinsically Safe Junction-box as per site

requirement) beside the pole. Uninterrupted Power Supply for the Camera shall be extended from the nearest point.

Fibre Patch Cord

	Fibre Patch Cord
	SC-SC / SC-LC patch cord should be of minimum 3 meters length suitable for nominal wavelength of 1310nm and 1550nm.
	9/125 micron SM fibre
	Connector Ferrule: Zirconia Ceramic
	Dust caps shall be fitted on each connector at the assembly.
	Thickness of patch cord cable should be 3 mm nominal.
	Insertion loss should be nominal 0.1 dB per connector
	Return loss should be better than 45 dB.

3.9.1 Type-2 MPLS-TP Equipment

1. The equipment manufacturer shall provide a high capacity optical Ethernet telecommunication equipment that can support both backbone and access service locations, and is based on active nodes that are linked by MPLS-TP connections over fiber or other media, to form reliable and redundant high speed networks for the transparent transport of legacy TDM and Ethernet based interface services.

2. The equipment shall be connection oriented and based on the MPLS-TP standard.

3. The installed system shall have the following characteristics:
   - High Availability
   - High Reliability
   - Easy to install and operate
   - Scalable
   - High degree of flexibility with respect to the type of interfaces
   - Apply strict bandwidth control on a per service/application basis

4. The network equipment shall use automatic protection switching based on MPLS-TP. The network will provide symmetrical delays for each application that is time critical and will ensure that delays remain symmetrical after the service is switched to the protection path. Protection switching that creates asymmetrical delays is not acceptable.

5. The entire Type-2 MPLS-TP network(s) equipment will exclusively be managed from a central point via an intuitive network management system.

6. The MPLS-TP System should be a carrier grade multi-service platform and should be able to supportwhole new breed of functionalities for efficiently aggregating, switching and managing a mix of globalservices ranging from applicable optical MPLS-TP services and Layer-2 Ethernet services.

7. The MPLS-TP System should be equipped with a fully non–blocking Switch Matrix.The Equipmentshall be connection-oriented packet switching model with traffic engineering capabilities thatallow deterministic control of the use of network resources. It shall support traffic engineeredpoint to point (P2P), point to multipoint (P2MP) and Multipoint to Multipoint (MP2MP) transportpath.

8. MPLS-TP equipment is expected to operate at Layer-1 through Layer-2 of the seven layer OSImodel. The basic function of the equipment is to add/drop various traffic from multiples ports(Ethernet / GigE), aggregate and transport across the network. The WAN sidewould allow support for carrier class protection, OAM and scalability as well as support for point-to-point, point-to-multipoint and multipoint-tomultipointtraffic.

9. In the MPLS-TP network, the services should be conveyed end-to-end through service tunnels overthe underlying transport network. In the service tunnel the services areto be encapsulated and isolated from the transport layer (e.g., MPLS labels). In

MPLS-TP, legacyTDM traffic should be emulated and encapsulated into Pseudo-Wire (PW) service tunnels to be transported over the carrier Ethernet network. The service tunnel should be configurable in aflexible way based on requirement

10. The underlying transport technology shall be able to establish transport paths within the MPLS-TPnetwork and enable the transport paths to carry the service tunnels. The transport path shall bedefined as end-to-end path as connectionless transport in principle can't fulfill carrier-graderequirements.

11. The MPLS-TP equipment shall collect various traffic with or without VLAN tag as per IEEE 802.1Q,aggregate and switch the same and shall hand over the 802.1ad traffic to other MPLS-TPequipment in the network for aggregation and transport through multiples of GigE or 10 GEinterfaces

12. The Equipment shall support packet transport network solution by using PW service tunnel andMPLS-TP transport technology. , TDM and Ethernet traffic are emulated into Pseudo-wires and PWlabel is added for service identification. End-to-end transport path LSP is created based on MPLSTPstandard (ongoing) and multiple PWs are transported over the same LSP end-to-end in bothdirections

13. The MPLS-TP network shall have advanced functionality like ability to create Ethernet Layer 2VPN(channels) such as point-to-point, point-to-multipoint as well as multipoint-to-multipointtoisolate various kind of traffic into their own logical virtual network.

14. The switching fabric plane of the MPLS-TP equipment shall be bidirectional and non-blocking. TheMPLS-TP equipment shall support a wire speed L2 switching capabilities under full load condition.

15. The equipment shall support Fast Ethernet electrical interface, Gigabit Ethernet (electrical &optical) & 10 Gigabit Ethernet interfaces meeting IEEE and ITU-T Standards.

16. All port should be Auto and Manual configurable to set parameters like: Rate/Bandwidth, Half/FullDuplex, etc.

17. It shall be possible to monitor transmit and receive power on all optical interface ports on theEquipment. The MPLS-TP equipment shall support built in power diagnostics to monitor opticalSFP/SFP+/XFP ports, system diagnostics to detect hardware failures.

18. All the SFP/SFP+/XFP should be with two port i.e one is TX port to transmit the signal, and theother one is RX port to receive signals

19. The equipment shall support all Ethernet interface to be configurable as user network interface(UNI) and network interface (NNI).

20. It shall be possible to manually configure end-to-end MPLS-TP tunnels through NMS. It shall bepossible to create co-routed bidirectional path from NMS as specified.

21. It shall support the creation of L2VPN solutions using statically configured PWs and tunnels as perRFC 4664

22. Customer ELAN traffic shall be transported over a co-routed bidirectional P2MP MPLS-TP tunnel toallow Traffic Engineered multicast traffic

23. Topology

    a) The network equipment shall allow creating networks of any topology. The MPLS-TP equipment should support various network topologies as listed below:
        - Multiple Rings
        - Star
        - Meshed-rings
        - Rings
        - Point-to-Point
        - Linear Chains.
        - dual homing

b) The network will be controlled via a centralized management system without a dynamic control plane to avoid complexity and non-deterministic behavior under fault conditions. At any given point in time it must be possible to identify the traffic flows of each individual application/service.

24. Principlesof Operation

a) The operation of the system shall be based on MPLS-TP technology (RFC 5654), where active nodes are interconnected via Ethernet links.

b) The different traffic flows over the network will be organized in pseudowires and tunnels. The network must support point-to-point and multipoint connections. In case of point-to-point connections, it must be possible to create transparent connections for all protocols.

c) Traffic engineering of the network will be based on quality of service for each of the individual flows. Traffic flows will be identified at ingress side of the network as port based or VLAN based. Strict ingress and egress bandwidth control must be applied to guarantee bandwidth and performance for each individual service and avoid interference between pseudowire traffic.

d) Protection of the services under fault conditions will be organized via automatic protection switching based on the MPLS-TP standard (RFC 6372). Fast reroute or proprietary protocols are not allowed. For optimization, it is allowed to create protection via alternative technologies but in that case, it must be a combination of existing public standards like ERPS (ITU G.8032) to allow interoperability with other parts of the network. In such a case these existing public standard protocols must run inside the MPLS-TP pseudowire infrastructure.

e) All provisioning parameters for setting up the network, including initial configuration and discovery, must be organized via the network management system. This network management system shall guide the operator via point and click wizards through the different steps of configuration of the individual network elements and services.

25. MPLS-TP compliancy specification

The offered equipment shall be compliant with MPLS-TP and therefore be compliant with following standards:

- RFC3985: Pseudo Wire Emulation Edge to Edge Architecture
- RFC5317: JWT Report on MPLS Architectural Considerations for a Transport Profile
- RFC4448: Encapsulation Methods for Transport of Ethernet over MPLS Networks
- RFC5462: Multiprotocol Label Switching (MPLS)
- RFC5586: MPLS Generic Associated Channel
- RFC5654: Requirements of a MPLS Transport Profile
- RFC5718: In-band communication channel
- RFC5860: Requirements OAM for MPLS-TP
- RFC5880: Bidirectional Forwarding Detection (BFD)
- RFC5921: A Framework for MPLS in Transport Networks
- RFC5950: network management for MPLS-TP
  RFC5951: network management requirements for MPLS-based transport networks
- RFC5960: MPLS Transport Profile Data Plane Architecture
- RFC6291: Guidelines for the Use of the “OAM” Acronym in the IETF
- RFC6371: Operations, Administration, and Maintenance Framework for MPLS-Based Transport
- Networks
- RFC6372: MPLS-TP Survivability Framework
- RFC6426: On demand connectivity verification
- RFC6428: Proactive connectivity verification
- RFC6669: An Overview of the Operations, Administration, and Maintenance (OAM) toolset for MPLS-Based Transport Networks

- G.8032: ERP
- G.8101: Terms and definitions for MPLS Transport Profile
- G.8110: MPLS layer network architecture
- G.8110.1: Architecture of the Multi-Protocol Label Switching transport profile layer network
- G.8112: Interfaces for the MPLS Transport Profile layer network
- G.8113.1: Operations, administration and maintenance mechanism for MPLS-TP in packet transport networks
- G.8113.2: Operations, administration and maintenance mechanisms for MPLS-TP networks using the tools defined for MPLS
- G.8121: Characteristics of MPLS-TP equipment functional blocks
- G.8121.1: Characteristics of MPLS-TP equipment functional blocks supporting ITU-T G.8113.1/Y.1372.1
- G.8121.2: Characteristics of MPLS-TP equipment functional blocks supporting ITU-T G.8113.2/Y.1372.2
- G.8131: Linear protection switching for transport MPLS (T-MPLS) networks
- G.8151: Management aspects of the MPLS-TP network element

26. QoS Support

The Equipment shall support traffic classification based on the following:

- Source Interface
- VLAN ID
- 802.1p priority bits
- Differentiated Services Code Point (DSCP)/ Telecommunications OptimizationServices (TOS) (RFC 5462)
- The Equipment shall support marking of 802.1P, DSCP, EXP/TOS, bits.
- It shall be possible to classify the micro-flow at the ingress.
- The Equipment shall support rate-limiting per class (or flow) in steps of 64kbpsfor less than 1 Mbps and at 1 Mbps for 1-100Mbps and at 100 Mbps granularityfor 100-1000 Mbps. It shall be possible to define Committed Information Rate(CIR) and an Excess Information Rate (EIR) for each flow in steps of 64kbps.
- The Equipment shall support following burst sizes: 16K, 32K, 64K, 128K and256kBytes
- The Equipment shall support 8 class of service per flow.
- The Equipment shall support following scheduling scheme:
  - Strict priority (SP)
  - SP + Weighted Round Robin (SP + WRR) Interface type
- The Equipment shall support congestion avoidance mechanism like WRED and Tail Drop or Flow Control

27. TRAFFIC INTERFACE SUPPORT

a) The equipment shall support Fast Ethernet electrical interface, Gigabit Ethernet(electrical & optical) & 10 Gigabit Ethernet interfaces meeting IEEE and ITU-TStandards.

b) All port should be Auto and Manual configurable to set parameters like:
   - Rate/Bandwidth, Half/Full Duplex, etc.
   - It shall be possible to monitor transmit and receive power on all opticalinterface ports on the Equipment.
   - Equipment shall have standard pluggable SFPs/SFP+s/ XFPs minimum for alloptical interfaces.
   - All the SFP/SFP+/XFP should be with two port i.e one is TX port to transmit thesignal, and the other one is RX port to receive signals.

28. INTERFACE SUPPORT

a) Interface support for the Equipment:
   - The equipment shall support the following IEEE standards and ITU-T Standardsinterfaces.
   - 10/100/1000BaseT, 1000BaseSX, 1000BaseLX.
   - 10GBASE-SR,10GBASE-LR and 10GBASE-ER
   - The MPLS-TP Equipment shall support full duplex capabilities on all EthernetPorts
   - It shall be possible to use all optical interfaces as either client interface and/ornetwork interface
   - Each port shall be configurable for any direction of transmission

- It shall be possible to monitor transmit and receive power on all optical interfaceports on the Equipment.
- Equipment shall be based on commercially available pluggable
- (SFP/SFP+/XFP) optics for all optical interfaces

29. Availabilityand Reliability

a) To ensure maximum system availability and minimum downtimes, special precautions must be taken on the system:

- Protection switching for services based on automatic protection switching according to MPLS-TP. The back-up path will be activated automatically whenever a fault occurs on the active path. The active/backup scenario shall be predefined in the system with the network management system. This shall be done via point and click within the network management systems and should supersede any dynamic routing protocol to make the protection switching deterministic. The protection switching must be bidirectional to avoid differential delay. In the event a single fiber in a fiber pair is broken both transmit and receive links need to switch over.
  The maximum reconfiguration time, in case of a node failure or cable break, shall not exceed 50 milliseconds for 1:1 protected services
- Dual redundant power supply input with separate power cords/connections are required.
- Configuration data shall be stored locally in every access node to ensure a quick restart after a power outage.
- The configuration of the node must be stored on a removable memory to allow an easy swap of hardware without reloading the configuration.
- All network nodes are always reachable from the network management system, even when they are not configured. Each MPLS-TP link shall carry management traffic in a dedicated MPLS-TP pseudowire with its own bandwidth which must guarantee there will be no influence of management traffic on the various services. This also guarantees reachability of the nodes by the network management system.
- The database holding all relevant information on the system configuration shall be backed up in the network management system. If configuration data is lost in a node, the network management system must be able to restore the data remotely.
- The high reliability shall be proven by submitting MTBF values of each individual module of the system, and by overall MTBF calculations of the system.

30. Environmental

a) Where possible nodes shall comply with following environmental standards.

System capacity	64 Gbps
Temperature range (operational)	-10°C to +65°C
IEEE1613	Compliant
IEC 61850-3	Compliant
EN50121-4	Compliant

31. SYNCRONIZATION:

a) It shall support adaptive timing where the clock is recovered from data in the PWE3 frameand the arrival time of the frame. Frequency accuracy of ±15ppb should be provided.

b) The method of synchronization used shall meet traffic interface requirements as specifiedin G.813 Section 5 and G.823 Section 1.2.4 for Synchronization interface

c) It shall support Sync-E (Synchronous Ethernet) as per ITU-T G.8261 as well as IEEE 1588 PTP (Precision Time Protocol)

d) MPLS-TP equipment shall be able to synchronize from the respective new Synchronizationsources to be supplied under this project. Vendor shall synchronize the new network byderiving the network clock. Other clocks as required shall be provided as per ITU – Trecommendation.

32. MPLS-TP EQUIPMENT CONFIGURATION:

a) Equipment Capacity: Category-wise Equipment Capacity in respect of providingmaximum numbers of various type of traffic interfaces without addition /upgradation of common & control modules (like: Switch Matrix,Synchronization/Timing unit, and Power Supply modules etc) and subrack/motherboard of MPLS-TP equipment are as given below:

Equipment Type	Full Duplex Packet Switching Fabric (Gbps)	10 G (Optical) Line Interface (Minimum)	1 G (Optical) Line Interface (Minimum)	10/100/1000 Base-T (Fixed Electrical Interface) (Min)
Type-2 MPLS-TP Equipment	64	2	4	4

b) It shall be possible to equip the above-mentioned equipment with traffic interfaces up to thecapacity mentioned in above table for carrying traffic up to the maximum interface rate/speed ofindividual traffic interfaces/ports in non-blocking manner.

c) The requirement mentioned in equipment configuration of each type of are minimum interfacesrequired of each type. However, if higher number of interface of any type is required to meet thetender requirements, the same shall be provided as per the telecom network configuration designapproved during detail engineering without any cost implication to IGGL/ MECON. Also, 25% spareshall be available for 10/100/1000 base-T (fixed) and 10/100 base-T (fixed) interfaces (withSFP/SFP+/XFP) after utilization of all ports as required as per approved telecom networkconfiguration.

d) For 10G and 1Goptical line interfaces, SFP/SFP+/XFP shall be provided only for the interfaceswhich shall be used for traffic interface as per the network requirement. For spare optical lineinterfaces, only spare ports shall be provided and SFP/SFP+/XFPs shall not be provided. Theequipment shall be configured from day 1 such that it shall be possible to install and operate therequired SFP/SFP+/XFP of maximum possible distance in the spare ports in the future without anyneed for hardware or software modification. However, for other interfaces (10/100/1000 base-T(fixed)), SFP/SFP+/XFP shall be provided from day 1 for each port asindicated in above table or as per the requirement based on approved Telecom networkconfiguration drawing (whichever is higher).

33. Mountingof Equipment

a) The Equipment shall be DIN RAIL mounted and suitable for installation in explosion proof junction box (which is suitable for installation in hazardous area Zone-1, Gr IIA/ IIB as per IEC 60079)

34. EthernetInterfaces

a) The DIN Rail Access node shall provide at least 6 Ethernet ports.
b) At least 4 SFP ports shall be used for optical WAN interconnections on the MPLS level at 1Gbps.
c) At least 2 of these ports shall also operate at 10Gbps using SFP/ SFP+ modules.
d) Of the remaining 6 ports, 2 ports shall be 1Gbps SFP ports and 4 ports are electrical POE+ ports supporting IEEE 802.3af and IEEE 802.3at.

35. Traffic Interfaces

a) Following Traffic interfaces as a minimum shall be configured in respective Equipment–

- 20 Mbps point to point LAN at each station on either direction for data transfer for RTU.
- 10 Mbps shared LAN shall be configured at each station for NMS application
- Shared LAN for CCTV as per the bandwidth requirement of CCTV

- 10 Mbps shared LAN for EPABX system
- 1 no. 50 Mbps shared LAN to be configured for future use

36. Digital I/O Interfaces

a) The equipment shall provide at least 2 Digital Inputs and 2 Digital Outputs for local alarming.

37. Mechanical design

- The equipmentshall be DIN rail mountable device.
- The equipment shall be based on fan-less design and shall be passively cooled.
- The operating temperature range for the equipment shall be from -10°C to +65°C
- The equipment shall be equipped with an SD card that stores the device configuration. When the device needs to be replaced in the field, the SD card can be swapped to the new device to automatically copy all the configuration data.

38. Powersupply

a) The equipment shall be powered redundantly with input voltages between 24-57VDC.

39. Security

a) It shall be possible to encrypt the 1Gbps and 10 Gbps WAN links based on MACsec (AES256).

b) For security reasons it must be possible to at least support following items:

- Shutdown unused ports
- Access control lists based on MAC address and IP address. Configuration of these access lists should be done via an automated procedure in the network management platform for ease of use.
- MAC table size limiting to avoid denial of service attacks

40. Synchronization

a) The DIN Rail Access node shall support Sync-E (Synchronous Ethernet) as well as IEEE 1588 PTP (Precision Time Protocol)

41. Following performance shall be guaranteed by the functionality-

Switching fabric capacity	64Gbps (full duplex)
MAC addresses	16K
VLAN IDs	4K
VRFs	10
L3-VLANs/ IP Interfaces	128
ARP entries	2048
Unicast routes	4096
Multicast routes	512
VRRP instance	10
OSPF Neighbors	64
PIM Neighbors	64
ACL L2 and L3	128
DHCP Relay	10

42. **NETWORK MANAGEMENT**

General

a) The network shall be equipped with a user-friendly Microsoft Windows® based Network Management System (NMS). The NMS shall allow the operator to manage and monitor the entire network in an efficient way.

b) The NMS shall have the following functionality: network configuration, configuration of services, monitoring, diagnostics, activation-deactivation of interface modules, bandwidth allocation, alarms and event logging and graphical network representation.

c) The network management hardware shall consist of one or more server/computers, which at the time of installation is the current industry standard.

d) The NMS architecture shall be based on client-server technology. It must be possible to connect multiple active clients to the NMS server allowing network management from multiple and/or remote locations or by multiple users.

e) For reliability it must be possible to configure the NMS in a warm standby configuration.

f) Automatic protection switching

g) The management platform shall not be critical in the automatic protection switching of the network. It will only report the event in detail to the network operator.

h) Relevant configuration details shall be stored in non-volatile memory of each node. After configuration, the network shall continue to work autonomously and shall reconfigure in error situations. It is therefore necessary that the reconfiguration algorithm resides in the nodes themselves.

NMS database

a) The NMS shall contain the network database containing all kinds of information: node names, node configurations including installed network and interface cards.

b) It must be possible to make following on-line changes: activation or deactivation of interface cards, add or remove interface cards, and add, change, or remove services. Each change shall automatically update the database on the hard disk of the network management PC and the non-volatile memory of the relevant node(s).

c) The NMS databases shall be based on MySQL technology.

d) It must be possible to use the database to restore the network configuration in case settings in one or more nodes are lost due to a hardware defect.

User management and audit trail

a) The NMS must support a user management with different roles.

b) The NMS must foresee an event log (system events) and audit trail (user actions) to allow a reconstruction of actions that took place in the network and by whom.

Network connection

a) The network management system shall connect to the network elements via SNMPv3.

b) The connection of the NMS shall be organized via an in-band communication network. This in band communication channel shall be auto established between the different network nodes. This network shall be based on standard routing protocols which have to be selected based on the scalability and converging time when the network reconfigures after an extension or network element failure.
Configuration Management

c) It must be possible to connect the NMS system to the network at any node via Ethernet.

d) Via the NMS, it shall be possible to configure the hardware modules that make up the network: nodes, network cards, interface cards and optical transceivers. This shall be possible via drag and drop and guidance shall be provided to the operator about in which slots certain hardware can be equipped.

e) The network management system shall allow the user to activate or deactivate an interface module.

f) It shall be possible to create various services over the network via wizards. This wizard must include all necessary steps and service parameters in a user friendly and logical way. Parameters like bandwidth, quality of service, level of protection, delay, route over the network can be configured. In all conditions the operator must be able to overrule the suggested parameters with more appropriate parameters, but the NMS must guard the settings and warn in case of inconsistency.

g) It must be possible to preconfigure the network and the services without being connected to the network, either via the Graphical User Interface (GUI) or via scripting.

h) It must be possible to group certain hardware in a logical entity for easy selection when configuring the network. An example of this could be certain geographical region.

Monitoring and network assurance

a) It shall be possible to easily monitor the operation of the network. This includes a graphical representation of links, tunnels, and services of the network.

b) At any point in time it must be possible to visualize which tunnels and pseudowires are traversing which links in the network to facilitate maintenance on the network.

c) Performance of the network shall be visualized via the results of OAM running in the network hardware.

d) It must be possible to monitor the quality of service behavior of the network via visualizing the policing per service and queue operation in each node. This must be possible via the NMS without the use of third-party tools. As a minimum, the NMS must be capable of visualizing the average bandwidth, average frame size, conform and exceed bytes.

e) Following service assurance tools must be present:

- Bit error test for E1, C37.94, OLS, Serial, CODIR with loopback possibility (network or line)
- Signal level test for 2/4Wire E&M interface
- MPLS-TP end-to-end delay test for point-to-point tunnels
- Interface end-to-end delay test for E1, C37.94, OLS, Serial, CODIR, 2/4Wire E&M

Graphical user interface

f) It shall be possible to visualize the network in a logical way with network nodes mapped on a drawing to represent the physical location of network elements.

g) It must be possible to select different views on the network infrastructure, which show links, tunnels and or services for a certain group of services that belong to the same application.

h) The graphical user interface shall be configurable in such a way that different information windows can be attached to different locations within the user interface of the NMS. This to ensure that the graphical user interface can be modified based on needs of the operator at that point in time or can be adapted to other display media (PC screens, display walls).

i) There shall be an easy way to compare settings of different hardware elements by viewing the different parameters in a datasheet style view to assist the operator in debugging configuration problems.

Reporting

a) The network management system should provide a way to easily create pdf or csv-based reports. Any information stored in the database should be usable for creating custom reports. A mechanism to create custom reports shall be available, e.g. XML based. Branding of reports with a logo should be possible.

SNMP northbound

a) A private MIB should be available to monitor the complete network through the network management system which must act as a proxy towards the nodes. This is required to guarantee security of the network.
Managing third party devices

b) The network management system should be able to monitor third party devices in a similar way as the MPLS-TP nodes:
- Devices should support SNMPv2 or SNMPv3
- Any information in the public or private MIB should be readable, translated in easy-to-understand text, and displayed in a property window. This shall be possible for global or port-based information.
- An image of the managed device shall be displayed when creating the specific type of device in the network management system
- It shall be possible to select the Ethernet ports that require management
- The 3rd party device shall be part of the network topology and links from the MPLS-TP nodes to the device shall be monitored

c) Custom alarms must be configurable and displayed in the alarm list of the network management system

4.0 TEST INSTRUEMNTS:

Not required as per the MR.

5.0 OPTICAL FIBER PIGTAIL, CONNECTORS & OPTICAL PATCH CORDS

The single mode fiber pigtails and connectors should meet the ITU-T recommendations as required.

Both connectors and cable should be robust and should withstand wear and tear due to frequent use, Connection and disconnection. Normal expected life should be 15 year or more.

Optical Fiber Cable, Patch Cord connections & pigtails shall be fully compatible and matching to each other.

PARAMETERS OF CONNECTORS WITH PIGTAILS

Insertion Loss	: Maximum 0.3db per connector plus fibre loss
Return Loss	: Better than 40db
Temperature Dependency	: < 0.3 db from -20 to +60
Change in connection Loss with passage of time at 60 ^{o}C for 100hrs	: It should be < 0.3db
Change in connection loss due to vibration	: < 0.05 db
Reproducibility of connection loss by repeated connection and disconnection for 500 times.	: < 0.3db
Change in connection loss in relation to tensile Strength	: Loaded : -50db, Unloaded: -30db

6.0 MISCELLENEOUS ITEMS

6.1 Telecommunication Junction Box and Glands

Junction box shall be provided for outdoor equipment's and shall be rated for IP-65. Explosion-proof junction box shall be Exd' rated and IP-65 rated. The Explosion proof junction box shall meet the hazardous area requirement as mentioned elsewhere in this document. All accessories like glands, washers, blank covers, mounting accessories, earth stud etc. shall be provided. The glands and other

related accessories shall meet the safe/hazardous area requirement. In general, material of construction for the enclosure and junction boxes shall be cast aluminium (LM-6).
All indoor junction box shall be minimum IP-42 rated.

6.2 Telecommunication Cables

Bidder shall consider all other cabinet wiring, patch cords, pigtails, cable tails for all the sub system. Bidder shall consider the termination and splicing of cables at cabinet end and field/indoor equipment end. Bidder shall provide minimum 5-meter cable tail with each end equipment unless specified otherwise.

6.3 FO Patch Panels

24 Port 19" rack mounted patch panels shall be provided at all the stations. All patch panels shall be equipped with label holders. Each input / output port shall be equipped with label holders. SC-PC connectors for single-mode fibres necessary for all connections shall be supplied. All patch panels shall be supplied with all required accessories (splicing cassette, cover, fibre splice holder, cable gland) and SC/ PC single mode crossing adapters. Patch panels shall include slide-out features to ease installation and maintenance. Min. 2 Meter Patch cords and pigtails shall be provided.

6.4 CAT-6/7 Patch Panels

24 Port 19" rack mounted CAT-6/ 7 patch panels shall be provided at all the stations for termination of Ethernet signals. All patch panels shall be equipped with label holders. Each input / output port shall be equipped with label holders. For cabinet termination min. 2-meter patch cords shall be provided, however for end equipment connection (ex. Patch Panel to Equipment/Outlet to equipment) patch cord of necessary length shall be provided by bidder.

6.5 Power Supply Converters

Power supply converters shall be provided by bidder wherever necessary. Power supply converters installed on field shall guarantee 100% load without derating up to 50 degrees. Power supply converters shall also have short circuit / Overload / Over voltage. Power supply converters shall also comply to latest safety and EMC Emission/Immunity standards.

6.6 Explosion Proof Mobile

Bidder shall provide Intrinsically Safe Mobile phones with 4G/LTE cellular connectivity at each main location. These mobile phones shall be suitable to operate in Zone 1 IIA/IIB T3 environment and certified by PESO. The mobile phones shall have 4" capacitive display with shock resistant and scratch resistant glass,5 MP camera, GPS / Glonass connectivity, Bluetooth and WIFI connectivity. The device shall have android-based OS and min 8 hrs battery backup. It shall be provided with Headset and Charger

7.0 Installation, Testing and Commissioning.

7.1 Scope of Installation Work

7.1.1 The scope of installation work includes, but not limited to, installation of all supplied telecommunication equipment in this tender document.

7.1.2 Laying of cables to field in the buried trenches, culverts, cable ducts, on the pipe rack, branch cable trays, conduits, up to junction box, field instruments etc. including dressing, glanding termination on both sides. For underground cables the scope includes excavation, trench work, sand filling, brick laying and back filling and glanding, termination on both sides. Different cables to be laid include communication cables, system cables, Fibre optic cables, instrumentation cables, Power supply cables control cables etc. in cable trays, trenches, conduits, etc.

7.1.3 Installation of all Telephones, cameras along with necessary stanchions/supports that are in the Bidder's scope of supply as well as laying, dressing, glanding and termination of all signal, control and power cables.

7.1.4 Minor civil works like chipping of pavement and grouting on the pavements the instrument panels / supports / stanchions and chipping, refilling and finishing of the pavement for conduits.

7.1.5 Painting of all structural supports for trays, pipes, junction boxes, instruments, ducts, trays etc., as per painting specification.

7.1.6 Grounding of shield of all shielded cables to respective instrument earth bus provided in the control room / JB's.

7.1.7 Laying and termination at both ends earth buses provided in control room to instrument/ telecom earth pit provided by others.

7.1.8 Supply free of cost of all types of consumables required for the execution of the job.

7.1.9 Detail installation plan including procedures and schedules for accomplishing the work to address various phases of implementation shall be submitted for review and approval.

7.1.10 Inspection and testing shall be carried out at the Supplier/Vendor's work place and shall be witnessed by IGGL/MECON representative.

7.1.11 Based on this document, Bidder shall submit full testing procedure for factory testing, site testing and acceptance procedure for IGGL/MECON approval. For hardware, the procedures shall include purpose of test, test definition of input, procedure, result expected, and acceptance criteria. For software, it shall include details of the method, list of tests, sequence of execution, result expected, and acceptance criteria.

7.1.12 The testing and acceptance of the system shall be carried out on the mutually agreed procedures and criteria based on this specification and Supplier/Vendors standard procedures.

7.1.13 Bidder shall identify in the project schedule hold points for Owner witnessed inspection/ test.

7.1.14 Complete cabling inside the buildings shall be concealed. Supply & installation of conduits of minimum 3/4" & 1" diameter size. Installation of conduit & wall finishing is by contractor. However contractor to plan & if required co-ordinate with building contractor for conducting job without affecting the other contractors.

7.1.15 The scope shall consist of the following main equipments, accessories and works as per technical specifications furnished in the design: The installation and commissioning shall include the following:

7.1.16 Installation of all other Components, Hardware, Software, Services etc required by the system for completeness & functioning.

7.1.17 Transportation of the materials at locations and supply, installation, testing & commissioning of equipments as per design.

7.1.18 Connecting different network devices by Copper/Fibre as would be required. Checking of all equipments for completeness and powering up the system.

7.1.19 Supply of all necessary cable laying accessories including GI conduits, PVC pipes/channels, cable trays, supporting structures, clamps, identification tags, ferules etc required for lying of cables. The Bidder shall include in scope, any excavation work required for lying of cables.

7.1.20 Civil works such as chipping / cutting of floors/wall for making grooves, making holes/opening through walls, ceiling or floors, drilling of holes through steel structures and frames, grouting of frames, hooks on walls/ceiling etc for concealed cabling as would required/necessary for execution of work. After erection, surface shall be made good by plastering / painting to their original shape and finish. Road cutting, if any, shall also be resurfaced and brought to their original shape and finish for complete systems.

7.1.21 Purchaser's involvement during each stage of implementation shall be ensured by the Bidder.

7.1.22 Testing and configuration of network equipment as per finalized and approved scheme.

7.1.23 The bidder would carry out the work of re-dressing, re-laying and commissioning under the supervision of MECON/IGGL.

7.1.24 The bidder would ensure and take care not to damage any false ceilings (if any) while laying the cables and other electrical cables passing through the ceilings.

7.1.25 All the civil work & other related jobs for installation of the cabinet would be carried out by the successful bidder. The required materials would be provided by bidder only.

7.1.26 The bidder should provide all the service support and components/ replacement during the warranty period. Bidders must provide addresses and contact details of engineers/office located at each of the proposed sites.

7.1.27 Any jobs not mentioned but required during the installation would be binding on the bidder.

Cable

7.1.28 All cables / cores shall be FRLS Armoured. Ethernet Cables shall be FRPVC Armoured. OFC shall be HDPE Armoured. This requirement is for all cables associated with the system including the power feed cables, fibre optic video cables and data cable for controlling camera.

7.1.29 All multi-core cables shall include 20% of spare pairs for future expansion.

7.1.30 Bidder shall lay cables for various items as defined in the scope of this tender document outside control room in field for various instruments/systems as well as inside control room/admin building/security room/terminal manager's office etc.

7.1.31 All cables shall be suitable for continuous service and for direct burial under ground. As far as possible cable shall be run in pipe tracks. All outdoor cables to be laid in cable trays shall have UV protection.

7.1.32 Any conduits, if used, shall be sealed on both sides with anti-rodent sealant. All fibre optic cables shall be armoured, rodent resistant and fire retardant type.

7.1.33 All Ethernet cables outside the buildings shall be CAT6 armoured, rodent resistant and fire retardant type.

7.1.34 All cables lay in duct/ tray shall be properly dressed and tied with aluminum clamp. Suitable cable clamps shall be provided at every 500 mm interval on vertical trays and 2 meters on horizontal trays. Clamp shall consist of formed Aluminum flat.

7.1.35 All cables (including system cables) shall be tagged at both the ends i.e. at origination and destination end. Cable tags shall be used for identification and shall be securely fastened to the cables. All wiring termination shall have proper ferrules and full direct, cross ferruling shall be used. Ferrules shall be printed with white sleeves and black text.

7.2 Cabling, conceal conducting

All system & monitors installed in Control Room, Terminal Managers Room, Security & Planning room shall be concealed. Supply, installation & finishing of concealed area are by bidder. Other cabling & accessories required to make complete functional system is also by Bidder. Bidder is responsible to supply the hardware and shall interface with other system & Bidder to verify the requirements.

7.3 Cabinet Design Requirements

7.4.1 Control room Cabinets shall be from approved vendor list with RAL 7035 finish. Plinth shall be black RAL7022.

7.4.2 Each cabinet shall be 2000 mm in height bolted to a 100 mm high plinth x 800 mm width(min) x 800 mm depth (Min), with 4 nos. of removable lifting eye bolts. The eye bolt size shall be 4 inch minimum. Blanking plugs shall be provided for lifting eyebolt holes.

7.4.3 Cabinets shall be thoroughly debarred and all sharp edges shall be grounded smooth after fabrication.

7.4.4 The enclosures shall be of sheet steel, weatherproof to IEC 60529, degree of protection IP42 as a minimum.

7.4.5 Stiffeners shall be provided as necessary to ensure a rigid structure and prevent warping.

7.4.6 Front and rear access shall be provided via detachable steel doors, preferably with 160° opening. Doors shall be double leaved type with lockable handles. Bolts and nuts and other fitting material shall be corrosion resistant material.

7.4.7 No equipment shall be mounted, inside the cabinet, within 200 mm of the gland plates.

7.4.8 All labels shall be in English. Cabinet shall be provided with a permanently fixed trafolite nameplate detailing Cabinet number and function. A drawing pocket shall be attached to the inside of each door, capable of holding a folded A1 size drawing.

7.4.9 All cabling to cabinets, cabinets and consoles shall be bottom entry. Split removable gland plates shall be provided fitted with metal brush seals. Cables shall be clamped within the cabinet base utilising the standard cable clamp system, preferably Rittal make.

7.4.10 Cabinets shall contain sufficient terminal blocks, cable trunks and raceways to accommodate all assigned wiring, plus spares. DC Power Supplies shall be mounted within the cabinets they service.

7.4.11 All Internal cabinet components including Power Supplies, relays, fuses and terminals shall be clearly labeled with engraved traffolite labels. All power supplies labels shall be in English.

7.4.12 All cabinets shall be equipped with internal lights of high efficiencies supplied from the 230V 50Hz Non UPS supply. The light shall be switchable from within the cabinet and segregated from other cabinet wiring.

7.4.13 Terminals connections within cabinets shall be made using terminal blocks, Crimped lugs and ferrules.

7.4.14 Power wiring for circuits within the cabinet shall not be less than 2.5 mm2.

7.4.15 Cooling fans shall be used to maintain the operability of the system. Exhaust fan with louvers to be provided at cabinet back upper side. Louvers and removable dust filter cartridge to be provided at back bottom of cabinet for suction of fresh/cold air. Dust filters shall be of the replaceable or cleanable type, and shall be possible without disturbing the functions of the cabinet.

7.4.16 Equipment, within the cabinet, shall be laid out in an accessible and logically segregated manner. Clamping rails shall be provided for incoming cables to prevent excessive stress on the individual terminal.

7.4.17 All metal parts of the cabinet including doors shall be electrically continuous and shall be provided with a common grounding lug.

7.4.18 The MCBs inside the cabinets shall be properly covered with 4 mm PVC sheet with Caution sign in order to prevent personnel from electrical hazard. MCBs shall be properly tagged.

7.4.19 The cross-reference concept shall be used for cable markers on all the cable terminations. Temporary wired-on tags are not acceptable.

7.4.20 All internal cubicle wiring shall run in suitably sized and Grey coloured PVC ducting/trucking.

7.4.21 Bidder shall provide details of the proposed cabinet regarding front and rear layout of equipment and accessories for review and approval by Owner/Consultant.

7.4.22 Terminals shall be screwed type. Terminal colours shall be grey. Each terminal shall hold only one wire on each side. If necessary, a pre-formed link shall be used for looping purpose between adjacent terminals. Double decker terminal shall not be used.

7.4.23 Interconnecting wiring shall be minimum 1.0 mm2 (except those forming part of the Bidder's standard ribbon cable). All interconnecting wiring shall be carried out using multi-stranded conductors (solid conductors shall not be used). No splices shall be made in cables at any point.

7.4.24 All cores/wires shall be marked at each end by a permanently marked sleeve ferrule. These ferrules shall be printed, non-slip type. The cross-reference concept shall be used for cable markers on all the cable terminations. The final tagging procedure shall be decided during detail engineering.

7.4.25 Cabinet shall be provided with 20% spare space for the installation of additional hardware for the future addition of facilities.

7.4.26 Power distribution to all the components of the system with in control room and in the field shall be done from the cabinet. All the necessary numbers of double pole miniature circuit breakers (for overcurrent and short circuit protection) shall be provided in the cabinet to have isolation facility for each instrument. 110 / 220 VAC terminals will have protective covers and have an electric hazard warning, labelled in English.

7.4.27 All miniature circuit breakers shall be lockable in the off position and shall have visible "tripped" indication and auxiliary contacts for remote fault annunciation on the workstations. These alarms may be communicated, if practical.

8.0 Engineering Activities

Preparation and furnishing of all drawings and documents as per the requirement and approved drawing list for further approvals from IGGL/MECON.

Documentation, training, preparation and submission of as built drawings.

9.0 Availability criteria/ Performance Guarantee

9.1 System Availability

The Systems shall provide 24 hours a day service on a year round basis. Bidder shall design and service the system to accomplish these requirements, including as necessary: redundant equipment, on site spares, level of spares, service locations and special test procedures or any other suitable mechanism.

Bidder shall provide a minimum "average monthly availability" of 99% with an average service restore time of 12 hours and a maximum no greater than 24 hours.

9.2 Performance guarantee

All supplies and installations shall be covered under guarantee for satisfactory performance as define. During the guarantee period, all system & equipment level defect diagnosis, replacement of defective parts, modification to hardware & software and rectification of defects shall be within the Contractor's agreed contract price and no extra payment towards replacement shall be allowed. The Contractor, at his own expense shall provide all materials / services necessary for diagnosis/ rectification / repairs of equipment & systems which are under guarantee period of this contract.

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ANNEXURE-1

TECHNICAL SPECIFICATION OF TYPE-1 RTU

Rev. : 1
Edition : 1

SPECIFICATION

FOR
REMOTE TELEMETRY UNITS

SPECIFICATION NO.: MEC/S/05/E5/099

ELECTRICAL & INSTRUMENTATION
(OIL & GAS SBU)
MECON LIMITED
DELHI 110 092

AMENDMENT STATUS

Sl. No.	Clause / Paragraph / Annexure / Exhibit / Drawing Amended	Page No.	Revision	Date	By (Name)	Verified (Name)
1	Cyber security update		01	02.07.2019	Ratnadeep	Pankaj

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1.0 GENERAL

The RTU's shall be 32 bit microprocessor based programmable units with both erasable RAM and ROM memory. Each of the RTUs shall have its own processor, battery backed / non-volatile memory, power supply unit & communication processors confirming to communication protocol like DNP 3, Ethernet etc and I/O cards complete in all respects. The RTUs shall have TCP/IP port for polling from MMS & BMS.

The I/O cards shall not be combined for the functionalities i.e. each card shall have dedicated modules for Analog input, Analog output, digital Input, Digital output etc. The RTU's shall be designed to function such that no single point of failure or the inadvertent leaving of a printed circuit board out of the RTU shall cause a control mal-operation or result in any false operation or continuous communication transmission.

The complete RTUs shall be supplied with all its components including the cabinets. The cabinets should be weather proof and suitable for non-air-conditioned room. The actual layout of RTU along with its internal wiring, mounting arrangement etc. shall be carried out in detailed engineering. Proper illumination shall be provided inside the RTU cabinet.

2.0 Environmental

The equipment selected will operate in the following conditions:

- Ambient Temperature 55 ° C
- Humidity 05-95% RH.
- Non air-conditioned environments

3.0 Power Supply

The power supply available will be 24V DC UPS Power supply. RTU shall operate at 24 V DC power supply. The bidder shall furnish the detailed consumption of each equipment.

4.0 RTU SUBSYSTEMS

4.1 The RTUs shall comprise the following subsystems**:**

- Central processor with system software.
- Back pane/ chassis
- Analog input Module
- Digital (contact) input Module
- Digital (contact) output Module
- Analog Output Module
- Ethernet ports for polling from MMS and BMS through DNP 3.0 (TCP/IP).
- Serial ports/Ethernet port to connect Portable Diagnostic Test Unit (PDT)
- Serial ports for connecting IEDs e.g. Flow computers
- Diagnostic tools
- Interposing Relays for Digital Output

The RTU's shall be configured such that interdependence of function is minimized and failure of any part of a RTU Module subsysterm except the common logic subsystem shall not directly affect the integrity of the unit, as a whole.

The RTU should be able to store alarm/ events in case of communication failure till the time of communication restoration.

4.2 The RTU system software shall provide the overall management of the supervision, monitoring and control function within the RTU and also manage the local Programmable Diagnostic Test Unit, communications, comprehensive diagnostic facilities and RTU start up procedures.

4.3 The RTU shall be programmable and shall have facilities for developing logic to interface with the IEDs as and when required. To this effect, all necessary tools, software and documentation shall be part of supply of the RTUs within the scope of this tender.

5.0 POWER SUPPLY

- RTU shall have single power supply modules.
- RTU shall have Power Supply module having 24V DC input which shall cater output requirement of all the modules of RTU. Power supply card shall have an independent on- off switch
- If RTU requires other voltage levels, then the necessary converter shall be supplied and provided without any additional financial implication to Client

6.0 CENTRAL PROCESSOR MODULE

- The RTU shall be a 32-bit microprocessor based programmable unit with both non-volatile RAM and FLASH memory. The RAM memory size shall be minimum 32 Mb.
- Central Processor module shall have CPU & power supply for total functionality of the RTU
- All the alarms, events and command history shall be stored in RTU memory (which shall be non-volatile) with date and time stamp on FIFO basis. Minimum 5000 alarms and events and 200 commands shall be stored in RTU memory which shall be non-volatile and accordingly the RTU memory shall be provided. The alarms, events, command log shall be stored in RTU memory and shall be accessible any number of times from the RTU.

7.0 DIGITAL INPUTS

Typical specification of Digital Input Modules to be supplied is as given below:

Input Type	:	Min. 16 nos. of Volt free contacts (2 wire isolated)
Contact Wetting	:	2-4mA per input at 24V DC
Resistance recognized	:	Not exceeding 1 Kilo Ohms as a closed contact
Resistance recognized	:	Not less than 50 Kilo Ohms as an open contact
Isolation	:	Using optocouplers/ external isolation
Insulation Resistance	:	20 M ohms at 500 V Dc inputs
Debounce circuitry	:	10 m/sec
Indicators	:	Loop & State LEDs for each DI point
Filter	:	Support for chatter and de-bounce filter

Voltage withstand Capacity	:	1.5 KV RMS
No/NC contacts	:	mixing of NO/NC contacts in the same card.
Security	:	Each DI channel shall be protected by suitable mechanism like fuse with suitable fuse blow indication provided

8.0 DIGITAL OUTPUTS

Typical specification of Digital Output Modules to be supplied is as given below:

Output Type	:	Max. 16 nos. of relay contacts, individually isolated
Indicators	:	LED indication for each DO point
Relay Type	:	Miniature power relay
Contact arrangement	:	1 NO + 1 NC relay contacts configuration to be provided up to the RTU terminal block
Contact Rating	:	Potential free contact rating of output interposing relay for each DO point (Contact rating 24 V DC, 5A)

(RTUvendor to provide interposing relays for each digital output point)

Isolation	:	2KV RMS Contacts to Logic/ external isolation
DO command activation	:	Configurable Pulse duration (min 2 sec) / Latch. For repeat DO output requirement, permanent DO shall be provided
Security	:	Output contacts shall be monitored via Opto-isolators and must be short circuit proof and protected by suitable mechanism like fuse with suitable fuse blow indication provided.

9.0 ANALOG INPUTS

Typical specification of Analog Input Modules to be supplied is as given below:

Input Type	:	Min 8 isolated, Current Inputs
Ranges	:	4 - 20 mA, 0-5 V
Input impedance	:	Not less than 100 K for Voltage input Not more than 0.4 K for current Input, 250 Ohm nominal
Multiplexer	:	Vendor Standard
ADC type	:	12 bit binary, (exclusive of sign bit)
Series Mode Rejection	:	Greater than 30 db at 50 Hz
Common Mode rejection	:	Greater than 100 db at 50 Hz
Roll over error	:	1 bit
Temperature coefficient	:	0.005% per degree C
Resolution	:	min. 14-bit data + 1 sign bit
Accuracy	:	± 0.1% of range including drop in resistor @25 deg

10.0 ANALOG OUTPUTS

Specifications of Analog Output modules to be supplied is as given below:

Output type	:	Min.4 Completely Isolated current (4-20 mA) outputs The external isolator, if required, for isolated output shall

be included for each AO point

DAC Type	:	12 bit binary (exclusive of sign bit)
DAC span	:	10 V or 5 V
Output Range	:	4-20 mA DC
Isolation	:	Each output shall be isolated from logic and others to 500 Volts
Loading	:	1K ohm for Current outputs
Differential Linearity	:	½ L.S.B.
Accuracy	:	± 0.1% of range at 20 degree C @ 25 deg
Temperature coefficient	:	0.01% FSD per degree C
Update	:	within 10 msec.
Retentivity	:	Set-point value to be held by AO card till update by new set-point value from SCADA system

11.0 COMMUNICATIONS

The RTU shall support both internal and external communications functions.

The communication network internal to the RTU shall be designed and implemented in such a way that the passing of data and commands between modules shall not be prevented by the failure of any module not directly involved in the communication exchange. In addition the internal network shall not become overloaded under the heaviest traffic possible in the RTU's ultimate expansion configuration.

The MMS / BMS shall initiate communications with a selected RTU by the addressing function. Each RTU shall recognize its own unique address and shall have the capability of being assigned any address within a range of possible addresses (minimum 256). It shall be possible to address all or selected number of RTUs from the MMS/BMS in order that global or broadcast message may be sent. The LED indication shall be provided in the RTU to check the health of RTU communication.

The RTU shall support DNP 3.00 (TCP/IP) / IEC-5-104 protocol for communicating with SCADA system at MMS / BMS. However, RTU shall communicate with SCADA system over DNP 3.0 (TCP/IP) protocol.

The RTU shall be polled through Ethernet port from MMS / BMS.

12.0 RTU FEATURES

12.1 The RTU sub-system shall support the following:

a) Scanning of Input and Output points.
b) Fast scanning of selected I/O's points.
c) Field input initiated discrete control action.
d) Discrete control action corresponding to Remote Control Command reception.
e) RTU shall store all Alarms, events and command log with time stamping in its non-volatile memory in FIFO basis. The command log and event log shall be available in RTU such that it shall be possible to know about the source of command by logging in the RTU. Similarly, it shall be possible to know about the events and critical alarms by logging in the RTU. All commands executed through RTU (whether given through SCADA or through RTU) shall

be stored in RTU log. Minimum 100 command logs, 3000 events and alarms shall be stored in RTU. Accordingly the RTU memory shall be provided.

f) Operator initiated discrete control action with check before execute and time out feature.
g) Operator initiated discrete control action with sequencing and interlocking.
h) Derivation of calculated digital points based on logical functions AND,OR,NOT etc from Digital and Analog input points.
i) Derivation of calculated analog points based on arithmetic functions +, -, /, *, sq, root etc. and driving external hardware. Calculation shall be performed in RTU in engineering units with 16 bit or higher floating point accuracy in case engineering conversion is being done at RTU level. (Calculations shall be performed in the SCADA server in case engineering conversion is being implemented in the SCADA server.)
j) Deviation of counter values using Integration of hardware and software generated analog points
k) All RTU cards, serial ports, and communications channels health points are to be configured in RTU and DNP3.0 index of same are to be reflected in I/O list and all serial ports should be independently configurable
l) RTU should have diagnostic feature for hardwired I/Os, DNP3.0 and IED (serial) communication
m) All the field / IED parameters should be configurable at RTU end
n) IED (Flow computers, CP Panel, UPS panel etc.) interfacing through RS232/ RS 485 ports/ Ethernet ports for serial data on MODBUS protocol. RTU shall support standard MODBUS (ASCII and RTU) protocol.
o) The RTU shall have provision to give analog and digital data (available in the RTU) over MODBUS protocol to third party systems (other than SCADA servers) through serial port. The register addresses for AI and DI parameters shall be configurable.
p) It shall be possible to do configure / write IED interface in RTU for which necessary software tools shall be supplied.
q) For communication with IEDs through serial ports, the RTU shall support 16-bit, 32-bit, signed, unsigned, integer and floating point data type
r) Rate of change of alarm
s) RTU resident accumulator points driven by analog points.
t) RTU should be capable to bulk AO (writing): SCADA – RTU on DNP protocol, RTU To IED (FC) on Modbus [RTU take AO all the around 10 gas composition parameter (as per AGA-3/8]

12.2 Time synchronization of Remote Telemetry Units shall be possible from SCADA System with a resolution of 100 msec.

12.3 The RTU shall scan and acquire parameters from field as per programmed (user configurable) scan cycles.

12.4 RTU should have event logging and buffering feature. In case of communication loss, RTU shall store the time stamped 5000 analog events and 1000 digital events in the buffer and transmit to master station on receiving the poll request after restoration of link.

12.5 The RTUs shall have a self diagnostic feature and software watchdog timer devices to monitor & report the healthiness of CPU, memory, power supply, comm. interfaces and Input/Output modules at the local level. Further the RTUs shall support remote diagnostics from MMS / BMS so that all these status shall be transmitted to MMS / BMS and displayed in the RTU status graphic.

12.6 Analog input card and Analog output card shall be self calibrating type and event shall be sent to MMS / BMS for out of calibration. Analog input card shall generate an event, if it is out of calibration, which shall be sent to MMS / BMS. Further if Analog output card is not self-calibrating type then all Analog outputs shall be wired back as along inputs and calculations performed on each channel to detect AO card out of calibration. This out of calibration shall be available as part of RTU status graphics along with set point value displayed in the graphics, next to the corresponding controller symbol.

12.7 It shall scan and acquire parameters from process as per programmed scan cycles.

12.8 RTUs shall be intelligent in support of the following:

a) It shall process the analog data for high-low limit violations as per stored limit tables and communicate the same to MMS / BMS along with time stamping.
b) Linear conversion to engineering units and input filtering, in case engineering unit conversion is being done at RTU level [conversion of raw data to normalized values (e.g. 0 to 1.0) for communication shall also be acceptable].
c) To support remote reconfiguration and downloading of parameters i.e. addition, deletion, modification and reassignment with different range, limits etc. from workstations to avoid local engineering at RTU level. The following requirements of RTU configuration form MMS / BMS shall be fulfilled:

(i) The remote configuration wrt following parameters for the points defined in the RTUs shall be remotely done form active SCADA Server at MMS / BMS, in case the features of Alarm generation, association of the alarm priority and engineering unit conversion are implemented at the RTU level.

- Analog alarm limits
- Analog scaling factor for engineering unit conversion
- Threshold value
- Smoothing factor (filter time constant) etc.

These shall be automatically updated to the standby SCADA Server also.

(ii) PDT configuration unit (Laptop, hardware & software with cables & connectors) shall be provided to create configuration file involving definition of:

- I/O modules attached to the RTUs
- Type of each I/O modules and time stamping requirements for points in each module.
- Software logic in RTUs
- Physical and software interfaces connected to the RTUs

(iii) The configuration file shall be able to be transferred online from MMS / BMS using the existing data channels to the corresponding RTU.

(d) Time stamping of all exception reports.

12.9 RTU shall comply the following:

a) RTU shall be capable of updating process parameters data and configuration data in its own built-in memory. Time stamping of all field values at RTU shall be required. In the event of failure or break of communication link, the RTU shall continue to scan all parameters and update its database.

b) RTU shall retain in its database the complete analog and digital information of the field till it is completely and correctly read by MMS / BMS in order to take care of no loss of data in case of failure of MMS / BMS. The RTU shall scan the field and the memory buffer is to be sized to store all the changing data (i.e. new exception report for the data every poll time) and MMS / BMS receive the same without any loss of data and alarms in the SCADA system.

c) Further to take care of long term communication outage with SCADA system, the RTUs shall be designed to also scan the field and store in the memory time stamped 5000 analog events and 1000 digital events during the period of communication outage for retrieval by SCADA system subsequently. The RTU memory sizing shall be adequate for the same. In case additional memory cards are required to meet this requirement, the same shall be provided by the vendor. RTUs buffer shall also be circular buffer with new events replacing old events.

d) The RTU system shall have the facility to attach to each digital event signal a time tag generated by the RTU local clock to enable the occurrence to be recorded and transferred to SCADA system.

12.10 At the RTU, failure of a module in a subsystem shall be identified by an individual LED display

12.11 Each I/O shall be protected against the reversal polarity of the power voltage to I/O

12.12 The RTU should have provision for time stamping of all analog exception reports and digital state changes. The RTU time stamped analog & digital data shall be sent to SCADA system

12.13 The RTU shall support communication protocol supporting report by exception to prevent unnecessary data communication when data is not changing and also support downloading of exception value deadband (each analog input wise) from SCADA system

12.14 It shall be possible to have highest priority of alarms, in order for the same to be sent to MMS / BMS.

12.15 It shall provide 'Check before Execute' feature before execution of command.

12.16 Every control associated with the RTU shall report the status of the point after control execution. In case the status has not changed within fixed specified time it shall report to MMS / BMS for not having executed the control.

12.17 RTU shall not generate any false control signal due to power supply on-off conditions.

12.18 RTU shall support communication protocol supporting report by exception to prevent unnecessary data communication when the data is not changing.

12.19 It shall provide error detection and control feature for data communication with SCADA Server to ensure data integrity.

12.20 It shall have feature of connecting a pluggable Programmable Diagnostic Test unit (PDT) with keyboard & monitors diagnostic and programming aid to trouble shoot and configuration tool for RTU and I/O boards. It shall be possible to exercise all the functions of the RTU without disconnecting the RTU from process.

12.21 RTU shall have provision for applying filtering on the input signals and scaling for engg. units conversion.

12.22 From SCADA Server, it shall be possible to off-scan complete RTU individually in addition to off-scan RTU points. In case of failure of complete RTU or off-scan of complete RTU only one alarm shall be generated and the RTU along & digital points shown in various graphics and printed in reports shall correspondingly have data integrity qualifier flag.

12.23 The RTU shall be able to store the configuration data and the process database upon power failure for at least one month on continues basis. Upon restoration on the power, RTU shall resume the normal operation automatically.

12.24 The failed RTU once put online shall initiate service requirement to SCADA Server for reinitialization

12.25 RTU shall operate power supply (230 V AC or 24 V DC as define elsewhere) as per power availability at site. Separate on/off power supply switch and fuse shall be supplied with each RTU. Vendor shall indicate power consumption for all the RTUs. Adequate isolation of input, output and power supply circuits shall be provided along with over voltage and short circuit protection.

Wherever 230V AC supply is provided for RTU, SCADA vendor shall carry out necessary conversion to covert the AC voltages to 24V DC for supply to field instrumentations and to RTU. The power to the field instrumentations is to be provided through barriers and all the digital output has to be driven through 3-5 A interposing relays. The necessary converter to covert the AC voltages to 24V DC, the barriers and the imposing relays shall form the integral part of the RTU.

12.26 All the field instrument connections for RTUs shall be terminated in the Control cum TIC panel. The I/O point wires shall not be directly terminated on the RTU I/O boards. Terminal blocks/panels is to be provided in the RTU cabinet. I/O termination blocks shall have both male and female portions so that to isolate the field wiring at RTU level, male/female termination block attached to be field wiring can be pulled out instead of removing the wiring. Printed tube type Cross ferruling shall be done.

12.27 The RTU shall be Immune to radio frequency interference generated by any nearby source meeting the latest international standards in this regard (MIL, VDE etc.)

12.28 The RTU equipment shall function continuously without requiring any preventive maintenance.

12.29 RTUs shall be multidropped on a pair of communication channels. Upon failure of primary channels, RTU shall respond to MS / EMS requests/ interrogation on secondary channel automatically without any loss of data & operation. System shall provide status on the availability of each of the channels.

12.30 It shall be possible to output any AI (Including serial data from IEDs) & DI point value available in real time database at SCADA Server, as AO (Including serial data from IEDs) & DO to any RTU respectively. The relay contact configuration shall be provided up to the RTU terminal block. The DO command contact closure duration shall be configurable. It shall be possible to configure DO contact duration open or close for a long duration as per the DI status. Within the scope of this tender, vendor shall down load Gas Chromatograph value to those Flow Computers, in whose locations Gas Chromatograph is not available, through the same serial link which is used for reading the Flow Computer values. Source Gas Chromatograph and target Flow Computers will be finalized during detail engineering.

12.31 For Gas Composition AGA Data writing from SCADA to Modbus Slave Flow Computer through RTU, Vendor should implement logic in RTU for smooth writing of AGA parameters in Modbus Slave after checking its validity and Gas Composition value of 100% as aggregated value. SCADA will write GC Analysis data to RTU over DNP Protocol, RTU will write all the GC data analysis data to IED (Flow computer over Modbus Protocol) Location, Modbus address shall be provided by Client/ MECON.

12.32 Non availability of any one of the two communication channels should not hamper the functioning of the other RTUs multidropped on the pair of channels.

12.33 It shall have feature of connecting a pluggable Programmable Diagnostic Test unit (PDT) with keyboard & monitors diagnostic and programming aid to trouble shoot and configuration tool for RTU and I/O boards. It shall be possible to exercise all the functions of the RTU without disconnecting the RTU from process.

12.34 Vendor shall detail the shelf and inter-shelf wiring and the termination of the wiring harness between the RTU, the terminal block area and the field instrumentation. Easy access to cabinet wiring, for maintenance purposes is essential. The RTU components shall be designed for high temperature rating and low power consumption so that air exchange with the ambient environment will not be required.

12.35 Identification labels for RTUs, RTU card files, power distribution boards, terminations etc complete in all respects properly correlating with the drawings is to be ensured by the vendor.

12.36 SCAN RATES

The local scan rate for the individual I/O modules shall be such that the time-tagging resolution and system performance requirements are achieved.

The consideration of scan times shall include the acquisition of data, processing and updating of the RTU database. The overall RTU local scan shall be defined as the time required to acquire field data and update the RTU database and the same shall be much faster than RTU poll time by MS / EMS. It is expected that scan rate shall not exceed 100 msec.

12.37 DIGITAL OUTPUT (CONTACT) SUBSYSTEM

- The contact output subsystem shall provide momentary closure of potential free contact relay output for the operation of equipments.
- The relay contact configuration shall be provided up to the RTU terminal block.
- The DO command contact closure duration shall be configurable. It shall be possible to configure DO contact duration open or close for a long duration and all contacts shall be voltage free.
- It shall not be possible for the RTU to energize an output that has not been selected for control.
- At RTU restart, following an RTU power failure, shall not reset the output circuits, shall not generate false control signal and shall cancel any pending control selection.
- The Digital Output should be configured for pulse duration. No separate program or logic will be acceptable at RTU end.
- The RTU shall provide 'Check before execute' feature as part of RTU protocol before execution of command
- Every control associated with RTU shall report the status of the point after control execution. In case, the status has not changed within specified time, it shall report to SCADA system for not having executed the control
- Each I/O shall be protected against the reverse polarity of the power voltage to I/O.

12.38 RTU Panels

RTU Panels shall be free standing and conform to NEMA-4 (IP52) requirement. The panels shall have lockable front and rear doors and bottom cable entry and provided with gasket and fitting to keep out moisture, dust, gases and corrosives. The panel shall be naturally cooled.

All doors, drawers, trays and other weight supporting parts shall be fabricated of metal and adequately reinforced to limit vibrations. All components and devices inside the panel shall be well highly and the panel shall have a tidy look.

The bidder shall furnish details of the shelf and inter-shelf wiring and the termination of the wiring harness between the RTU and the terminal block area.. the connections from PCB's to back frame wiring shall preferably be with gold plated edge connectors which utilize a wiping action. Easy access to cabinet wiring for maintenance purpose is essential. The I/O point wires shall not be terminated directly on the I/O boards. Termination panel is to be provided for this.

The CONTRACTOR shall guarantee satisfactory functioning of the system hardware mounted in the panels even in the event of failure of air-conditioning unit.

Each panel shall have provision for fully wired 20% spare additional space on the back pane/ chassis for mounting of additional IOs in future.

Hardware mounted and wired panels of all systems included in the scope of the CONTRACTOR shall be subjected to burn-in operation for minimum 15 days before dispatch to site.

12.39 SET POINT CONTROLS

- All analog output control functions shall utilize the select-check-operate control sequence associated with set point control.

12.40 COMMUNICATION PORT

- The RTU shall support both internal and external communication functions. The communications network internal to the RTU shall be designed and implemented in such a way that the passing of data and commands shall not be prevented by the failure of any module not directly involved in the communication exchange. In addition, the internal network shall not become overloaded under the heaviest traffic possible in an RTU's ultimate expansion configuration.
  a) Each RTU shall recognize its own unique address and shall have the capability of being assigned any address within a range of possible addresses. The LED indication shall be provided in the RTU to check the health of RTU communication.
  b) The RTU shall support DNP 3.0 protocol (both DNP 3.0 (Serial) and DNP 3.0 (TCP/IP)) for communicating with SCADA servers.
  c) The RTU shall have dual Ethernet ports (IEEE 802.3) for TCP/IP communication with SCADA system in multi-dropped environment.
  d) The RTUs shall have the provision to be polled for data by SCADA system, independently and simultaneously on both communication ports. Both the primary and secondary ports (for SCADA server communication) shall have same data in their buffer at a time.
  e) RTU buffer shall be sized in such a way to include simultaneous polling of 10 flow computers over dedicated point to point serial communication and simultaneous polling of flow computers shall not degrade the performance of RTUs.
  f) Each communication port of RTU shall be isolated and surge protected.

12.41 SERIAL PORT FOR POLLING IED OVER MODBUS (MASTER AND SLAVE)

- The RTU shall be equipped with the necessary no of serial ports for polling the IEDs as specified.
- Each serial port of the RTU shall have following provision for communication with Flow Computer / Gas Chromatograph/Sulfur & Moisture Analyzer / PLC:

a) RS-232C communications
b) Support for baud rates from 4800 bps to 64 kbps.
c) Variable parity: Odd, Even, None
d) Variable data bits: 7, 8
e) Support for various Modbus function codes.
f) Support for Modbus ASCII and RTU
g) Provision to be configured as Modbus Master or slave.
h) DB-9 port for serial communication
i) Diagnostic feature for Modbus communication. It shall be possible to view the Modbus data transfer either in the RTU serial card or through the RTU configuration software for diagnostic purpose

12.42 RTU DIAGNOSTIC AND CONFIGURATION SOFTWARE

- The RTU diagnostic and configuration software shall provide the overall management of the supervision, monitoring and control function within the RTU and communications, comprehensive diagnostic facilities and RTU startup procedures. Bidder to supply licenses for 6 Nos of RTU configuration software.
- RTU configurator / diagnostic software shall have the following provisions:

a) The software shall be compatible with latest OS.
b) DNP index of all I/O points along with real time field value shall be viewable in diagnostic software table/window.
c) Facility to issue controls (DOs) from RTU to field.
d) The RTU configurator shall have provision for configuring / interfacing IEDs (Flow computer/ PLCs/ GC) over MODBUS protocol (ASCII and RTU) with the RTU.
e) The RTUs shall have a self-diagnostic feature (without uploading / downloading RTU configuration to PC/Laptop) and software watchdog timer devices to monitor and report the healthiness of CPU, memory, power supply, comm. Interfaces (both DNP communication with SCADA system and serial communication) and input/output modules at the local level. Further the RTUs shall support remote diagnostics from SCADA system so that all these status shall be transmitted to SCADA system for displaying in SCADA graphics.
f) The RTU configurator shall have provision for configuring RTU serial port as Modbus slave for polling by third party systems (other than SCADA servers). It should be possible to assign AI and DI data available in RTU to Modbus register addresses for accessing by 3rd party systems.
g) It should be possible to download configuration to RTUs from the SCADA system / PDT online and offline.
h) RTU configurator licenses shall be preferred in software (software key) form instead of hardware (dongle).
i) RTU shall have error detection/control feature to ensure data integrity.
j) It shall be possible to configure, generate and compile RTU configuration file in Offline mode that can be downloaded in RTU

12.43 CYBER SECURITY REQUIREMENTS FOR RTU

- The proposed RTU by the vendor shall have the following cyber security features from the outset.
- Any licensed software or license required to meet the following cyber security features shall be provided by the vendor with the RTU –
  a) DNP3 with level-4
  b) DNP3 (SAv5)
  c) AGA-12 DNP3 Data encryption
  d) RTU should be capable to bulk AO (writing): SCADA – RTU on DNP protocol, RTU To IED (FC) on Modbus [RTU take AO all the around 10 gas composition parameter (as per AGA-3/8] from SCADA and then buffer it and calculate total Gas composition to 100%, only then RTU should write to FC) which is in compliance of O&M maintenance policy.
  e) User access control
  f) Password complexity
  g) Role Based Access Control
  h) Integrated firewall
  i) Patch management (The frequency of patches as provided by OEM shall also be indicated)
  j) Support Network access control (Authentication) IEEE 802.1X
  k) Support Application access control (Authentication) DNP3 Secure Authentication in firmware
  l) Should be able to restrict Master IP

13.0 PACKAGING:

The RTU shall be packaged to withstand rough handling during ocean shipment and in-land journey. It shall be vendor's responsibility to make good any deterioration that

occurs during shipment. Sling points shall be clearly indicated on crates.

14.0 DATA AND DRAWING DETAIL

Vendor shall furnish all the documents as per "Vendor Data Requirements" enclosed with Material Requisition/ Job Specifications. All the other documents as per Technical specification and the documents required for better understanding and execution of the job to be supplied by the Vendor.

A certificate from statutory authorities confirming suitability of design / construction of all electrical and electronic items for use in hazardous area classification has to be furnished.

ANNEXURE-1

TECHNICAL SCHEDULE TO BE FILLED BY THE TENDERER

The Bidder shall fill the following technical particulars and submit the same with the offer for selected Remote Telemetry Unit.

Item	Description	Particulars
	GENERAL	
1.	Make	
2.	Model no.	
3.	Degree of protection (IP No.)	
4.	Operating temperature range (degree centigrade)	
5.	Operating relative humidity range %	
6.	Maximum number of I/O modules per subrack Main subrack Extension subrack	
7.	Maximum number of communication modules per subrack	
8.	Selectable communication speed range	
09.	Resolution of time tagging	
10.	High/low limit checking yes/no	
11.	Whether RTU supports self-checkback-execute and time out feature yes/no	
12.	Interfacing with flow computers of different makes (Instromet/Spectra Tek, etc.) yes/no	
13.	Remote configuration and downloading of parameters from Master Station supported yes/no	
14.	Self diagnostic of RTU and reporting it to Master Station yes/no	
15.	Number of serial ports supported in addition to redundant communication links with Master Station (minimum 4 nos.)	
16.	Whether RTU supports connection of portable maintenance diagnostic test unit yes/no	
17.	Whether hardware for 25 % spare installed I/O's for RTU included yes/no	
18.	MTBF for a fully equipped RTU h	
19.	Equipment availability %	
20.	MTTR for a fully equipped RTU h	
21.	Power requirement for a fully equipped RTU W	
22.	Maximum number of I/O modules per RTU (separately for each type to be given)	
23.	Spare capacity for each type of I/O	

Item	Description	Particulars
24.	Rack dimensions	
25.	**Main Processing Module** Module designation	
26.	Microprocessor type	
27.	Word length	
28.	Basic clocking rate	
29.	Engineering unit conversion yes/no	
30.	Arithmatic processor facility with floating point capability yes/no	
31.	Programe location (i.e. EPROM,RAM)	
32.	EPROM k bytes	
33.	RAM k bytes	
34.	RAM battery back up for one month yes/no	
35.	Type of data bus available for communication among the I/O modules (serial/parallel)	
36.	MTBF h	
37.	Equipment availability %	
	Response Times	
38.	Time taken to access and display information requested by the user from the Master Station	
39.	Time taken to write one modified entry to the data base from Master Station	
40.	Time taken to write one modified entry to the data base from RTU maintenance facility	
41.	Time taken to validate a complete database following an instruction from the Master Station	
	Compliance with CCITT recommendations	
42	Physical interface	

Item	Description	Particulars
	ANALOG INPUT MODULE	
1.	Module designation	
2.	Microcontroller/microprocessor type	
3.	No. of inputs per module	
4.	Type of ADC	
5.	Scanning resolution bits	
6.	Whether AI module of self calibrating type and event reporting to Master Station if out of calibration yes/no	
7.	Accuracy %	
8.	Conversion time ms	
9.	Type of Analog multiplexer	
10.	Method of isolation	

11.	Surge withstand capability (as per IEEE Standards)	
12.	MTBF h	
13.	Equipment availability %	
14.	Power requirement W	
15.	Signal support: 4-20 mA and 0-5 V(Yes/No)	
	DIGITAL INPUT MODULE	
15.	Module designation	
16.	Microcontroller/microprocessor type	
17.	No. of inputs per module	
18.	Is input module type configurable as a) Status and alarms b) Sequence of events c) Parallel input d) Pulse accumulator e) Any combination of these	
19.	Contact bounce protection yes/no	
20.	Optical isolation yes/no	
21.	Scan time ms	
22.	Noise rejection yes/no	
23.	Surge withstand capability (as per IEEE standard)	
24.	MTBF h	
25.	Equipment availability %	
26.	Power requirement W	

	DIGITAL OUTPUT MODULE	
27.	Module designation	
28.	Microcontroller/microprocessor type	
29.	No. of outputs per module	
30.	Maximum output current mA	
31.	Maximum switched output voltage V	
32.	MTBF h	
33.	Equipment availability %	
34.	Power requirement W	
	ANALOG OUTPUT MODULE	
35.	Module designation	
36.	Microcontroller/microprocessor type	
37.	No. of outputs per module Max. no. of voltage outputs Max. no. of current outputs	
38.	Type of output interface (DAC)	
39.	DAC resolution bits	

40.	Overall accuracy	
41.	Type of isolation	
42.	Whether module of self calibrating type and event reporting to Master Station if out of calibration yes/no	
43.	MTBF h	
44.	Equipment availability %	
45.	Power requirement W	
	COMMUNICATION MODULE	
46.	Module designation	
47.	Microcontroller/microprocessor type	
48.	No. of communication channels	
49.	Type of communications interfaces supported	
50.	Designation of communication protocol	
51.	Type of protection	
52.	Type of isolation	
53.	MTBF h	
54.	Equipment availability %	
55.	Power requirement W	
56.	The standards to which modem conforms to	

	POWER SUPPLY MODULE	
57.	Module designation	
58.	Nominal input voltage V	
59.	Operating voltage range %	
60.	Output voltage range V	
61.	Input voltage protection kV	
62.	Output voltage protection kV	
63.	MTBF h	
64.	Equipment availability %	
65.	Power requirement for a fully equipped RTU W	

ANNEXURE-2

TECHNICAL SPECIFICATION OF TYPE-2 RTU

Rev. : 0
Edition : 1

SPECIFICATION

FOR
TYPE-2 REMOTE TELEMETRY UNITS

(TYPE-2 RTU)

SPECIFICATION NO.: MEC/S/05/E5/099M

ELECTRICAL & INSTRUMENTATION

(OIL & GAS SBU)

MECON LIMITED

DELHI 110 092

1.0 PURPOSE

- The purpose of this specification is to define the minimum requirements of Type-2 RTUs installed at consumer side
- This specification stipulates the requirements for the design including hardware & licensed software, engineering, configuration, programming, documentation, manufacture, inspection and testing, installation and commissioning of Type-2 RTU, start- up, performance test, documentation and training of complete system
- The Type-2 RTU shall be designed, tested, certified, installed, commissioned and maintained in accordance with the requirements.
- The requirements which have not been explicitly identified, but required for the completion and satisfactory performance of the entire system are implied

2.0 SCOPE

- This specification defines the minimum requirements of system design including hardware and licensed software, engineering, configuration, programming, documentation, manufacture, inspection and testing, supply, installation and commissioning of the System. This shall also include building of all operator interface, screen displays, database, reports, and system hardware and licensed software configuration.
- Job scope also covers design, engineering of individual loops specific for site including all input elements including voting rights, output elements, and hardware, special cables, licensed software, integration, glanding, terminations, loop checking etc. complete.
- Entire lot of cables (power, control, signal or any other type of special cables) required for hooking input elements to RTU and from RTU to output elements along with junction boxes, terminals, connectors, terminations, hardware fixtures, cable tray with covers etc. required for complete system is in scope of vendor and shall be part of the system.

3.0 DESIGN & CONSTRUCTION

Type-2 RTU shall be a 32-bit(min.) microprocessor based programmable unit. The Type-2 RTU shall be used for implementation of Startup, safety shutdown and all critical process interlocks. The RTU shall communicate with other subsystems as required.

The vendor shall provide documents for system availability of RTU.

The Type-2 RTU shall have very high noise immunity (RFI/EMI) in order to ensure safe and reliable operation when subjected to electrical radio frequency interference and electromagnetic disturbances expected in the terminal. The surges withstand capacity for input /output modules shall be as per IEC standard.

- The Type-2 RTU's shall be configured such that interdependence of function is minimized and failure of any part of a RTU Module subsystem except the common logic subsystem shall not directly affect the integrity of the unit, as a whole.

- The RTU should have event logging and buffering feature The RTU's should be able to store minimum 600 alarm/ events in case of communication failure till the time of communication restoration and shall be able to transmit to master station on receiving the poll request after restoration of link. The alarm/ events shall be stored in the Type-2 RTU and shall be retrievable on connection of external device (Laptop) and also shall be communicated to SCADA.

4.0 Type-2 RTU FEATURES

The Type-2 RTU shall support the

following

i. Scanning of Input and Output points.

ii. Fast scanning of selected I/O points

iii. Field input initiated discrete control action

iv. Derivation of calculated analog points based on arithmetic functions +, -, /, *, sq, root etc. and driving external hardware. Calculation shall be performed in Type-2 RTU in engineering units with 16 bit or higher floating-point accuracy in case engineering conversion is being done at Type-2 RTU level.

v. The Type-2RTU can be modular type (with dedicated I/O card for each type of I/O) or Mixed-I/O type (with multiple types of I/Os on same module) or Fixed I/O type(with fixed number of I/Os on the Type-2RTU). All Type-2 RTU modules, serial ports, and communications channels health points are to be configured in Type-2 RTU and DNP 3.0 index of same are to be reflected in I/O list and all serial ports should be independently configurable.

vi. Type-2 RTU should have diagnostic feature for hardwired I/Os, DNP3.0 and IED (serial)
communication.

vii. The Type-2 RTU shall have provision to give analog and digital data (available in the Type-2 RTU) over Modbus protocol to third party systems (other than SCADA servers)

through serial port. The register addresses for AI and DI parameters shall be configurable.

viii. IED interfacing through Serial ports on MODBUS protocol. Type-2 RTU shall support standard MODBUS (ASCII and RTU) protocol.

ix. It shall be possible to do configure / write IED interface in Type-2 RTU for which necessary software tools shall be supplied.

x. For communication with IEDs through serial ports, the Type-2 RTU shall support 16-bit, 32-bit, signed, unsigned, integer and floating point data type.

xi. Indicate the operator that trip has initiated and has been successfully completed.

xii. Monitor dangerous condition and take appropriate automatic shutdown action.

xiii. Respond to manual request for shutdown, reset and override from operator

xiv. Record sequence of event record (SER) for all events, alarms and actions taken by system

xv. Derivation of calculated digital points based on logical functions AND, OR, NOT etc. from digital and analog points.

xvi. The Type-2 RTU shall scan and acquire parameters from field as per programmed (user configurable) scan cycles

xvii. Type-2 RTU should have event logging and buffering feature.

xviii. Type-2 RTU should have surge/lightening protection for power supply.

xix. The Type-2 RTU shall be able to store the configuration data and the process database upon power failure. Upon restoration of power, Type-2 RTU shall resume the normal operation automatically.

xx. Separate on/off power supply switch and fuse shall be supplied with each Type-2 RTU. Type-2 RTU vendor shall indicate power consumption for all Type-2 RTU s. Adequate isolation of input, output and power supply circuits shall be provided along with over voltage and short circuit protection. Terminations for connections of power supply shall be of standard industrial type.

xxi. Type-2 RTU shall have error detection/control feature to ensure data integrity

xxii. The Type-2 RTU shall be immune to radio frequency interference generated by any nearby source meeting the latest international standards in this regard

xxiii. The Type-2 RTU should have provision for time stamping of all analog exception reports and digital state changes. The Type-2 RTU time stamped analog & digital data shall be sent to SCADA system.

xxiv. The Type-2 RTU equipment shall function continuously without requiring any preventive maintenance.

xxv. Type-2 RTU shall support communication protocol supporting report by exception to prevent unnecessary data communication when data is not changing and also support downloading of exception value dead band (each analog input wise) from scada system.

xxvi. The scan time of programmable controller shall be less than 100 milliseconds. Scan time of RTU is defined as the cycle time taken by the system to read input, process input executing logic and update control output for all the logics configured within the system. Other activities like diagnostic routines, output/ dump of data to peripherals, or any other activity which consume processor time shall also be accounted for while computing scan time.

xxvii. The output module shall have the capacity to drive loads upto 24 W at 24 V dc upto +60 degree C or as per requirement. This shall be for all channels simultaneously driven. The digital output module shall feature stuck-on and stuck-off testing.

xxviii. The system shall have extensive set of self-diagnostics hardware for easy and fast maintenance of Type-2 RTU. Routine checks should run automatically at frequent intervals for identifying any fault in the hardware.

xxix. Operation of the Type-2 RTU shall be completely unaffected by the momentary power loss up to the 20 milliseconds, unless otherwise specified.

xxx. Input type shall be intrinsically safe with barriers for analog input modules. These barriers shall be active type and certified by statutory authority like BASEEFA, CENELEC, FM, and PTB, CMRI etc. for the use in Zone 1, Group II A, II B, and T3. The proper selection of the safety barriers shall be bidder's total responsibility.

xxxi. Bidder shall configure the system in such a way that if the " Command is not given by system and the valve status input is opposite to command then system shall generate alarm, blinking of valve to alert the operator and log the event to indicate the override action/abnormality.

xxxii. In Type-2 RTU provision shall be made to bypass interlocks. Bypass of interlocks shall be User defined and password protected so only authorised person have access to operate the same. When Event is occurs, alarm shall be generating in system and event shall be logged in system with time & sate.

xxxiii. Type-2 RTU system shall have facility to export all alarm and logs to SCADA system.

xxxiv. Type-2 RTU shall be capable of updating process parameters data and configuration data in its own built-in memory. In the event of failure of SCADA communication break, the RTU shall continue to scan all parameters and update its database.

xxxv. Type-2 RTU shall retain in its database the complete analog and digital information of the field till it is completely and correctly read by the SCADA system, in order to take care of no loss of data, in case of failure of communication, SCADA server, communication via other location. The RTU shall scan the field and the memory buffer is to be sized to store all the changing data (i.e. new exception report for the data every poll time) and SCADA system receive the same without and loss of data and alarms.

xxxvi. Type-2 RTU system shall have the facility to attach to each digital event signal a time tag generated by the RTU local clock to enable the occurrence to be recorded and transferred to SCADA system.

xxxvii. Should Support trip/close and Check before execute for DO Commands

5.0 OVERALL SYSTEM ARCHITECTURE

- The system shall consist of following major sub systems

5.1 Input/ Output system

- Each I/O shall be protected against reverse polarity of the signal.
- Each input shall be provided with filters to filter out any noise in the input line or noise because of input contact bouncing.
- Output shall be able to drive solenoid valves and the contact rating shall be 1 amps. Each output shall be short circuit proof and protected by fuse. Visual indication for fuse down must be provided for each output.
- Maintenance override switches (MOS) shall be provided in logic group wise so that the instruments can be tested without initiating a shutdown. The logic will ensure that no more than one MOS per logic group can be activated by means of soft keys from the PC based operator station of system after entering the necessary security level password

5.2 PROCESSOR SYSTEM

- The processor shall have capability to implement all the control functions required to implement the logic schemes.

- The size of the memory shall be sufficient for storage of the program instruction required by the logic schemes. A minimum of 40% spare memory space shall be provided at the time of handover of the system to client. Bidder to submit the memory capacity calculations.

- Memory shall be non-volatile.
- Watchdog timer shall be a available. The healthiness of the processors shall be continuously monitored by the watchdog timer. Any hardware or software problem in the processor subsystem including CPU, memory, power supply, communication interface etc. shall cause the watch dog timer to report processor failure.
- In case of failure of complete processors, output shall take fail safe state automatically unless otherwise specified.
- It shall be possible to generate the first out alarm output by RTU, in case a group of parameters trip the system.
- Time stamping shall be done at processor/IO level.
- To allow for Sequence of Event Recording(SER) or communication failure at least last 100 events shall be stored in RTU

5.3 COMMUNICATION SUBSYSTEM

a) Each Type-2 RTU shall recognize its own unique address and shall have the capability of being assigned any address within a range of possible addresses.
b) The Type-2 RTU Cum RTU shall support DNP 3.0 protocol (both DNP 3.0 (Serial) and DNP 3.0 (TCP/IP)) for communicating with SCADA servers
c) The Type-2 RTU shall have the provision of being polled through its serial port as well as Ethernet port simultaneously from SCADA server.
d) The Type-2 RTU shall have dual Ethernet ports (IEEE 802.3) for TCP/IP communication with SCADA system in multi-dropped environment.
e) The Type-2 RTU shall have the provision to be polled for data by SCADA system, independently and simultaneously on both communication ports. Both the primary and secondary ports (for SCADA server communication) shall have same data in their buffer at a time.
f) Each communication port of Type-2 RTU shall be isolated and surge protected.
g) Communication subsystem shall be a digital communication bus/ or an integral component of the system that provides reliable and high speed data transfer between processor subsystem, I/O subsystem, and other external devices connected to Type-2 RTU.
h) Communication system shall have continuous checks for any faults/ errors.
i) System shall have a port to connect laptop computer for programming/ configuration

6.0 SELF DIAGONOSTICS

- The system shall have an extensive set of self-diagnostics routines which shall be able to identify and provide information on the system failure at least up to the module level including redundant component and power supplied through detailed display pages and report printouts.

- Self-diagnostics shall be provided to detect faults (which makes the contacts permanently open or close) in the input and output modules or input and output signal conditioning modules. The system performance shall not degrade whenever

testing feature is specified.

- Testing software shall be capable of detecting faults in case of normally closed system as well as normally open system.

- No internal self-diagnostics shall be capable of preventing or delaying normal system operation and system availability. The self-diagnostic shall be carried out with the main purpose of reliability and integrity as paramount aims.

- System shall have an Earth Leakage Detector (ELD) installed inside the system cabinet. The potential free contact from the ELD will be wired to the RTU, this will ensure that IO signals are not grounded.

- Minimum requirement for system diagnostics shall be as follows-

a) Configuration diagnostics - checking the compatibility and availability of selected I/O hardware and software.
b) Memory diagnostics- checksum, parity check etc.
c) CPU/memory diagnostics
d) Processor executes a test control or arithmetic algorithm, and then compares results with pre stored answer.
e) Power system diagnostics -monitor the availability of supply voltage
f) The RTU system shall be able to generate a common alarm (high priority) for RTU diagnostics, power supply failure, and fan failure and battery life over etc.

- The operator shall be continuously informed of the system health status by means of the system diagnostics communication. As a minimum, a common cabinet utility alarm per cabinet and a common system alarm, both hardwired, shall be transmitted to the RTU for the attention of the operator. This should include power supply failure, temperature high, fan failure, Earth leak detection signal.

7.0 SYSTEM SOFTWARE AND DATA BASE BACKUP

- Any software supplied shall be licensed of latest version with long term support from software vendor. It shall be responsibility of bidder to ensure software protocol compatibility to third party systems and transfer of data between the same

- When fully tested, the configuration software shall be stored in a central point nonvolatile memory. Logic program shall be recorded on the DVD or suitable media. All database shall be field configurable and expandable without software redesign.

- The RTU programming language for implementation of the logic operation shall be based on following representation conforming to IEC 61131:

a) FBD : following FBD shall be provided as minimum

- Basic functions
- Manual loader
- Cascade (with set point tracking)
- High alarm
- High High alarm
- Low alarm
- Low Low alarm
- Rate of change alarm

b) Comparison function
c) Arithmetic function
d) Linearization function
e) Dynamic function
f) Limiter and selector function
g) Alarm priority shown at SER and/or OIC

- I/O assignment should be grouped based on equipment's System software for the report generation for report likely hourly demand per shift daily and weekly report shall be provided in the user defined format.

- Loss of data communication in the engineering workstation shall not result in trip or status changes of the SIS communication points. Recovery of communication shall be automatic. The vendor shall indicate the type of output (hardwired) that can be made available, to permit (back up) annunciation of communication failure at the operator interface console (OIC).

- The system shall have an automatic and on demand data protection scheme for the preservation of all data during a planned/ unplanned outage. The entire control software shall be backed up including vendor software control database, user built programs, source code and data files.

- Backup copies produced on bulk devices shall be removable for remote storage. Online backup shall not degrade system performance.

- To correct from an outage, any component of the system must be able to reload from the bulk.

- The following signals (as a minimum) are required to be logged

  a) Trip alarm
  b) Input status (i.e. line or loop monitoring)

c) Output status (i.e. line or loop monitoring)
d) Each individual system and utility alarm
e) Operator action (such as bypassing the interlock)
f) Valve actions and failures etc.

- If any interlock is bypassed it shall be logged in SER and on associated graphic page, it shall be clearly indicated clearly with warning colour to associated tag no.

8.0 SEQUENCE OF EVENT RECORDING (SER)

- The system supplied shall have a sequence of event recording facility. All the events shall be recorded, time stamped and stored in memory. The system shall be capable of providing recording to a resolution of 200 milliseconds or better. The SER shall be capable of storing 500 time stamped events in a file. Any software supplied shall be licensed of latest version with long term support from software vendor.

9.0 TIME SYNCHRONISATION

- The system shall accept time synchronization signals from an SCADA MMS, BMS and external source (if required).

10.0 SYSTEM INTERFACES

- For all system interfaces, the supply, installation and termination of all type of cables is in vendor scope

11.0 CYBER SECURITY REQUIREMENTS FOR RTU

- The Type-2RTU shall be certified for use as per IEC 62443.
- The proposed Type-2RTU by the vendor shall have the following cyber security features from the outset. (Any licensed software or license required to meet the following cyber security features shall be provided by the vendor with the RTU) –
    a) DNP3 with level-4
    b) DNP3 (SAv5)
    c) AGA-12 DNP3 Data encryption
    d) User access control
    e) Password complexity
    f) Role Based Access Control
    g) Patch management (The frequency of patches as provided by OEM shall also be indicated)
    h) Support Network access control (Authentication) IEEE 802.1X
    i) Support Application access control (Authentication) DNP3 Secure Authentication in firmware
    j) Should be able to restrict Master IP

		Type-2 RTU	
GENERAL	1.	Tag No.	*
	5.	Quantity	*
	6.	Area / Unit	Terminal
	7.	Location	To be decided during detailed engg
	8.	Make	As per Suggested vendor list
	9.	Model No.	*
	10.	Ordering Code	*
	11.	Power Consumption	*
	12.	Operating temp	-10 – 70 Deg C
	13.	Humidity	Upto 95% non condensing
	14.	Electrostatic Discharge	Meets IEC EN 60001-4-2, EN 61326
	15.	Installation	Suitable for installation inside explosion proof junction box. 2 nos. of explosion proof breather shall be provided with each junction box.
SPECIFICATION	16.	Performance	exceptional performance and low power consumption
	17.	Processor	Min. 32-bit processor, higher frequency CPUs (for scan time < 100ms) with watchdog timer
	18.	SRAM	Min 2 MB SRAM memory preferably non-volatile, however in case, volatile memory is provided, battery backup shall be provided for minimum 6 months to keep the stored program intact
	19.	Flash Memory	Min 8 MB Flash for Program source, historical Archive , Events and Audit storage
	20.	Operating Voltage	Nominal- 24 VDC, Range- Min 20-26 VDC with facility of surge suppression

SPECIFICATION	21.	I/Os	As per IO List provided in tender
	22.	Serial Interface	Min 1 No. RS-485 Serial Ports to be provided
	23.	Ethernet Interface	Min 2 Nos. 10/100 (or 10/100/1000) Ethernet Ports (configurable independently) to be provided
	24.	Additional Features	1. Battery voltage monitor 2. Power-fail detection and recovery sequencer 3. Reverse voltage protection 4. DNP 3 Protocol 6. Failure status Indications 7. visual fuse blown indication 8. Output contacts shall be short circuit proof and protected by suitable mechanism 9. Should Support trip/close and Check before execute for DO Commands 10. DIN rail mounting 11. Storage of Minimum 600 alarms/ events

NOTES :

1. * Vendor to furnish
2. Certification for hazardous area installation to be furnished by vendor for offered model.
3. Any I/O, serial port or Ethernet port required for integration of additional features with Type-2RTU, the same shall be considered in addition to the serial ports and I/Os required as per datasheet.
4. If any feature is not indicated in the datasheet, but indicated in the specification of Type-2 RTU , the same has to be considered in Type-2RTU

ANNEXURE-3

SCOPE OF WORK, TS AND DRAWINGS FOR SOLAR POWER SUPPLY SYSTEM

PARTICULAR JOB SPECIFICATION (PJS)
SPV (SOLAR PHOTOVOLTAIC) SYSTEM

STRUCTURE SKID MOUNTED SOLAR POWER SOURCE (150W)
FOR North East Gas Grid (NEGG) Project – ONGC Feeder Lines

DOCUMENT No. -MEC/23VC/05/E9/E-SPV/001

(ELECTRICAL SECTION)
MECON LIMITED
DELHI 110 092

TABLE OF CONTENT

1.0 GENERAL

The intent of this specification is to define the requirements of SPV solar power supply system and the associated battery sets in FLP Boxes, mounting structures shed for Solar panels & FLP Junction boxes mounting, Solar Charge Controller (MPPT Charger) in FLP Junction boxed for power supply to the metering skids at ONGC Feeder lines Gas Source locations. Tenderer's scope of work includes design, manufacture, testing, packing, delivery to site, installation, earthing, testing & commissioning of the complete Solar system with solar PV Modules, SMF battery,

1.1 Standards

1.1.1 The equipment/material shall be in conformity with standard specifications, data sheet and code of practices of the relevant Bureau of India Standards& IEC. In case of any conflict, the stipulations under this specification/data sheet shall govern. Refer Technical specification of Solar PV system for the applicable codes and standards.

1.2 Site Conditions

The equipment offered and the installation shall be suitable for continuous operation under the following site conditions.

Max. / Min temperature	:	$50^0C/2^0C$
Max. Relative humidity	:	90 %
Installation Location	:	
Altitude	:	less than 1000 m above MSL
Atmosphere	:	Hydrocarbon handling & Heavy rainfall **(Painting thickness of all equipment & structure shall be more than 100 micron)**

1.3 Power Supply Parameters:

1	INSTRUMENTATION	24 V DC (Unearth- Isolated system)
2	TELECOM SYSTEM	
3	SCADA	

2.0 SCOPE

2.1 SCOPE OF SURVEY, DESIGN & ENGINEERING

2.1.1 Submission of solar array sizing calculations, SMPS size calculations, battery size calculations for approval. Preparation of site engineering drawings and details for installation works wherever applicable or required by the Engineer-in-charge, and submit to the Engineer-in-charge for review.

The system shall be designed on the daily Ah requirement considering the max. 14 day cycle (Additional AH requirements to charge the full discharge battery) considering Two/ three No SUN DAYS in four weeks. At seven stations, the design shall be done considering two non-sun days and at 1 station, the design shall be

done considering three Non-Sun days. However this cycle depends upon the Geo Graphical location of the installation & may go below the above consideration. The excess Ah shall be determined accordingly apart from the daily Ah requirement.

The Bidder shall survey the particular locations & accordingly determine the geo graphical data required for the installation of solar system & its design (i.e Avg. /High/Low Insolation throughout year, wind velocity Avg. /High/Low throughout year, Solar Radiation Avg. /High/Low throughout year (Radiation data of each month from 9AM to 5 PM of each location), sun path diagram etc as required for designing & installation of the PV system.

The result of the survey shall be presented in the graphical format & accordingly the optimised tilt angle for the installation PV system shall be calculated of each location for max power output throughout the year.

The required nos. of array shall be calculated from the max. Current requirement by the battery bank during charging & the nos. of series modules shall be calculated as per the boost voltage of the battery bank.

All solar calculations shall be done on PV system software (latest) and Bidder shall have valid licence of the software for the same at the time of Bidding. Bidder shall submit all the reports as per the software simulations.

2.1.2 The photovoltaic solar array, charge controller shall be sized to meet through battery back-up, load cycle requirement of connected load with availability of solar energy. However, the rating of solar system & equipment shall not be less than as specified in SOR/MR.

2.1.3 Correction, updating and submission of all Owner's drawings for as-built status.

2.2 SCOPE OF SUPPLY

Following electrical equipment and material are in the contractor's scope of supply in this tender.

2.2.1 ATEX/ CSA certified Solar Array/Panels, MS mounting structure for Solar panels and junction boxes, FLP Junction boxes with breather for housing Battery and Charge controller, 230V AC (±5%) to 24V DC SMPS for charging the battery through external power source, SMF Battery pack (24V), interconnecting cables among - arrays, SMPS, Battery bank, Grid charger etc as per enclosed SOR and specification.

Note- Structure size may change as per the requirement for installation of the modules, final area shall be taken into consideration for the purpose of payment.

2.2.2 MV power and control cable (Cu-Conductor, XLPE – insulated, PVC sheathed, armoured/unarmoured, FRLS cables as required). Solar grade cable shall be used for the Module wiring & outdoor cables.

2.2.3 GI pipes, GI Cable-trays and accessories, cable markers, identifier tags, GI saddles and all other associated accessories as required for cable laying. maintenance free earthing system with 3mtr earth electrode of low carbon steel with 250 micron copper coating with

carbon based backfill compound (Resitivity of compound shall be less than 1 ohm-m) as per IS 3043/IEEE-80. (25 mm dia, 3M long steel rod with 250 micron CU bonding) with Civil Chamber.

2.2.4 FLP (CMRI, PESO approved) type double-compression nickel-plated brass cable glands, tinned-copper lugs, clamping material etc. for cable termination.

2.2.5 Earthing including earthing pits chamber,earth electrodes, carbon backfill, GI earthing strips& grounding conductor of various sizesetc as per SOR.

2.2.6 Lightning & Lighting surge protection must be provided for the SPV array and other solar system components, MPPT/PCU/Charger Input side and Output side as per IEC 62305.

2.2.7 Supply& fabrication of MS frames& Painting, supports, canopies and brackets for installation of electrical equipment, FLP Junction boxes, Mounting of Solar Panels, including welding, supply of bolts, nuts etc for mounting and other necessary supplies, all-inclusiveincluding painting etc as required.**(Painting thickness of all equipment & structure shall be more than 100 micron)**

2.2.8 Two years operational spares as per list provided in this document.

2.3 INSTALLATION, TESTING & COMMISSIONING

2.3.1 Delivery to site, storage, Transportation from storage to site, Installation, earthing, testing, commissioning and performance test at site (full load test) of the complete Solar system with solar array, MPPT Charger, SMF lead acid battery banks,FLP junction boxes with breather, interconnecting cables, FLP Glands etc as per enclosed specification, data sheets and SOR. Tenderer shall submit the sizing calculations for SPV array, charge controller, battery bank and Grid charger for approval before procurement. However, the rating of each subsystem shall not be less than as indicated in SOR.

2.3.2 Installation testing & commissioning of earthing material as per specification and requirement.

2.3.3 Laying, Termination, Glanding, Ferruling of all interconnecting cables between array JBs, Main FLP JBs, Charge controller, Grid charger, Battery Bank etc.

2.3.4 Suitable cable-tray shall be installed for laying of cables from solar array to Junction boxed and required for all interconnecting cables of the system.

2.3.5 Interconnecting cables among modules shall be laid in PVC conduits & tied with UV resistance cable ties.

2.3.6 Structural work for mounting of solar panels & Junction boxes under the Solar Panels. Height of structure for module mounting shall be min 2 meter.

2.3.7 During the installation & commissioning work all consumables including water, power, DG set of suitable rating & load bank shall be arranged by the successful Bidder.

3.0 OTHER MISCELLANEOUS WORKS

3.1 Installation, Routing & Laying of cable in trays/ GI Conduits required for the cable laying.

3.2 The job includes repairing of all civil works damaged during installation of electrical facilities and complete solar system.

3.3 The scope of work under this contract shall be inclusive of breaking of walls, floors and chipping of concrete foundations necessary for the installation of equipment, materials, and making good of the same.

3.4 Minor modifications wherever required to be done in the owner free supplied equipment / devices to enable cable entry, termination etc.

3.5 Sealing of opening made in the walls / floors for cables trays, cables, bus ducts, etc. using acceptable practice and standards.

3.6 Supply and installation of all other accessories not specifically mentioned herein, but never the less necessary for completion of the job.

4.0 AREA CLASSIFICATION

Hydrocarbon handling areas have been generally classified as zone 2, gas group IIA/IIB as per IS: 5572, API RP-500, OISD - 113 and IP Rules. All equipment to be installed in these areas shall be suitable for the area classification with temperature class T3 (200˚C), and approved by CCOE/PESO/ ATEX/ CSA or equivalent agency.

5.0 EQUIPMENT SPECIFICATION

5.1 SOLAR PANEL

The solar panel shall be highly efficient photovoltaic type. PV Panel shall be suitable for hazardous area and shall be certified for the Zone 2, Gas IIA/IIB from PESO or any international certifying agencies for use in Oil & Gas industries (ATEX/CSA or equivalent). The solar panel shall be weatherproof (IP 65min).

The solar panel shall be sized to feed the battery which will have backup of 3/2 (72 /48 hrs) days continuous operation of RTU, Telecom system, Instruments etc. in this package.

The solar panel, solar charge controller and solar battery shall be located on system skid and shall be for outdoor application.

5.2 SOLAR BATTERY

The solar battery shall be SMF Lead Acid type. Sealed maintenance free battery, enclosed in a flameproof enclosure shall be considered with EX/EXD breather. The battery enclosure shall be Weatherproof (IP 65 min) & Flameproof and shall be certified for the Zone1, Gas IIA/IIB, T3 from PESO or any international certifying agencies for use in Oil& gas industries.

The solar battery shall have backup of 3 days continuous operation of RTU, Telecom

system etc.

5.3 POWER CABLES

Power and control cables within the solar system shall be in vendor scope of supplyand including laying &installations. Power cables shall be 650/1100V grade, Copper conductor, XLPE insulated, sheathed, armoured and overall PVC sheathed FRLS Cables as per BIS 7098 Part -1 &BIS certified Solar grade wires for the solar panels.

Sizing of cables shall be carried out as per the current requirement, voltage drop with derating factor of 0.65.

Cables for the illumination shall be additional, shall be 3.5Cx2.5 Sqmm, XLPE Insulated, PVC sheathed, Armoured, FRLS type.

Cables for the solar system shall be additional, shall be 3.5Cx4 Sqmm, XLPE Insulated, PVC sheathed, Armoured, FRLS type.

5.4 POWER AND CONTROL CABLE GLANDS

Power and control cables glands shall be in vendor scope ofsupply and installations. Cable glands shall be of nickel-plated brass and shall be manufactured inaccordance with IS/IEC 60529 and IS/IEC 60079-1.

The cable glands for outdoor terminations shall be flameproof and weather protected, double compression FLP type and shall have PVC shroud for additional weather protection.

Cable glands forming a part of relevant FLP enclosure, shall be FLP type, tested by CMRI or any other recognized independent testing laboratory and approved by PESO/DGMS or any other statutory authority as applicable. Indigenous FLP glands shall have valid BIS license as per the requirements of statutory authorities. The size of cable glands supplied shall be appropriate to the size of cable so that flame proof-ness of glands is retained. Cable glands shall meet the requirements of IP-65 (minimum) for suitable weather protection.

5.5 CABLE LUGS & GLANDS

The cable lugs shall be tinned copper, tubular, seamless compression type unless specified otherwise.

The type of cable lug shall be as follows.

a) Single hole, ring type for power cable and earthing cable terminations.
b) Pin type insulated or fork type insulated for small power and control cable terminations

Where copper to aluminium connections are made, necessary bimetallic washers shall be used.

Cable glands shall be of brass & double compression type suitable for hazardous area as

classified in the area classification.

5.6 EARTHING

All the equipment on the skid shall be connected to common earth bus bar. Common earth bar shall be provided on the skid to connect to external earth grid and earth pits. Earthbus bar shall be GI type.

Separate earthing system (Clean earthing) for RTU shall be provided.

All the connections shall be made with 650V grade green/yellow copper cable of following sizes.2nos of earthing bosses shall be provided on the skid in addition to earth busbar.

External connections to earth grid shall be done by contractor.

5.7 FLP Junction boxes

FLP junction boxes shall be suitable for the Hazardous area classification provided in this specification.

Size of junction boxes shall be min 560*560*300 mmor higher to accommodate the battery and MPPT Charger.

5.8 ILLUMINATION

Normal Light

It has been considered to provide the 02 Pole mounted LED light fixtures for each stations including 6 mtr GI Octagonal pole, earthing, etc

Emergency Light

Solar Street lighting system complete with GI pole and GI mounting bracket, control gear box, internal cable from fitting to junction box, and min FLP WG LED fixture (PESO Approved), three days battery backup with VRLA battery with Ex-d FLP box (2x75 AH), ATEX certified Solar PV Module (2x100Wp), earthing, electronics, charger, dusk-dawn operation, GI -pole (5 Mtr, with 80 Micron Galvanization) etc including pipe inserts for cables and connecting work, civil work and commissioning spares as required, with all material and labour as per specifications, drawings and instruction of Engineer-in-charge. Work to be completed in all respects.

6.0 JOB SPECIFICAITONS

6.1 Various electrical works covered under this contract like equipment erection, cabling, outdoor lighting (Solar) and grounding works, etc shall be performed in accordance with specifications attached with this tender. (Certain clauses of specifications, which are applicable to equipment or system not covered under this contract, shall not be applicable).

6.2 Erection and commissioning of certain special equipment shall be performed in accordance with supplier's instructions and directions of the Engineer-in-charges under supervision by equipment supplier/s.

6.3 All equipment/materials to be supplied by the contractor shall conform to the requirements of the applicable specifications enclosed in the tender document.

6.4 Price of erection & commissioning spares and special tools shall be included in the quoted price by the bidder.

7.0 MAKES OF EQUIPMENTS AND MATERIALS, SPARE AVAILABILITY

All equipment / materials supplied by the contractor shall be as per the list of approved makes enclosed with this document.

Vendor shall ensure availability of spare parts and maintenance support services for the offered equipment for at least for 20 years from the date of supply& shall submit the undertaking of the same along with BID.

Vendor shall give a notice for at least one year to the Purchaser of equipment beforephasing out the product/spares to enable the end user for placement of order for spares andservices.

8.0 INSPECTION, TESTING & COMMISSIONING

The contractor shall carry out all the tests as enumerated in the technical specifications and as per applicable codes and standards and QAP.

9.0 DRAWINGS AND DATA SHEET

8.1 Contractor shall submit drawings and data sheet as enumerated in the technical specification of the equipment / materials to be supplied.

8.2 After the job completion, contractor shall prepare **AS-BUILT** drawings and documents, submit catalogues/manuals (O&M) of major brought out items like solar system, charge controller, DCDB, battery bank, DC-DC Converter, junction boxes, Grid charger etc. Final certified as built drawings, documents and manuals etc shall be submitted by the contractor to owner in bound volume with one set in soft copy (CD) plus five sets of prints.

Scope of Works CAMC for 5 years

CAMC Annual Maintenance of the Solar PV system (Comprehensive Annual Maintenance Contract-CAMC)

Complete Solar system is to be maintained for a period of Five (05) years after the expiry of warranty period of Two years (02 years)as per the details given below:

- After expiry of warranty period, Cost of all spares, consumables, equipment, instruments & services, to take care of maintenance (Preventive & Breakdown), including all statutory

taxes and duties including entry tax, service tax etc. has to be borne by the Vendor during the CAMC period. In case of failure to attend within 3 days, these will be attended through alternate agency at vendor's risk and cost.

- Two Nos. normal visits (once in six months) per annum for carrying out regular maintenance work, for checking the operation of system and do preventive maintenance and Four No. emergency visits per annum (as & when required) are included in scope of C.A.M.C (Annual Maintenance Contract) at each location. M/s IGGL will have the right to reschedule the visits and adjust the total no. of regular and emergency visits. Each Visit shall conclude only after the deliverables are achieved as per the approved check list/work specified by IGGL before start of the visit.

- During warrantee and AMC period, any replacement of parts/rectification shall form an integral part of the contract and agreed contract price. Since the equipment is under warranty and CAMC obligations, no extra payment towards replacement of components, parts etc shall be allowed.

- The effective date of Annual Maintenance Contract shall be from the date of successful completion of warranty period/DLP as per contract and on request from the purchaser. During regular maintenance / breakdown visits any replacement/consumable required will be provided by the Vendor.

- The vendor's service engineer will check and service supplied Solar System, PV Panels, Solar Charge controller, SMPS, FLP Junction boxes, Cables & Battery and all its associated electrical, electronics & magnetics components & accessories installed under this contract and maintain them in good working condition. Any consumables required for servicing the equipment shall be arranged by the Vendor at no extra cost to IGGL during CAMC.

- Vendor shall ensure availability of consumables and critical spares for smooth working of complete solar systems during CAMC. The vendor should do proper spares management by carrying out periodical testing of the spares, safeguards against obsolescence, any up gradation, timely replenishment, etc.

- IGGL can terminate the annual maintenance contract by giving one months' notice in advance to the vendor for CAMC.

- In case the Bidder does not undertake the AMC contract later when awarded or does not abide by the terms of the contract for supply of spares as well as the AMC contract, then IGGL reserves the right to en-cash the performance bank guarantee available with them besides blacklisting and putting the Bidder on holiday list of IGGL for a period of five years.

- Any software upgrades required shall be included in the scope of the Bidder during annual maintenance. The Bidder shall seek permission from the Project / Terminal incharge before loading the new version of the software in the clients / server. The data backup shall be taken before upgrading the software. If during CAMC /Warranty period a new version of Software is released by the Vendor/ OEM, the same is to be updated at the location without any additional charges.

- The vendor shall ensure availability of spares for the supplied complete Solar System, MPPT Charger, SMPS and all its associated electronics, for a minimum period of 20 years after warranty period. In the event of non-availability of spares due to fast obsolescence of hardware and software, the vendor shall arrange to upgrade/ replace the equipment's with equivalent or higher hardware and software at no additional cost till end of CAMC period for the items supplied by the Vendor.

- The Vendor must note that all commissioning spares and the spares / consumables during warranty and comprehensive CAMC shall be supplied by the vendor free of cost.

- For payment terms and penalty clauses refer the annexure to SCC-Payment Terms (Annexure-5 to SCC).

- Bids will be evaluated taking into account the charges towards CAMC for 5 years. However IGGL reserves the right to award the CAMC contract & these items subsequently at the end of the warranty period or earlier.

- For all Windows OS & other Microsoft product, the security/ functionality patches which are mandatory in nature shall be upgraded /installed in all machines during project execution, system stabilization, warranty & CAMC. Vendor shall carry out such updates in coordination with IGGL. Using IGGL's software deployment/ upgrade infrastructure.

- Quoted LS Prices for CAMC are applicable for all the stations& systems in the SOR and its further breakup shall be made for pro-rata basis (station wise) Payment as recommended and approved by MECON & IGGL. Accordingly, separate CAMC order shall be issued by M/s IGGL for individual stations.

- **During the CAMC period bidder scope shall also include the regular checking of the Battery bankand its preventive maintenance per visit and annual capacity test of the bank and replacement of the faulty battery cell as per the capacity test reports.**

  Battery cell replacement shall be carried out by M/s IGGL as per the capacity test report.

  Prices of replacement of the all-faulty other parts/system other than Battery is included in the CAMC.

Sl no	Parameter	Scope	Time line	Penalty
a	Fault in PV System, charger , FCBC, battery etc.	To ensure that the PV System, charger , FCBC, battery etc.are working properly and all the instruments/ items in the system are in good working condition	Within 2 working days of reporting	*Penalty of Rs 10000/- per day will be imposed for delay in execution of job.*

Bidder to maintain at least one maintenance office with storage facility for operation and maintenance spare parts, all types of tools and tackles etc. At maintenance office contractor to deploy one technician and one helper during the AMC period as or when

required.

Annexure – I

STATIONWISE SOLAR SYSTEM DETAILS

S. No.	STATION DESCRIPTION	LOCATION	LOAD	REQUIRED NO. OF SOLAR SYSTEM
1		ASSAM	150W	1 No.
2			150W	1 No.
3			150W	1 No.
4			150W	1 No.
5			150W	1 No.
6			150W	1 No.
7			150W	1 No.
8		TRIPURA	150W	1 No.

Annexure – II

LIST OF TWO YEAR OPERATION & MAINTENANCE SPARES

Sl No.	Description	UOM	Qty
1	Solar Module	Nos.	1
2	Solar Charge Controller (MPPT Charger)	Sets	1
3	Spare SMPS	Set	2
4	SMPS card*	Sets	1
5	MCB's & MCCB's (consist of one no. of each rating MCCB & MCCB)**	Sets	1
6	Fuseof all ratings**	Sets	1
7	Push button, toggle switches, Rotary switches	Sets	1
8	Indicating lamp	Sets	1
9	Relays -10% with min. 1 No. for eachtype of relay	Sets	1
10	Contactors (AC, DC & Aux.)	Sets	1

1) * 1 Set=One of card of each rating &type
(2) ** 1 Set= 10% of each rating (minimumone number)

(Prices of 02 years O&M spares are deemed to be inclusive of total prices quoted by the Bidder for the complete solar system package)

Annexure – III

Vendor Data Requirement (Solar)
To be Submitted by Bidder

Sl No.	Documents	With Bid	After award of Contract	
			For Review & Approval	For Records
1	List of deviations to Bid Document	*		
2	Vendor Drawing/ Document Submission Schedule (Within 07 days after award of Contract)		*	
3	Filled up data sheets. (Attached with specifications & standard data sheets)	*		
4	Equipment storage procedure at Bidders store & site	*		
5	Catalogues for solar Modules, MPPT Solar charge controller, FCBC charger and battery bank	*		
6	Solar array sizing, charge controller sizing, FCBC Chargerand battery sizing calculations.		*	
7	G.A. drawings of, charge controller, FCBC Charger, PCU and battery.		*	
8	Complete Hybrid solar system working philosophy.		*	
9	Cable size selection calculation considering the voltage drop & insulation along with voltage grade, type, size and Cable schedule		*	
10	System protections provided at various stages of the system		*	
11	Inspection & Test Plan (As per MECON Format)	*	*	
12	Schematic and Wiring diagram		*	
13	List of two years operation and maintenance spare.	*	*	
14	Installation Manual		*	*
15	Operating/ Maintenance Manual		*	*
16	System Schematic & Block Diagram with interlocking logic		*	
17	Installation and SAT procedures		*	
18	Installation record formats		*	
19	Bill of material		*	
20	Confirmation undertaking from OEM that they shall provide support to the successful bidder during I&C & CAMC. Another undertaking by OEM for Availability of spares of MPPT Charger, FCBC Charger & Converter for 20 years from date of commissioning of the system	*	*	

Notes-

1. ***** Data Required

2. All documents shall be in English Language.
3. Unless otherwise agreed, the number of copies of various drawings and documents shall be as below:

a.	With bids	:	Same as the number of copies of bids
b.	Post order submission for review / records	:	Four copies
c.	Final documents	:	Six prints / One Soft Copy

4. Post order documents for review / records shall be submitted within three weeks of release of letter of intent/FOA unless otherwise agreed.
5. Documents for review and documents for records shall be submitted in separate folders and under separate covering letter to facilitate processing by the company.

   As a part of the contractual obligations, final documents shall be duly bound under hard cover with clear identification of the equipment tag no, PR no, client details and the name of the project.
7. A blank space measuring 75 mm x 50 mm will be provided on all vendor drawings for marking of review codes, etc.
8. Review of the vendor drawings by MECON would be only to check compatibility with basic designs and concepts, and would in no way absolve the manufacturer / fabricator of his responsibility to meet applicable codes, specification and statutory rules and regulations.

9. Inspection & Test plan- Review& record.

10. BOM of SPV System –Review & records

-X-X-X-

DATA SHEET
FOR
SOLAR PHOTO VOLTAIC (SPV)
POWER SUPPLY SYSTEM

DATA SHEET NO. - MEC/DS/05/E9/078

(ELECTRICAL SECTION)
MECON LIMITED
DELHI 110 092

ANNEXURE – I

PURCHASER'S DATA FOR SOLAR PHOTO VOLTAIC (SPV) POWER SUPPLY SYSTEM

1.0	**SOLAR SYSTEM**	
1.1	Type	Solar Photovoltaic (SPV)
1.2	System/Application	Instrumentation (24 V DC), SCADA (24 V DC) , Telecom (24V DC)
1.3	Daily load demand of system	150W continuous load
1.4	System rating (KWp)	As per MR/SOR
1.5	Earthing system	Two wire isolated system (No system Earthing provided for PV system),
1.6	Battery Back up	48 Hours/ 72 Hrs (2/ 3 Days Autonomy) As per the tender requirement
1.7	Location	**IGGL _ Assam/ Tripura**
1.8	Wind Velocity	Min 55 m/s or as Per Site Condition/Survey data. It may be ensured that the design has been certified by a recognized Lab/ Institution in this regard and submit wind loading calculation sheet to MECON.
1.9	Ambient Temperature	Max. 50 deg C, Min 2 deg C
2.0	**SOLAR PANEL- ATEX / CSA CERTIFIED**	
2.1	Module output Watts (Wp)	≥1920Wp – ATEX/ CSA Certified, suitable for Hazardous area location
2.2	Hazardous area classification	As per hazardous area classification
2.3	Insolation data	As per site condition, however average insolation value shall not be higher than 5.2 kWH/Sq.M/Day
2.4	Number of no sun days	02 days / 03 days (As per tender requirement)
2.5	Nominal voltage of solar array	As per design
2.6	PV Array mounting	Structure mounting with mounting of FLP JBs on the structures
2.7	De-rating Factors to be considered a) Solar array- (Module deterioration x dust deposit x Module mismatch x line resistance of	0.7

	cable x Array wiring x panel orientation x Rise in temp. x Charge controller eff.) c) Ageing factor b) DC-DC converter efficiency c) Battery Efficiency	 0.80 0.80 0.9
2.8	Solar module framing material	Withstand up to Min 55 m/s wind velocity and Temp Range as specified.
2.9	Material of bird spikes	N/A
2.10	Degree of protection of Solar Array and junction box	IP65
2.11	Supporting structure	Anodized AL/Hot dipped Galvanized MS
2.12	Expected life span	20 years @ 80% of initial power rating
2.13	Structure Design	The mounting structure steel shall be as per latest IS 2062: 1992 and galvanization of the mounting structure shall be in compliance of latest IS 4759. Structural material shall be corrosion resistant and electrolytically compatible with the materials used in the module frame, its fasteners, nuts and bolts. Necessary protection towards rusting need to be provided either by coating or anodization.
2.14	Fasteners	The fasteners used should be made up of stainless steel
3.0	**HYBRID SOLAR INVERTER**	
3.1	Type of Inverter	Parallel Redundant (2x100%), MPPT type
3.2	Enclosure degree of protection	Inside FLP Junction boxes
3.3	Mounting	Structure mounted
3.4	Cable entry	From Bottom
3.5	Rating (Amp)/KW	As per design calculation
3.6	Battery Voltage range	40-60 V
3.7	DC Input power	As per design calculation
3.8	DC Input voltage	As per design calculation
3.9	Rated O/P Voltage	220-230V AC 50 Hz
3.10	Grid Input	1-Phase
3.11	Warranty	As per tender requirement
3.12	Efficiency	>97%

3.13	Charger I/O	RS 485 serial communication Signals – as per OEM standard
4.0	**BATTERY BANK**	
4.1	Make	As per approved vendor
4.2	Type	VRLA SMF Sealed Maintenance free battery
4.3	Mode of arrangement	As per the design in the FLP Junction box
4.4	AH Rating	As per MR/ SOR
4.5	Self discharge of battery	<3% per month at 20 deg C <6% per month at 30 deg C
4.6	SOC/ DOD	20%/80%
5.0	**JUNCTION BOXES**	
5.1	Type	FLP Type, PESO Approved suitable for Hazardous area classification
5.2	Degree of protection	Min IP65
5.3	Mode of arrangement	Structure Mounted
6.0	**SOLAR STREET LIGHTING SYSTEM- FLAMEPROOF TYPE**	
6.1	Type	Stand alone, Dusk-Dawn type
6.2	PV Module	2x100 Wp
6.3	Lamp	20 W LED -FLP Fixture – PESO Approved
6.5	Battery Rating	2x75AH arrangement in FLP junction box
6.6	Battery Type	VRLA- SMF battery
6.7	Indications	Green LED-Charging in progress Red LED- For deep discharge
7.0	**CABLE AND ACCESSORIES**	
7.1	Interconnecting Cables Type	Cu- conductor XLPE Insulated, PVC sheathed, armoured/unarmoured FRLS type
7.2	Cable gland type	Double compression type
7.3	Lugs-type	Tinned Cu
7.4	Other accessories	As required

ANNEXURE – II

TECHNICAL DATA FOR SPV POWER SUPPLY SYSTEM
(To be submitted up by the successful bidder)

1.0	**SOLAR ARRAY**	
1.1	Manufacturer's Ref. No./ Model No.	
1.2	Size of solar system	**Sizing calculation after award of bid**
1.3	No. of Solar panel/array	**Sizing calculation after award of bid**
1.4	Applicable codes/standards- ATEX	
1.5	Steady state output volt	
1.6	Mode of Arrangement	
1.7	Peak power output of each module (Pmax, Watts)	
1.8	Current at Pmax (Imax)	
1.9	Voltage at Pmax (Vmax)	
1.10	Short circuit current (Isc)	
1.11	Open circuit voltage (Voc)	
1.12	Dimensions (in mm)	
1.13	Degree of protection of the panel.	
1.10	Tilt factor	
1.11	Loss factor	
1.12	Efficiency at 100% load	
1.13	Type of control circuit	
1.14	No. of days autonomy	**48 Hrs/ 72 Hrs (2/ 3 Days autonomy) (As per the tender requirement)**
1.15	Total space requirement of the Arrays (Sq-m)	
2.0	**HYBRID INVERTER**	
2.1	Rating (Amp.) / kW	**Sizing calculation after award of bid**
2.2	Output voltage	
2.3	Input Grid Voltage	
3.0	**BATTERY**	
3.1	Make	
3.2	Type (Enclose catalogue)	VRLA SMF Lead Acid Battery
3.3	Type of construction	
3.4	AH rating	**Sizing calculation after award of bid**

3.5	Battery charge eff.	
3.6	Mode of arrangement	
3.7	Nominal cell voltage	
3.8	End cell volt. At specified discharge rate (V/ cell)	
3.9	No. of cells	
3.10	Recommended Float charging voltage per cell	
3.11	Maximum Float charging voltage per cell	
3.12	Recommended Boost charging voltage per cell	
3.13	Maximum Boost charging voltage per cell	
3.14	Accessories for battery	
3.15	Dimension of battery bank FLP Junction Box (WXDXH)	
3.16	Each battery cell shall be mounted in FLP Junction box	
4.0	**INDICATIONS AND ALARM**	
4.1	**METERING & INDICATION–** i) Voltage and Current from Solar Array. ii) Load Voltage and current iii) Battery current and voltage with indication of status – “in charge” or “discharge”. iv) Solar array Voltage and Current. v) Annunciation for battery deep discharge of battery. vi) Indication for charging of battery from solar charge controller or grid charger	
4.2	Confirmation on Remote Monitoring of the solar system through SCADA as per specification (Protocol shall be ModBus).	
5.0	**DIMENSIONS FOR EACH SYSTEM**	
5.1	Solar Array	
5.2	Battery Bank	
5.3	Charge Controller	

5.4	3x1Ph Grid Charger-FCBC	

ANNEXURE – III

TECHNICAL DATA FOR SOLAR STREET LIGHITING SYSTEM-FLP TYPE
(To be submitted up by the successful bidder)

1.0	**SOLAR MODULE- ATEX CERTIFIED**	
1.1	Peak Power (Wp)	
1.2	Peak Voltage	
1.3	Peak Current	
1.4	Open Circuit Voltage	
1.5	Short Circuit Current	
1.6	Nominal Voltage	
2.0	**BATTERY IN FLP JUNCTION BOX**	
2.1	Make	
2.2	Type	
2.3	Ah rating	
2.4	System Autonomy	
2.5	Nominal Voltage	
2.6	Depth of discharge	
3.0	**LUMINARY ASSEMBLY- FLP TYPE**	
3.1	Type of lamp	
3.2	Luminous Efficiency	
4.0	**DIMENSIONS:** (Enclose Catalogue**)**	

ANNEXURE – IV

CHECK LIST (To be submitted by the Bidder)

Sl. No	Description	Remarks
1	Solar Array sizing calculation	After award
2	Hybrid Inverter sizing calculation	After award
3	Battery sizing calculation	After award
4	PCU Model no. & Rating	After award
5	PCU Sizing calculation	After award
6	List of spares, tools & tackles for system.	Yes/No
7	Solar Array, Battery catalogue enclosed	Yes/No
8	Confirmation for Inspection of Solar Array, Hybrid inverter and battery as per Specification/QAP.	Yes/No
9	Confirmation for Remote monitoring of the parameters through SCADA system (Hook-up with Owner's SCADA system through RS232/485) and automatic changeover between grid charger & solar Charger.	Yes/No
10	Unpriced schedule of rate (SOR) enclosed.	Yes/No

	CONTRACTOR		**QUALITY ASSURANCE PLAN FOR SOLAR SYSTEM EQUIPMENT**	CLIENT:	**M/s IGGL**
				PROJECT:	**M/s Indradhanush Gas Grid Limited**
	ORDER NO. & DATE			PACKAGE NO.	**23VC**
	SUB-CONTRACTOR			PACKAGE NAME	**SOLAR SYSTEM_ Structure Mounted**
	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.

ABBREVIATIONS USED:
CONTR : CONTRACTOR
MFR : MANUFACTURER

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

Code Description

1. Visual
2. Dimensional
3. Fitment & Alignment
4. Physical Test (Sample)
5. Chemical Test (Sample)
6. Ultrasonic Test
7. Magnetic Particle Test (MPT)
8. Radiography Test
9. Dye Penetration Test
10. Measurement of IR Value
    a) Before HV Test
    b) After HV Test
11. High Voltage test/Dielectric test
12. Routine test as per relevant IS other standard
13. Type test as per relevant IS/ other standard
14. Impulse Test
15. Partial Discharge Test
16. Heat run test\temp rise.
17. Enclosure Protection Test
18. Calibration
19. Noise & Vibration
20. Test certificates for bought out components
21. Tank Pressure Test
22. Paint shade and thichness verification
23. Short time rating
24. Operational & functional check
25. Over Speed Test
26. Flame Proof Test
27. Clearance and creepage Distance
28. Acceptance Test
29. Harmonics measurement.

DOCUMENTS:

D1. Approved GA drawings
D2. Approved single line/ schematic diagram
D3. Approved data sheet
D4. Approved bill of materials
D5. Unpriced P.O. copy
D6. Calibration Certificate of all measuring instruments and gauges

EQUIPMENT DETAILS							INSPECTION AND TESTS								
Sl. No.	Description (With equipment heading, place of use, and Breif Specifications)	Indentificatuin No.	Quantity		Manufacturer's Name and Address	Expected schedule of Final Inspection	Raw Material and inprocess stage inspection			Final Inspection/Test by			Test Certificates & documents to be submitted to MECON / ONGC	Acceptance Criteria Standards /IS/ BS/ASME/ Norms and Documents	REMARKS / SAMPLING PLAN
			No/M	T			MFR	CONTR	MECON	MFR	CONTR/ TPI	MECON			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1.0	**LT Power and Control Cable**		**Mtr**				-	-	-	**1,2,10,11, 12, 28**	**1,2,10,11, 12, 28**	**IWC***	**12,13,28 D3, D5, D6,**	**I.S., Data Sheet, Specifications & Test Certificate**	**13 Document to be reviewed by MECON**
2.0	**Solar Array/Module with complete hardware (FLP Type) (JBs etc)**		**Nos.**				**1,2,3,4, 24, 27**	-	-	**1,2,3,10, 11,12,28**	**1,2,3,10, 11,12,28**	**1,2,3,10, 11,12,28**	**D1, D2, D3, D4, D5, D6, 20, 12,13,17,29**	**Tech. Specification, Approved Drawings, BIS 14286 & Applicable IS & IEC standards and ATEX Certifcation**	**13 Document to be reviewed by MECON**
3.0	**Module Mounting Structure**		**Nos.**				**1,2,3,12, 22**	-	-	**1,2,3,12, 22**	**1,2,3,12, 22**	**1,2,3,12, 22**	**D1, D2, D3, D4, D5, D6, 20, 12,13,17,29**	**Tech. Specification, Approved Drawings**	
4.0	**Solae charge controller, SMPS**		**Set**				**1,2,3,4, 24, 27**			**1,2,3,12, 16, 22, 23,24,27**	**1,2,3,12, 16, 22, 23,24,27**	**1,2,3,12, 16*, 22, 23,24,27,**	**D1, D2, D3, D4, D5, D6, 20, 12,13**	**Tech. Specification, Approved Drawings & Data Sheets applicable IS & IEC standards**	**(*) 12 hour heat run test 13 Document to be reviewed by MECON**
5.0	**Battery Set-Solar system**		**Set**				**1,2,3,4, 24,27**	-	-	**1,2,3,12, 13**	**1,2,28**	**1.2,28**	**D1, D3, D4, D5, D6, 12,13,20**	**Tech. Specification, Approved Drawings & Data Sheets Test certificates applicable IS & IEC standards**	**13 Document to be reviewed by MECON**

6.0	**FLP Junction boxes**		**Nos.**				**1,2,3,10, 11,12,17, 20,22,27**			**1,2,3,10, 11,12,22, 24,27**	**1,2,3,10, 11,12,22, 24,27**	**IWC***	**D1, D3, D4, D5, D6, 12,13,20**	**Tech. Specification, Approved Drawings & Data Sheets Test certificates applicable IS & IEC standards**	**13 Document to be reviewed by MECON**
7.0	**Solar Street light system**		**Nos.**				**1.2,3,12, 24**	**-**	**-**	**1.2,3,12, 24**	**1.2,3,12, 24**	**IWC***	**D1, D3, D4, D5, D6, 12,13,20**	**Tech. Specification, Approved Drawings & Data Sheets Test certificates**	**13 Document to be reviewed by MECON**

For Manufacturer (Stamp & Signature)	For CONTR (Stamp & Signature)	For MECON (Stamp & Signature)	Q.A.P. NO. MEC/05/E9/QAP/23VC/078/001-A SHEET 1 OF 1 R-0

*IWC- Inspection will not be conducted by MECON, Inspection waiver certificate based on thr TPI inspection report.

SKID MOUNTED SPV POWER SOURCE System Design, Detailed Engineering, procurement of materials, Inspection/FAT (Factory acceptance test), Supply of materials, Transportation, loading/unloading, insurance, Storage at warehouse/store (hired by bidder) of complete Skid Mounted Solar PV based Power source with two days autonomy (72 Hrs Backup) for 150W DC load for twenty four hours operation per day operation as per tender specification, data sheet, scope of work and block diagram enclosed including commissioning spares as required at each SV station. The system shall include following- (i) ATEX / EX type Solar PV Panel with junction boxes, Anodized AL/ Hot dipped Galvanized M-Steel structure for skid and mounting of the solar panels and battery box. (ii) Hybrid Solar charge controller-MPPT type (output suitable to charge the battery bank in CC & CV mode) (iii) SMF- VRLA battery cells (12V DC) in Ex (FLP) junction boxes (iv) Interconnecting cables among arrays, hybrid charge controller, battery bank, junction boxes etc including supply of all accessories like FLP cable glands, cable tray, tinned-cu lugs etc as required. (vi) Earthing and lightning protection system as required to complete the system. (vii) Erection materials & Other miscellaneous work. (vii) Warrantee of 2 years from date of commissioning. Rating of SPV array, charge controller and battery bank shall be selected to meet the load requirement as specified above. However, each subsystem rating shall not be less than the value given below-				
Solar PV Modules- Ex type, ATEX Certified for SPV array along with junction boxes as per specification and scope of work (Total capacity Min 2000 Wp)	Sets	1	1	2
Anodized AL/ Hot dipped Galvanized M-Steel structure for structure skid (Min 3 (l) x3 (w)x2 (h) Mtr or as required to install Modules & JBs) as per specification and scope of work for mounting the solar panels and battery pack in FLP (Ex-d) Junction boxes along with all required hardware, civil & mechanical material & anchoring material etc. (Design of structure shall with stand the wind velocity of 180 KMPH)	Sets	1	1	2
Hybrid MPPT Solar Charger in PESO approved Ex-d enclosure with 24V SMPS- Hybrid (Solar +Grid) Inverter cum charger in PESO approved Ex-d enclosure with Exd/Exe breather - 1. Hybrid inverter works on both solar power and single-phase grid supply (230V AC raw power) to charge the battery bank & supply power to 24V SMPS refer PJS for further detail. 2. SMPS 18V-28V I/P & 24V+/- 1% Output.	Sets	1	1	2
SMF Battery Min @ 12 V, 200 Ah x 4 nos in FLP (Ex- d certified) junction boxes (one battery in each junction box with Exd/Exe breather) as per specification.	Sets	1	1	2

Balance of System (BOS) materials & equipment for solar system- 1) Interconnecting cables among arrays (solar grade), hybrid charge controller, battery pack, converter, junction boxes etc including supply of all accessories like FLP cable glands, cable tie, cable tray, tinned-cu lugs etc as required. 2) Lightning protection system as required to complete the system. 3) Supply of 2 year O&M spares as per list attached in scope of work 4) Required material for Erection work, Civil & Other miscellaneous work	Sets	1	1	2
SKID MOUNTED SPV POWER SOURCE System Design, Detailed Engineering, procurement of materials, Inspection/FAT (Factory acceptance test), Supply of materials, Transportation, loading/unloading, insurance, Storage at warehouse/store (hired by bidder) of complete Skid Mounted Solar PV based Power source with two days autonomy (48 Hrs Backup) for 150W DC load for twenty four hours operation per day operation as per tender specification, data sheet, scope of work and block diagram enclosed including commissioning spares as required at each SV station. The system shall include following- (i) ATEX / EX type Solar PV Panel with junction boxes, Anodized AL/ Hot dipped Galvanized M-Steel structure for skid and mounting of the solar panels and battery box. (ii) Hybrid Solar charge controller-MPPT type (output suitable to charge the battery bank in CC & CV mode) (iii) SMF- VRLA battery cells (12V DC) in Ex (FLP) junction boxes (iv) Interconnecting cables among arrays, hybrid charge controller, battery bank, junction boxes etc including supply of all accessories like FLP cable glands, cable tray, tinned-cu lugs etc as required. (vi) Earthing and lightning protection system as required to complete the system. (vii) Erection materials & Other miscellaneous work. (vii) Warrantee of 2 years from date of commissioning. Rating of SPV array, charge controller and battery bank shall be selected to meet the load requirement as specified above. However, each subsystem rating shall not be less than the value given below-				
Solar PV Modules- Ex type, ATEX Certified for SPV array along with junction boxes as per specification and scope of work (Total capacity Min 2000 Wp)	Sets	7	1	8

Anodized AL/ Hot dipped Galvanized M-Steel structure for structure skid (Min 3 (l) x3 (w)x2 (h) Mtr or as required to install Modules & JBs) as per specification and scope of work for mounting the solar panels and battery pack in FLP (Ex-d) Junction boxes along with all required hardware, civil & mechanical material & anchoring material etc. (Design of structure shall with stand the wind velocity of 180 KMPH)	Sets	7	1	8
Hybrid MPPT Solar Charger in PESO approved Ex-d enclosure with 24V SMPS- Hybrid (Solar +Grid) Inverter cum charger in PESO approved Ex-d enclosure with Exd/Exe breather - 1. Hybrid inverter works on both solar power and single-phase grid supply (230V AC raw power) to charge the battery bank & supply power to 24V SMPS refer PJS for further detail. 2. SMPS 18V-28V I/P & 24V+/- 1% Output	Sets	7	1	8
SMF Battery Min @ 12 V, 200 Ah x 3 nos in FLP (Ex- d certified) junction boxes (one battery in each junction box with Exd/Exe breather) as per specification.	Sets	7	1	8

Rev.: 2
Edition: 1

SPECIFICATION

FOR

SOLAR PHOTO VOLTAIC (SPV)

POWER SUPPLY SYSTEM

SPECIFICATION NO. - MEC/TS/05/E9/078

(ELECTRICAL SECTION)
MECON LIMITED
DELHI 110 092

CONTENTS

PREPARED BY:	Checked By:	APPROVED BY:	ISSUE DATE :
(Aashish Moyal)	(Saurabh Singh)	(D.K. Pande)	Nov, 2009

AMENDMENT STATUS

Sl. No.	Clause / Paragraph / Annexure / Exhibit / Drawing Amended	Page No.	Revision	Date	By (Name)	Verified (Name)
1	Revised & Re-Issued as Standard Specification	-	1	05.06.2011	AM	DGM
2	Revised & Re-Issued as Standard Specification	-	2	28.08.2018	AM	DGM

1.0 SCOPE

The intent of this specification is to define the requirements of solar power supply system and the associated battery sets, solar street lighting system. Tenderer's scope of work includes design, manufacture, testing, packing, storage, delivery to site, installation, earthing, testing & commissioning of the complete Solar system with solar array, charge controllers, battery banks, 3 Ph chargers, DC-DC converters, Distribution boxes, interconnecting cables etc as per this specification, data sheets that meet the critical load requirement.

2.0 STANDARDS

1) IS-12762 (Pt.1) 2010-Photovoltaic devices: Part 1. Measurement of PV current and voltage characteristics.
2) IS-12762 (Pt.2): 2013- Photovoltaic devices: Part 2: Requirement for reference solar cells.
3) IS -12763:2013 Procedure for temperature and irradiance correction to measure I-V characteristics of crystalline silicon PV devices.
4) IS- 12834: 1989: Solar photovoltaic energy system-Terminology.
5) IS- 14153:1994 Guide for General Description of Photovoltaic (PV) Power Generating System.
6) IS-4244: 1995: Characteristics parameters of stand alone photovoltaic (PV) system.
7) IS-14286: 2010: Crystalline Silicon Terrestrial Photovoltaic (PV) modules - Design Qualification And Type Approval
8) IEC 61215: PV module design and type approval
9) IEC 62259: Battery Bank (Ni-Cd)
10) IS-1554:1988 Specification for PVC insulated (heavy duty) electric cables.
11) IS-3043:1987 Code of practice for earting.
12) IEC: 62257-Recommendations for small renewable energy and hybrid systems for rural electrification
13) IEC: 61427- Secondary cells and batteries for photovoltaic energy systems (PVES) – General requirements and methods of test
14) IEC: 62257-Selection of batteries and battery management systems for stand-alone electrification systems – Specific case of automotive flooded lead-acid batteries available in developing countries
15) IEC: 60364-Requirements for special installations or locations – Solar photovoltaic (PV) power supply systems
16) IEC: 61386- Solar photovoltaic energy systems – Terms, definitions and symbols
17) IEC: 62124- Photovoltaic (PV) stand-alone systems – Design verification
18) IEC: 60904- Measurement of photovoltaic current-voltage characteristics
19) IEC: 61727- Photovoltaic (PV) systems-Characteristics of the utility interface
20) IEC: 60068- Environmental test
21) IS/IEC 61730 (Part 1 & Part 2) : 2004 Photovoltaic (PV) Module Safety Qualification Part 1 Requirements for Construction Photovoltaic (PV) Module Safety Qualification Part 2 Requirements for Testing
22) IEC 62446 Grid connected photovoltaic systems – Minimum requirements for system documentation, commissioning tests and inspection
23) SP 30 : 2011 National Electrical Code (first revision)

Note- Latest edition of all applicable standards shall be considered.

Abbreviations

PV	-	Photo Voltaic
ELV	-	Extra low Voltage
LV	-	Low Voltage

VOC MOD - Module Open Ckt Voltage
VOC ARRAY - Array Open Ckt Voltage

VOC STC - Module Open Ckt Voltage at STC
Isc MOD - Module Short Circuit Current
Isc ARRAY - Array Short Circuit Current
AC - Alternating current
DC - Direct current
NOCT - Nominal operating cell temperature
STC - Stand testing conditions

3.0 GENERALREQUIREMENTS

3.1 SOLAR POWER SYSTEMS FOR

I. Telecom, SCADA, Instrumentation.
II. Outdoor lighting (Stand-alone solar street lighting poles)

3.2 BASIC PARTICULARS FOR DESIGN

Basic Details

- Suitable for industrial application.
- The system shall be designed as per Schedule of Quantity/MR at 50°C /2 °C ambient and load specified.
- The charge controller must be of Maximum Power Point Tracking (MPPT) type and shall be capable to charge the battery from SPV array & simultaneously feed the load.
- Battery shall be suitable to store the energy as per specified autonomy.
- DC-DC Converters as per data sheet & drawing.
- DC Distribution boards as per data sheet.
- Interconnecting cables & Equipments earthing- Cu plate type.

System Voltage

Differences of potential normally existing between conductors and between conductors and earth as follows:

a) Extra-low voltage: not exceeding 50 V a.c. or 120 V ripple-free d.c.;
b) Low voltage: exceeding extra-low voltage, but not exceeding 1000 V a.c. or 1500 V d.c.
c) High voltage: exceeding low voltage.

NOTE In consideration of ELV status, V_{OC} ARRAY must be used.

Voltage domain for PV array

Voltage domain	Voltage (volts)	
	Alternating current	Smoothed direct current

ELV	*Un ≤ 50 V*	*Uoc ≤ 120 V*
LV	*50 V < Un ≤ 1000 V*	*120 V < Uoc ≤ 1500 V*

Batteries in systems

Batteries in PV systems can be a source of high prospective fault currents. The location of fault current protection related to battery systems is generally between the battery and charge controller and as close as practical to the battery. This protection can be used to provide overcurrent protection for PV array cables provided the PV array cable is rated to withstand the same current as the battery overcurrent protection device.

Accordingly, the system shall be designed & The value of effective/prospective fault current shall be calculated & the calculation shall be submitted during the approval of the design document.

NOTE- The current rating of string cables must be much higher in battery systems if no individual over current protection is provided. In this case, the nearest downstream over current protection may be the battery fuse.

Marking

Each PV module used in the solar power project must use a RF identification tag (RFID), which must contain the following information. The RFID can be inside or outside the module Laminate, but must be able to withstand harsh environmental conditions.

i) Name of the manufacturer of PV Module

ii)Name of the Manufacturer of Solar cells of PV Module

iii)Month and year of the manufacture (separately for solar cells and module).

iv) Country of origin (separately for solar cells and module)

v) I-V curve for the module

vi) Peak Wattage, Im, Vm and field factor (FF)for the module

vii)Unique Serial No. and Model No. of the module

viii) Date and year of obtaining IEC/BIS PV module qualification certificate

ix) Name of the test lab issuing IEC/BIS Certificate

x) Other relevant information on traceability of solar cells and module as per ISO 9000 series.
xi) Polarity of terminals or leads (colour coding is permissible as per standard practice);
xii) Maximum system voltage for which the module is suitable.

The date and place of manufacture shall be marked on the module or be traceable from the serial number.

Warranty of PV Module

The warranty of the solar module is the measurement of the power after a certain time of working, warranty of the Module should be for the 20 years @ 80% of guaranteed power output of Module at the time of purchase.

4.0 SOLAR PHOTOVOLTAIC MODULES- FLP TYPE, ATEX/ CSA CERTIFED

SPV modules manufactured using Crystalline Silicon solar cells shall be used for power generation. SPV modules should have excellent durability to withstand extreme temperature and weather conditions. The photovoltaic solar array, charge controller shall be sized to meet battery back-up, load cycle requirement (as per scope of work/PJS) of connected load with availability of solar energy. SPV array shall be connected in series-parallel combination to obtain required voltage and current rating of a solar module. However, the rating of solar system shall not be less than as specified in SOR/MR.

5.0 ESSENTIAL FEATURE OF THE SOLAR MODULES/STRING/SUB-ARRAY/ARRAY

- Crystalline silicon cells shall be mono/poly Crystalline shall be used in solar module for power generation.
- Suitable for DC 24V system
- Encapsulation of cells using UV stabilized polymer (EVA) and protective back cover using Tedler-Polyster-Tedler.
- High transmission toughened glass and anodized aluminium/hot dip galvanized Steel frame for mounting.
- Total dimensions of solar array panels shall be such that it can be accommodated in existing space/roof as indicated in data sheet.
- Solar module must comply with IEC 61215/IS:14286
- Bird spikes shall be provided to avoid bird setting on solar module/array.
- Solar module shall be able to withstand following environment conditions
  Wind Velocity –Min. 170 Km/Hr or as per site survey
  Max Relative Humidity – 98%
- Long service life (20 Years).
- Power guarantee of 80% @ 20 year

5.1 Protection against electric shock and fire- (As per IEC: 62257)

Protection by extra-low voltage systems shall be classified as Class III or better as per IEC.

For all other systems, protection by double or reinforced insulation between any live conductor and any earthed or exposed conductive part (i.e. Class II modules and double or reinforced insulation for the whole PV array) is required.

5.2 Protection against over current to be provided for Modules/Array/String/Sub Arrays-

Fault currents due to short circuits in modules, in junction boxes or in module wiring or earth faults in array wiring can result in overcurrent in a PV array. PV modules are current limited sources but because they can be connected in parallel and also connected to external sources (e.g. batteries), they can be subjected to overcurrent caused by either multiple parallel adjacent strings or from external sources or both.

The over current protection shall be provided as per IEC: 62257.

5.3 Protection against Lightning & Over-Voltages

The protection shall be provided as per IEC: 62257 & 62305.

When a PV array is protected by a lightning protection system, the metal structure of the PV array should be bonded to the lightning protection system, unless the minimum safety clearances as specified in IEC 62305-3 can be achieved.

5.4 Surge arresters

Surge arresters shall be provided for protecting electrical systems and equipment against over-voltages. When these devices are used the recommendations of IEC 61643-12 should be observed.

Over-voltage protection with surge arresters should be provided when the PV power system meets any of the following criteria:

a) Supply of critical loads (e.g. telecommunication repeater stations), or
b) The PV array has a rated capacity greater than 500 W, or
c) The PV array is protected with a lightning protection system.

Recommended specifications

The recommended specifications for surge arresters to protect PV arrays from over-voltages caused by indirect lightning strikes are as follows: (refer to list of parameters for surge arrester selection in IEC 61643-12:

a) Maximum continuous operating voltage (UC): $U_C > 1.3 \times V_{OC}$ STC GEN
b) Maximum discharge current (I max): I max ≥ 5 kA
c) Voltage protection level (Up): $U_C < Up < 1.1$ kV

6.0 BATTERY UNIT

6.1 The battery shall be SMF VRLA type & in series -parallel combination.

6.2 Ampere-hour capacity of the battery are mentioned in the SOR/MR.

6.3 Battery installation shall be inside the FLP junction boxes in outdoor.

6.4 Overall dimensions of complete battery set shall be such that it can be accommodated in FLP Junction boxes.

7.0 MPPT CHARGER

a) MPPT Charger shall be supplied as integrated unit depending upon the size of the solar power system.

b) Safety EMC / Standard IEC/EN 61000-6-1/2/3/4, IEC/EN 62109-1, IEC/EN 62109-2.

c) MPPT Charger shall be capable of complete automatic operation, including wake-up, synchronization & shut down.

d) The MPPT charger shall be provided with dual input sources - one input from the SPV array and second input from the 230V AC to 24V DC SMPS. The MPPT charger output shall be provided such that it shall charge the battery and feed the load simultaneously. In absence of SPV source, it shall charge the battery through the second input. Also, in absence of any source, it shall be able to feed the load through the battery.

e) The software for performance monitoring of the system along with Laptop (at each plant) for remote monitoring (RS-485 serial communication, protocol-ModBus) and required hardware for interfacing the plant are to be supplied.

TOOLS & TACKLES AND SPARES:

After completion of installation & commissioning of the power plant, necessary tools & tackles are to be provided free of cost by the bidder for maintenance purpose. List of tools and tackles to be submitted by Bidder for approval

A list of requisite spares in case of MPPT charger comprising of a set of control logic cards, IGBT driver cards etc. Junction Boxes. Fuses, MOVs / arrestors, MCCBs etc along with spare set of PV modules be indicated, which shall be supplied along with the equipment.

8.0 DISTRIBUTION BOARDS

COSTRUCTION FEATURES-

8.1 MECHANICAL DESIGN-

a) Non-draw out type, floor mounted/wall mounted as specified in data sheet.
b) Sheet steel clad, front operation and maintenance type.
c) Degree of protection IP 65.
d) Cable entry from bottom
e) Tinned-Cu Bus Bar of suitable size.

8.2 INDICATIONS/METERS-

a) O/P DC Voltage
b) O/P AC Voltage
c) O/P AC Current

9.0 INTERCONNECTING CABLES

- Cu conductor, XLPE insulated, PVC sheathed, armoured/unarmored, FRLS type cables as per

relevant IS/IEC standard, used for interconnection among arrays, charge controller, battery bank, junction boxes and distribution boxes etc.

- IR/UV protected Cables shall be used. (Solar Grade)
- Double compression type cable glands, tinned Cu lugs, cable tags, cable marker for underground cables.
- Cable sizes for PV string cables, PV sub-array cables and PV array cable shall be determined with regard to both, the minimum current capacity and the maximum voltage drop requirements-

Voltage drop criteria-

It is recommended that under maximum load conditions the voltage drop from the most remote module in the array to the terminals of the application circuit should not exceed **1%** of the nominal system voltage for DC system & **2%** for AC system. The necessary voltage drop calculations to be submitted for approval.

Max. Current requirement Criteria-

- **Current carrying capacity (CCC)-**The minimum cable sizes for PV array wiring, based on CCC, shall be based upon a current rating calculated from below table, and the current carrying capacity of cables as specified in IEC 60287/ IS-7098/1554.

NOTE In some PV module technologies $I_{SC\ MOD}$ is higher than the nominal rated value during the first weeks or months of operation. This should be taken into account when establishing cable ratings.

Type of cable	Minimum current upon which cable cross sectional area should be chosen* **
PV string cable (PV string overcurrent protection not provided)	Trip current *** of the nearest downstream overcurrent protection device + 1.3 x Isc MOD x (*S*PO – 1) Where: *S*PO is the number of parallel connected strings protected by the nearest overcurrent protection device. NOTE When no overcurrent protection is used *S*PO is the total number of parallel connected strings in the PV array; and the trip current of the nearest overcurrent protection device is replaced by zero.
PV string cable (PV string overcurrent protection provided)	Trip current *** of the PV string overcurrent protection device
PV sub-array cable (PV sub-array overcurrent protection not provided)	The greater of the following: a) Trip current*** of the PV array overcurrent protection device + 1.3 xSum of short circuit current of all other sub-arrays b) 1.3 x *I*SC S-ARRAY (of relevant array) NOTE When PV array overcurrent protection is not used, the corresponding parameter is replaced by zero in equation (a).

PV sub-array cable (PV sub-array overcurrent protection provided)	Trip current*** of the PV sub-array overcurrent protection device
PV array cable (PV array overcurrent protection not provided)	1.3 x Isc ARRAY
PV array cable (PV array overcurrent protection provided)	Trip current*** of the PV array overcurrent protection device
* The operating temperature of PV modules and consequently their associated wiring can be significantly higher than the ambient temperature. A minimum operating temperature of maximum expected ambient temperature + 45° C should be considered for cables installed near or in contact with PV modules. ** The location and method of installation (i.e. enclosed, clipped, buried etc) of cables also needs to be considered in establishing a cable rating. Cable manufacturers recommendations need to be taken into account in establishing the rating according to installation method. ***Trip current is the nominal current at which the overcurrent protection device is calibrated to operate. The current at which the device trips will generally be greater than the nominal rated current.	

Insulation of cables

The insulation of cables used within the PV array shall:

Have a voltage rating of at least 1.2 x V_{OC} ARRAY,

NOTE The use of single core insulated and sheathed cable is recommended for wiring of LV PV arrays, to minimise the risk of faults within the wiring.
Have a temperature rating according to the application,

NOTE PV modules frequently operate at temperatures of the order of 45 °C above ambient temperature. Cable insulation of wiring installed in contact or near PV modules shall be rated accordingly.

The calculation for the selection of the conductor sizes & insulation thickness to be submitted for approval

Switching Devices

All switching devices, shall comply with the following requirements:

– rated for d.c. use (especially when voltage is over 30 V due to the risk of arcs);
– have a voltage rating equal to or greater than 1.2 x V_{OC} ARRAY;
– not have exposed live metal parts in connected or disconnected state;
– interrupt all poles, except in the case of a pole connected either to earth or to a protective conductor.

Disconnectors

In addition to the requirements of switching devices, disconnectors shall have a current rating equal to or greater than the associated overcurrent protection device, or in the absence of such device, have a current rating equal to or greater than the required current carrying capacity of the circuit to which they are fitted. (Refer to Table for current calculation) In addition, circuit breakers and any other load breaking disconnection devices used for protection and/or disconnecting means shall comply with the following requirements-

Not be polarity sensitive (Fault currents in a PV array may flow in the opposite direction of normal operating currents).

- Be rated to interrupt full load and prospective fault currents from the PV array and any other connected Power sources such as batteries, generators and the grid if present.
- When overcurrent protection is incorporated, the trip current shall be rated according to IEC 62257
- Plug connections for interruption under load may also be used if equivalent level of safety can be assured.

NOTE Only specially constructed plugs and sockets are capable of interrupting load safely. All systems with an open circuit voltage greater than 30 V can experience d.c. arcs. Plugs and sockets which are not specially constructed for load interruption if disconnected under load represent a safety risk and generally incur damage to the connection which will compromise the quality of the electrical connection and could lead to overheating of the connection.

Fuses

Fuses used in PV arrays shall comply with the following requirements:

- Be rated for d.c. use
- Have a voltage rating equal or greater than 1.2 x *V*OC ARRAY
- Be rated to interrupt full load and prospective fault currents from the PV array and any other connected power sources such as batteries, generators and the grid, if present.

NOTE When fuses are provided for over current protection, the use of fused switch-disconnectors (fuse combination units) is recommended.

Fuse holders

Fuse holders shall comply with the following requirements:

- Have a voltage rating equal or greater than 1.2 x VOC ARRAY.
- Have a current rating equal or greater than the corresponding fuse.
- Provide a degree of protection not less than IP 2X.

By-pass diodes

By pass diodes may be used to prevent PV modules from being reverse biased and consequent hot spot heating. If by-pass diodes are used, and they are not embedded in the PV module encapsulation, they shall comply with the following requirements-

- Have a voltage rating at least 2XVOC MOD of the protected module.
- Have a current rating of at least 1.25 XISC MOD.
- Installed according to module manufacturer's recommendations.
- Installed so, no live parts are exposed.
- Protected from degradation due to environmental factors.

Blocking diodes

Blocking diodes may be used but they are not a substitute for overcurrent protection. In systems containing batteries it is recommended that some device will be implemented to avoid reverse current leakage from the batteries into the array at night. A number of solutions exist to achieve this including blocking diodes.

If used, blocking diodes shall comply with the following requirements:

Have a voltage rating at least 2 x *V*OC ARRAY

Have a current rating of at least 1.25 times the short circuit current at STC of the circuit that they are intended to protect; that is-

- 1.25 x *I*SC MOD for PV strings
- 1.25 x *I*SC S-ARRAY for PV sub-arrays
- 1.25 x *I*SC ARRAY for PV arrays
- Installed so no live parts are exposed
- Protected from degradation due to environmental factors.

If there is a special recommendation from the manufacturer or from local regulation to use blocking diodes in PV strings of the PV array, these diodes shall be installed as per their recommendations.

Blocking diodes are used, their reverse voltage shall be rated for 2 x UOC STC of the PV string. The blocking diodes shall be connected in series with the PV strings

10.0 JUNCTION BOXES-FLP TYPE

The junction boxes shall be dust vermin proof, flame & waterproof, AL material with IP65 protection with adequate size current collection terminals. Size of the JB's shall be suitable with adequate safety factor & space to accommodate battery, MPPT Charger etc. Metal oxide arrestor shall be provided inside the array junction boxes.

FLP Junction boxes shall be mounted on MS structure and shall be suitable for the hazardous area mentioned in the area classification.

11.0 ARRAY SUPPORT STRUCTURE

The photovoltaic array support structure forms part of installation and must be constructed of MS Steel. The support frame shall hold the array at the optimum angle and orientation for the site and shall be roof/ground mounted.

The PV array support structures should comply with national standards and regulations with respect to loading characteristics. Particular attention should be given to wind loads on PV arrays.

Support structures and module mounting arrangements should comply with applicable building codes (including earthquake requirements where relevant), regulations and standards.

Corrosion-

When possible all structures shall be painted with 3 layers of painting for corrosion resistance – 1 layer of primer and 2 coats of paint.

All bolts, nuts and fasteners shall be preferably of Hot dip Galvanised Iron or SS material to prevent the coroosion.

Provisions shall be made in order not to create electrochemical corrosion between the structures and the building on the one hand, and the structures and photovoltaic modules on the other. **If the system is earthed**, it is recommended that the negative conductor be connected to the earth electrode as this arrangement will reduce electro-chemical degradation of the electrode and other metallic parts.

Wind load-

Wind force applied to the PV array will generate a significant load for building structures. This overload should be accounted for in assessing the capability of the building to withstand the resulting forces.
On assessing this component, the maximum wind speed observed (or known) on site shall be used, with due consideration for punctual wind events (cyclones, tornadoes, hurricanes, etc.). The PV array structure shall be secured in an appropriate manner or in accordance with local building standards.

The minimum wind flow requirement is given in cl no. 4.1, however it shall be observed at site & accordingly the effective loading capacity of the structure to be calculated.

The Bidder shall submit the total weight of structure, array & other accessories taking care of wind load, according the strength of the structure to be designed.

12.0 Earthing system

PV array earthing

General

The earthing of the PV system is classified as follows-

1. Earthing of the main current carrying conductors of the array (system earthing)
2. Earthing of exposed conductive parts for lightning protection and/or equi-potential bonding.

PV array system earthing

In the following Table several configurations are considered. No consideration is given to earthing of exposed conductive parts, which is covered in the following clause.

PV system earthing configurations

Photovoltaic array earthing equipment	Application circuit	Consequence on the status of the PV array
Unearthed	Unearthed DC loads	Floating
	Earthed DC loads	Fixed to earth
	AC loads connected via isolated PCU	Floating
	AC loads connected via a nonisolated power conditioning unit	Fixed by the status of the neutral of the application circuit
Earthed * **	Unearthed DC loads	Fixed to earth
	Earthed DC loads	
	AC loads connected via isolated PCU	
	AC loads connected via a nonisolated power conditioning unit PCU	Not permitted

* In non-centre-tapped, earthed PV arrays, either the positive or negative pole could be connected to the earth, but the preferred configuration is to earth the negative, because connecting the positive to earth could result in corrosion of the earthing electrode.
** In a centre-tapped earthed PV array where the PV array is equally divided into two segments connected in series and the midpoint connected to earth. The “consequences on the status of the PV array” column is not changed whether the array is centre-tapped earthed or earthed on only one pole.

Earthing of exposed conductive parts and equipotential bonding

There are three possible reasons for earthing exposed conductive parts of a PV array-
a) Protective earthing to provide a path for fault currents to flow
b) Lightning protection
c) Equipotential bonding to avoid uneven potentials across an installation.

PV array frame earthing shall be done in accordance with the IEC: 62257/IS: 3043.

Earthing electrode

If a separate earthing electrode is provided for the PV array, this electrode shall be bonded to the installation earth.

See recommendations on the design of electrodes for lightning protection.

Equipment earthing

Equipment earthing refers to the bonding to earth of all exposed conductive parts and frames of the PV array including any structural metalwork. PV array frame earthing shall be done in accordance with the IEC: 62257.

Earthing conductors

All PV array earthing conductors shall comply with the material, type, insulation, identification, installation and connection requirements specified in IEC 60364-5-54.

Earthing terminal of PV system

When the PV array is earthed, the connection to earth shall be made at a single point and this point shall be bonded to the installation earth.

In systems without batteries, this connection point shall be between the PV array disconnection device and the power conditioning unit and as close as possible to the power conditioning system.

In systems containing batteries, this connection point shall be between the charge controller and the battery protection device.
NOTE This is to allow for interruption of any earth fault current.

PV system earthing conductor

If the PV array is earthed, the PV system earthing conductor shall be sized to carry 1.25 x ISC ARRAY continuously, and comply with the provisions for earthing conductors specified in national wiring standards or in absence of such standards, with the provisions set out in IEC 60364-5-54/IS: 3043 with respect to material and type, insulation, identification, installation, connections and aluminium conductors.

Installation Requirements-

PV array production optimization

To optimize the PV array production it is necessary to fulfil the following requirements:

Orientation, tilt angle and flatness

In so far as possible, the orientation and tilt angle of the modules shall optimize the production of energy in relation to the needs. The north or south orientation of the modules is hemisphere dependent. However, the building may not necessarily allow ideal orientation of these two

parameters (roof not orientated south or north, vertical front…) and therefore they shall be clearly accounted for in the production calculation at the sizing design phase. What ever the array latitude, it is generally recommended that the slope shall keep to a minimum value of ten degrees (10°) in relation to the horizontal, thus preventing stagnation and allowing rain water to carry away dust deposits. Moreover, periodical cleaning actions shall be performed, however, as need be. The surface for fitting photovoltaic modules to structures shall be perfectly flat in order not to induce mechanical stresses on securing the modules in order to avoid risks of module rupture.

Location: accounting for shadow

Environmental

Shadowing of the PV array should be minimized or preferably eliminated over the whole day with consideration given to all seasons of the year. A shadow blanking off a photovoltaic cell may cause loss of almost the whole production of this module, significantly reducing the performance of a string of modules.

One line of photovoltaic modules over the other

On flat roofs, photovoltaic modules are arranged in rows. The first row is fully exposed to sunshine and therefore, the shadow thus generated may affect the next row and so on.

As a basic rule, no shadow should be generated from one row to another. It may occur that the available space will not allow to have this rule readily applied: an energy production study versus the various structure configurations should be conducted (e.g., moreor less high, hence more or less spaced structures, acceptance of shadow early in the morning and end of the afternoon, change of orientation and/or of slope.)
A compromise should be retained allowing to best fulfill the site requirements for useful energy site.

NOTE Where a row comprises several modules along height, care shall be exercised in order to connect the modules to one another as a function of their height along this row. For example, lower modules will constitute a branch and upper modules will constitute another branch. This will make it possible for upper modules to continue producing energy even though lower modules are in the shadow.

Maintaining the integrity of the covering

The attachment of structures to the building must keep to the sealing efficiency of the covering and mechanical integrity of the building. Special care shall be exercised with terrace fitted units where the quality of the covering and related structure is often very poor. It is advisable to have structures laid onto the building instead of attached to it.

Safety

Attention should be given in the operation and maintenance procedures to the following safety requirements:

a) Emergency shutdown procedure;
b) Obey all warning signs;

c) Shut system down and interrupt PV array currents according to the manual shutdown procedure;
d) Split strings into extra low voltage sections (if relevant);
e) Warn of the live parts that cannot be de-energised during daylight.

13.0 SOLAR STREET LIGHTING SYSTEM

A stand alone dusk-dawn solar photovoltaic street lighting system comprises of FLP solar PV module, FLP LED Light, lead acid battery in FLP Junction boxes, control electronics, Inter-connecting wire/cables, Battery box, Module mounting hardware, Hot Dipped GI-Pole.

14.0 DRAWINGS AND DOCUMENTS

15.1 The following documents shall be submitted along with the offer:

a) Filled up data sheet.
b) Approx. dimensions of the system

15.2 The following drawings (in three sets) shall be submitted **for approval** within 3 weeks of award of contract.

a) Geographical survey report required for solar system design, tilt angle calculations etc
b) Geo Graphical Data of the site (Avg Insolation, Wind Flow, Solar Radiation data (Monthly), and battery sizing calculations.
c) Data sheets & specification of SPV Modules, FCBC Charges, MPPT Chargers, Ni-Cd Battery, DC-DC Converter, DCDBs, Solar Street Lights
d) STAAD analysis report of SPV structure
e) SPV array installation & foundation drawings on MS structure.
f) Junction box installation on MS structure.
g) Earthing & Lightning calculations & drawings
h) Complete Hybrid solar system working philosophy.
i) MPPT Charger working philosophy.
j) Cable size selection calculation considering the voltage drop & insulation along with voltage grade, type, size and Cable schedule
k) System protections provided at various stages of the system
l) G.A. of solar panel, charge controller and battery bank.
m) G.A. drawing of street lighting pole
n) G.A. drawing of MPPT charger.
o) Schematic.
p) Bill of Material.
q) Installation manual.
r) Operation & Maintenance Manual.
s) Wiring diagram for reference.

15.3 Final drawings/data sheets, operation & maintenance manual and erection instructions shall be submitted in six prints / One Soft Copy.

15.0 TESTING OF SOLAR MODULES

Solar modules shall be tested as per the test sequence mentioned in the IEC: 61215 & IEC: 60904.

Insulation test of Modules-

500V DC+2 x Max System Voltage (For Modules less that 0.1 m^2 area)
1000V DC+2 x Max System Voltage (For Modules area greater than 0.1 m^2 area)
Value of Insulation Resistance should be as per IEC; 61215

16.0 INSPECTION

Inspection and testing of equipment shall be carried out by the owner/ consultant at the works of the contractor and performance test at site on final product to ensure conformity of the same with the acceptable criteria of technical specification, approval drgs. and reference national/ international standards.

16.1 The contractor shall submit Quality Assurance Plan (QAP) for respective equipments within 3 weeks of award of contract.

QAP shall be prepared and furnished by the contractor in MECON Form No. 11.20(4.4) F-10 along with their internal in process quality checks.

16.2 Tests as per international standard for solar system and grid charger at manufacturer works.

16.3 Batteries shall be tested for `Acceptance Test at manufacturer's works as per IS. Type and routine test reports shall be submitted for review.

16.4 Final integrated testing (Full load test) along with solar array, charge controller and the batteries & PCU shall be done at site. Site acceptance test procedure shall be submitted by the Contractor along with QAP.

-X-X-X-

ANNEXURE-4

RTU I/O LIST

MECON LIMITED	PARTICULAR JOB SPECIFICATION	
	PJS No.: MEC/05/E5/T/23VC/SPUR/PJS-098	
	Rev. 0	

I/O LIST

Sl. No.	RTU	Location	Type of RTU as per MR	AI I/O's				AO I/O's	DI I/O's				DO I/O's				Serial/ (RS-485) ports			
				Inst	CP/CC & Cathodic Protection	UPS / Solar/ Electrical	Total		Inst	CP/CC & Cathodic Protection	UPS / Solar/ Electrical	Total	Inst	CP/CC & Cathodic Protection	UPS / Solar/ Electrica	Total	Inst	Electrical	UPS / Solar	Total
1	RTU TYPE-1	TO BE FINALIZED DURING DETAIL ENG	TYPE-1	12	4	6	22	2	26	2	10	38	8	2	0	10	2	1	1	4
2	RTU TYPE-2	TO BE FINALIZED DURING DETAIL ENG	TYPE-2	6	0	0	6	0	7	0	2	9	2	0	0	2	0	0	1	1

NOTES:

	1	In Addition to the above Quantities 25% Spare I/Os shall be considered while sizing of RTU for each Station. Each spare channel of each type of I/O shall be terminated till the terminal block of each RTU.
	2	The I/Os for each system are tentative. If any number of the IO points(including the MODBUS port) mentioned in the IO list is not used for its intended purpose, the same shall be utilised by IGGL/ MECON for other purpose as deemed necessary by IGGL/ MECON.
	3	The I/O Counts will be finalized during Detail Engineering.
	4	In addition to above, Minimum 1 nos. of spare RS 485 ports shall be provided at each station