

SECTION-V
TECHNICAL SPECIFICATION FOR SUBSTATION AUTOMATION SYSTEM

1.01 General:

The Sub-station Automation System is to be installed and commissioned on 220 kV sub-stations to make it suitable to operate and control it from remote, communicate important data to control and various load dispatch centres and make it possible to unman sub-station when required.

1.02 Philosophy of Sub-station Automation System:

Sub-station Automation System (hence forth SAS) shall be provided on sub- stations to make it possible to control all the 220 kV switchyard equipment (i.e. circuit breakers and isolators), from local & remote control room. There will be two operator work station (OWS) (**Industrial PC**), one engineer work station (EWS) (**Industrial PC**) at each sub-station. The status of complete 220kV switchyard, including the alarm/event log shall be available in the station control room (SCR). It shall be possible to control sub-stations from remote and station HMI. Control shall be possible from BCU/control IEDs at bay level as well. System shall maintain log sheet of various parameters being monitored half hourly/daily as per format (**Annexure**) and it shall be possible to change the format of parameters being recorded as and when required. The SAS shall be suitable for full protection, control, metering, monitoring, communication functions of all the bays **including bus bar protection system and NIFPES system**. The architecture for the SAS is enclosed in the attached "SAS Architecture" (Annexure-XIV). The SAS shall be flexible to allow future extensions in switchyard. **At present SAS software shall be sized to cater present bays with minimum 20% spare capacity OR minimum 8000 process IOs whichever is higher.** The SAS at substation level and the communication network(s) shall be designed in a dual redundancy configuration. No single failure of any component/module of the SAS, including the communication links, shall cause loss of functionality of the SAS of more than a single bay. SAS shall be designed such that maintenance, modification or extension of its components/modules shall not cause shutdown of the complete SAS. ***In all the aforementioned substations, {Signal And System (SANDS), Chennai make} GPS time referenced clock receivers are in service for time synchronization of IEDs on SNTP. The time of SAS and all its components shall be synchronized with these GPS reference clocks.*** Substation Automation System (SAS) shall be installed to control and monitor all the sub-station equipment from remote control centre (RCC) as well as from local control centre. The SAS shall be equipped with cyber security features (**hardware base firewall and networking cum intrusion detection tool**) for preventing the grid network from the external network threats to the system. The Cyber security for SAS offered by bidder shall be as per relevant NERC/IEC standard. ***Hardware and software for SAS to be provided at all substations should be of similar type and configuration and should be sufficient for serving as RCC. Also there shall be provision to assign any of the substations as RCC at any time.***

Note:

1. Industrial Workstations (capable for 24x7 running) should be used for all applications including Servers, Gateways, HMIs as well as Engineering PC. Moreover, storage should be SSD+HDD type

such that Operating Systems as well as Software should be installed on SSD for smooth and fast operation.

2. Hardware such as RAM, Processors etc. of Engineering PC should be of suitable specifications so that multiple OEM Relay configuration software may run at the same time efficiently.

1.03 Scope

Complete engineering, supply, erection, testing and commissioning of the substation automation system for 220kV substation Budhlada (RCC at 220kV Mansa) and 220kV Gurdaspur (RCC at 220kV Sarna) as per detail specification. Bidder will supply erect and commission control server for SAS and VMS for remote operation form RCC stations. Bidder shall provide all the material required for provision of complete SAS as per Schedule of Requirements (Annexure-II) and Details of material (Annexure-III). Any item which is not mentioned in the Details of material (Annexure-III), which is otherwise required for completion/ commissioning of the SAS, shall be provided by the bidder without any extra cost. Wherever necessary, the contractor shall provide Red Boxes (Redundancy Boxes) to connect existing IEDs to the SAS Network. In case of any expansion takes place on any Sub-Station before commissioning of SAS, the contractor shall supply the additional necessary equipment/material to integrate the equipment added due to such expansion, in the SAS and the cost for the same shall be paid as per the prices given in the Schedules of Prices (Annexure-IX).

The following works are included in the scope of tender/contractor for providing SAS on the substations: -

- i) Design, fabrication, wiring & testing at manufacturer's works, supply, erection, testing & commissioning of Substation Automation System at 220 kV Substations as given in Schedule of requirement in Annexure-II.
- ii) Following controls of switchgears and substation auxiliaries shall be provided through SAS from local & remote control centre (RCC):-
 - a) Opening-Closing of Breakers of all ratings.
 - b) Opening-Closing of Earth Switches of 220 kV/132 kV/66 kV.
 - c) Opening-Closing of Isolators of 220 kV/132 kV/66 kV.
 - d) Battery charger operations.
 - e) All auxiliaries, yard/street lighting etc.
- iii) Procurement & mounting of all equipment included in the schedule of requirements together with auxiliary items adjunct or complementary to those specified. Minor civil work at any site shall also be in the scope of bidder.
- iv) All wiring from the bay control units, distance protection relays/over current relays, other control circuits in the control & relay panels/other sub-station auxiliary equipment & communication equipment to terminal blocks. The control cables, optical fiber cable, Ethernet cable and other allied equipment required for interconnection of sub-station equipments and various computer work stations shall be in the contractor's scope and should conform to relevant Indian/international standards. Each control cable shall have at least two cores and optical fiber cable shall have four optical fibers as spare for future use. **Inter panel wiring for**

LBB (Local Breaker Back up) shall be in the scope of bidder. (point only applicable in case of new panels to be installed or retrofitting job to be executed in the substations in respect of BOQ)

- v) Newly installed panels are commissioned with dedicated numerical Bay Control Units (BCUs) for each 220 kV, 132 kV & 66 kV Bays bay for monitoring and Control functionality on IEC-61850 standard and for 11 kV breakers are already installed with IEDs (IEC- 61850 and PRP compliant). In case of old panels Dedicated numerical Bay Control Units (BCUs) shall be provided for each 220 kV/132kV bay/66 kV Bays for monitoring and Control functionality on IEC-61850 Ed1/Ed2 standard. For control of old 11 kV breakers, the bidders may optimize the solution in such a way that all the monitoring & power data, events and disturbance record should be available on IEC-61850 Ed1/Ed2 Protocol on local and remote work stations. In case multiple bay control is offered through one BCU, redundancy of BCU may be ensured. The bidders required to integrate these panel in such a way that all the monitoring & power data, events and disturbance record should be available on IEC-61850 Protocol on local and remote work stations.

Analog Inputs of IEDs had already connected to current transformer and voltage transformers as the measurement of power quantities (Voltage, Current, MVAR, MW, MVA etc.) shall be taken from the IEDs. In case of and missing input the bidder required to integrate the signals to SAS directly or through concerned C&R panels IEDS. Configuring existing IEDs for integration in SAS will be in bidders scope.

Note:- In case of multiple bay control, the bidder shall supply separate panels having comfortable working space, for mounting BCUs.

- vi) In all respects and any equipment of auxiliary nature not specifically mentioned but essentially required for proper design, coordination, operation and maintenance should be considered and included under scope of this specification without any extra cost to the PSTCL.
- vii) The successful tenderer shall supply all equipment (SAS, C&R Panels etc.), ***furniture of Godrej make (wooden top with steel frame tables, revolving cushioned chairs etc. of good quality and suitable sizes) required for each work stations in substations and accessories*** listed in the specification with such modifications and alterations as are agreed upon in writing after mutual consultations without any financial commitment to the PSTCL. All fittings control devices and supports for equipment offered or required for linking up of all such equipment to the PSTCL's system shall be supplied by the tenderer.
- viii) The control and protection relays shall be retrofitted (where required) in the substations control room in existing panels. Relays shall be replaced/retrofitted in such a way that at least one IEC 61850 compliant main protection scheme for each line bay and one IEC61850 compliant numerical over current/earth fault relay for secondary side of transformer bay shall be available to integrate all the bays with SAS. Wherever required, Protection and control panels shall be provided & shall be kept in control room. Replacement of the panels identified as very old shall be in the scope of supplier.
- ix) Contact multiplication and all type of cabling shall be in the scope of contactor.

- x) To get all analog signals (temperature of transformers, tap position, battery charger voltage/current etc.) from various equipment on SAS, Transducers (if required) shall be provided by the bidder.
- ~~xi) All the existing master relays and auxiliary relays that do not have electrically reset facility shall be replaced with hand as well as electrically reset relays and shall be in the scope of contractor.~~
- xii) Outdoor cameras and video monitoring system for monitoring of the equipment installed in the yard shall be provided by the contractor. **The control of all auxiliaries/ through HMI shall be in the bidder's scope.**
- xiii) Deleted.
- xiv) The supply of Mandatory Spares and spares required to meet the availability of the system, if any, shall be included in the scope of Contract.
- xv) There shall be provision for the integration of all the condition monitoring equipment (e.g. Dissolved Gas Analyzers etc.) installed in the substations with the Substation Automation System.

1.04 Standards

The equipment shall conform to the latest edition of relevant Indian Standards/IEC specifications or any other recognized international standards except in so far as modified by the specification. The copies of the relevant standard specification may be attached with the tender. The tenderer shall state the standard specification to which the equipment conforms.

1.05 Deviations from specification:

Should the tenderer wish to depart from the provisions of the specification either on account of better manufacturing practices or for any other good reasons, he shall draw attention to the proposed points of departure in his tender & submit such full information, drawings and specification so that the merit of his proposal may be fully understood. The specification shall be held binding unless the departures have been fully recorded as required above. Detailed calculations/comments justifying the suitability of the relays/protection schemes/transducers offered should be given in the first instance. The calculations/comments should be supported by schematic drawings ,write ups, wherever necessary.

1.06 Climatic Conditions:

The climatic conditions prevailing at site under which the equipment shall operate satisfactorily are as follows:-

- i) Maximum temperature of the air in shade : 50 degree C
- ii) Minimum temperature of the air in shade : 0 degree C
- iii) Maximum temperature of the air in sun : 60 degree C
- iv) Maximum relative humidity : 100%
- v) Number of months for tropical monsoon : 3 Months

condition per annum.		(approx.)
vi) Average number of dust storm days per annum	:	40
vii) Earth quake incidences	:	Site susceptible to earthquakes.
viii) Altitude	:	Not exceeding 1000meters above mean sea level.

Tropical Treatment

All corrodible parts and surfaces shall be of such material and be provided with such protective finishes that no part of the installed equipment shall be injuriously affected by atmospheric conditions. All electrical auxiliary equipment shall be given special treatment for tropical conditions.

1.07 Drawings and literature:

- i) The tenderer should submit with his tender dimensioned drawings of the equipment offered along with illustrated and descriptive literature of protection scheme offered, the complete technical literature of each relay is to be submitted with the tender irrespective of the fact whether the similar literature has earlier been supplied or not. Also leaflets showing relay/transducer characteristics/cutouts & other technical details of each equipment to be mounted on the panel are to be submitted with the tender.
- ii) The successful tenderer shall complete detailed engineering of all sub stations and furnish 2 sets of the wiring drawings, layouts, material list (substation wise) and literature within three months from the date of issuance of Work order. The drawings shall be approved within 21 days from the date of submission.
- iii) The successful bidder shall also supply 3 sets of above drawings and amended wiring drawing of existing panels on A-3 paper size (duly bound) per sub-station and 3 sets of literature along with 5 sets of soft copies(CD's) for each sub-station shall be supplied for use of field offices before commissioning. Photocopies of the literature shall not be accepted. ***The contractor shall also supply 4 CDs of latest softwares of IEDs, SAS etc., used in SAS at each sub-station.*** Required drawings of C&R panels, circuit breaker, Transformer M. Boxes etc. will be furnished to the contractor to prepare/coordinate wiring diagram and cable schedule.
- iv) The Employer/Purchaser will return to the Vendor/Contractor (a) one print stamped "Approved" or (b) one print stamped "Approved with comments as noticed" or (c) one print marked with comments. In this case of (a) no further submission of the drawings is required. In the case of (b) the Vendor/Contractor shall correct his original drawing to conform with comments of the Employer/Purchaser or the Engineer/Consultant and furnish the corrected drawings to the Employer/Purchaser and Engineer/Consultant for the purpose of records. In the case of (c) the Vendor/Contractor shall correct his original drawing to conform with comments and corrections of the Employer/Purchaser or the Engineer/Consultant and resubmit the drawings to the Purchaser/Engineer within two (2) weeks after receipt of the marked up print for approval. When the Vendor/Contractor resubmits the drawing, he should

incorporate Engineer's/Consultant's drawing number which corresponds to the Vendor/Contractor's in the respective drawing. The Engineer's/Consultant's drawing number shall be thereafter for all purpose of reference.

- v) Drawings prepared by the Vendor/Contractor and approved by the Employer/Purchaser shall be considered as a part of the Specification. However, examination and approval of the drawing by the Employer/Purchaser or the Engineer/Consultant shall not relieve the Vendor/Contractor of his responsibility for engineering, design, workmanship and materials, under the contract.

1.08 Wiring

Suitably colored/marked PVC 1100/650 V grade FRLS insulated wires shall be used throughout. Wiring shall be with not less than 1.5 sq. mm Stranded copper conductor except CT circuit wiring which shall not be less than 2.5 sq. mm. Copper conductor. All wiring shall be securely fixed in position and shall be so arranged as to enable connections to be easily traced and shall have small number of angles and bends. Connections to the instruments, relays etc. shall be so arranged or marked as to be neatly dressed and should not protrude in air giving it a indecent look & it should be easily traceable. The ferruling shall be as per relevant standards. At the terminals of each wire shall be provided an erinoid cap which shall have engraved on it a number corresponding to that on the wiring diagram of the control panels to the remote end of the multicore cables. Separate terminal block shall be used by contractor for wiring of new added equipment in panels. All trip circuit's connection shall have additional red ferrules marked TRIP. Equipment wise/wire wise detailed amended wiring schedule including TBs detail for all panels shall be supplied to the PSTCL before the commissioning of SAS. Contractor shall be responsible for completeness of all circuits modified/rearranged during retro-fitting/ installation of IEDs/relays. **Wherever AC/DC supply is required in control room/yard through sockets, contractor shall provide additional supply points with proper required fittings/wiring using PVC conduits, Kiosks (wherever required) etc.**

1.09 Relays

- i) All the main relays shall be dust & vermin proof as per requirement of class IP 5X of IS 2147 and of draw out type modular construction in flush mounting pattern. In case of draw out type relays, arrangement shall be such as to short circuit the CT terminals automatically, the moment relay/relay module is taken out.
- ii) ***Test blocks (wherever required) shall be provided in the panels for testing of Main protection relays. The test blocks shall be of suitable current rating and should have terminals for feeding current and DC supply to relays from an outside testing set without causing open circuit secondary of CTs or switching off the protection.***
- iii) All the relays shall comply fully with the requirements of ISS: 3231/8686 and relevant IEC or other internationally recognized standards. The requirement of protection schemes and the function performed by various relays are as detailed in the schedule of requirements. The

relays shall have electrically separate contacts for trip and alarm purposes. All tripping relays should have suitable contacts to complete the scheme.

- iv) Type test certificate of main protection schemes (Distance Protection Relays & Transformer Differential Relays), bay control units, numerical over-current/earth-fault relays & communication equipment issued by the recognized test house should be submitted with the tender without which the bid is not likely to be considered. These type tests certificates must accompany the tender irrespective of the fact that same had already been submitted along with previous tenders. Also the copies of ISS/IEC of relevant extract thereof, according to which the type tests have been performed, must be enclosed with the tender.
- v) All the offered IEC 61850 **Ed1/Ed2** compliant relays shall be interoperable with the other make IEC 61850 compliant relays existing on the PSTCL sub-stations.
- vi) Offered numeric relays/BCUs should be conforming to IEC-61850 **Ed1/Ed2** protocol. Test certificates regarding conformity of the offered numeric relays to IEC-61850 **Ed1/Ed2** protocol from independent reputed/govt. recognized laboratory authorized by GOI must be submitted with the tender.

These type test certificates should relate to the works where the offered relays are manufactured/assembled.

1.10 Auxiliary Supply

For illumination and heaters etc. single phase 230V, 50 Hz AC supply shall be made available through local station transformer. The auxiliary supply for control and protective relay circuits, DC alarm and for indication etc. shall be made available at 220V DC (normal operating range: 160V to 250V) through a two wire system from station storage battery.

1.11 Requirement of CTs and PTs

VA output of CTs & PTs at rated values and under different fault conditions, their accuracy class and accuracy limit factor required for the proposed protection schemes shall be stated in the tender. Knee point voltage and exciting current at knee point voltage requirements of CTs under worst fault conditions shall also be stated.

1.12 Tests:

Contractor shall supply the copy of standard to which equipment comply with and also supply the test specification FAT/SAT for SAS for approval.

1.12.1 AT CONTRACTOR'S WORKS:

Functionality tests and routine tests applicable as per relevant Indian standard/IEC/FAT will be carried out on relays, bay control units and communication equipment at the contractor's works and four copies of the test reports will be supplied and got approved from the PSTCL before dispatching the equipment. ***The bidder shall have adequate knowledge of software and hardware used in SAS. Also the firm shall have complete testing facility/testing equipment required for testing of SAS at their quoted works. The bidder should submit***

undertaking in this regard mentioning the equipment available at its works along with tender documents. At the time of inspection the successful bidder shall make the network of minimum 3 no. bays at their works to demonstrate the functionality (control commands, interlocking, measurements etc.) of SAS through BCUs.

1.12.2 AT SITE:

All the relays and other equipments shall be tested at respective sites of PSTCL as per relevant Indian Standard/IEC/SAT during commissioning of SAS.

1.12.3 AVAILABILITY TEST TERMS:

- a) **Actual Outage Duration:** - The time elapsed in hours between the start and the end of an outage. The time shall be counted to the nearest 1/4th of an hour. Time less than 1/4th of an hour shall be counted as having duration of 1/4th of an hour.
- b) **Period hours:** - The number of hours in the reporting period. In a full year the period hour are 8760 h (8784h for a leap year).
- c) **Actual Outage Hours:** - The sum of actual outage duration within the reporting period.
- d) **Availability:** - The contractor shall demonstrate their availability guaranteed by conducting the availability test for **1000 hours** on the total sub-station automation system as a whole after commissioning of total Sub-station Automation system. The test shall verify the reliability and integrity of all sub-systems. Under these conditions the test shall establish an overall availability of 99.98% (i.e. the ratio of total time duration minus the actual outage duration to total time duration). In case of any outage/failure during the availability test, the firm shall rectify the problem and after rectification, the 1000 Hours period start after such rectification.

1.12.4 MAINTENANCE RESPONSIBILITY DURING THE GUARANTEED AVAILABILITY PERIOD:

During Guaranteed Availability Period, the Contractor shall take continual actions to ensure the guaranteed availability and shall make available all the necessary resources such as specialist personnel, spare parts, tools, test devices etc. for replacement or repair of all defective parts and shall have prime responsibility for keeping the system operational. During guarantee period as specified in tender document, contractor shall arrange half yearly visit of their representative to site to review the performance of system and in case any defect/shortcoming etc. is observed during the period, the same shall be set right by the contractor within 15 days.

1.13 TECHNICAL REQUIREMENTS:

The requisite technical data for all material required for provision of SAS at substations under schedule of requirement is given in Annexure-II & III. Detailed calculations/comments justifying the suitability of the protection scheme relays, bay control units etc. offered by the contractor must be given. The tenderer shall also indicate the Guaranteed Technical particulars as per Annexure-IV.

A) Sub-station automation system:

Sub-station automation system shall be provided at various 220 kV sub-stations given in schedule of requirement (Annexure-II). It should be possible to control all the 220kV switchyard equipment (i.e. circuit breakers and isolators, from switchyard control room & remote control room. There will be two operator work station (OWS) and one engineer work station (EWS) at each sub-station. The status of complete 220kV switchyard, including the alarm/event log shall be available in the SCR. It shall be possible to control sub-stations from remote and station HMI. Control shall be possible from BCU/control IEDs at bay level as well. The SAS shall be suitable for full protection, control, metering, monitoring and communication functions of all the bays in the bidder's scope. The architecture for the SAS is enclosed in the attached "SAS Architecture" (Annexure-XIV). The Bidder shall provide full details of the offered system Architecture with the Bid. The SAS architecture shall be flexible to allow future extensions in switchyard. The SAS at substation level and the communication network(s) shall be designed in a dual redundancy configuration. No single failure of any component/module of the SAS, including the communication links, shall cause loss of functionality of the SAS of more than a single bay. **Existing Battery and battery charger may be used for backup purpose however bidder required to submit the current loading calculation for vetting.**

PSTCL substation are with double DC sources hence the SAS architecture should be distributed in such a way the redundant system should be on another DC source.SAS shall be designed such that maintenance, modification or extension of its components/modules shall not cause shutdown of the complete SAS. Substation Automation System (SAS) shall be installed to control and monitor all the substation equipment from remote control centre (RCC) as well as from local control centre. The system shall be designed such that personnel without any background knowledge in Microprocessor-based technology are able to operate the system. The operator interface shall be intuitive such that operating personnel shall be able to operate the system easily after having received some basic training.

The SAS shall contain

- Unit for Control and Monitoring.
- Bay Protection
- Station Human Machine Interface (HMI)
- Output devices

SAS shall have following features: -

I. Run Time Command cancellation

Command execution timer (configurable) must be available for each control level connection. If the control action is not completed within a specified time, the command should get cancelled. If the command is not executed within the specified time, reason/suggestion should be displayed on screen of monitor.

- II. Configurable interlocking provisions in software for various control commands and blockings.
- III. A software interlock override function shall also be provided which can be enabled to bypass the interlocking function.
- IV. Threshold limit values will be selectable for alarm indications. Events and alarms generated by the switchgear, the control or protection IEDs or by any station level unit will be recorded in an event list in the Remote and Local Station HMI. **Disturbance record shall also be available at RCC (Remote Control Centre).** Alarm/abnormal conditions etc. will be displayed by means of change in colour, pop-up of separate dialog box etc. Alarm and trip events will be displayed separately on HMI. Audible alarm shall also be provided through HMI at local as well as remote Stations. Audible alarm shall have accept and reset facility through HMI.
- V. Provision of creating arithmetic functions (addition, subtraction etc.) for power computation in substation shall be there.
- VI. Continuous self-supervision function with self-diagnostic feature shall be included.
- VII. It shall be possible to form logics using OR/AND gates etc.
- VIII. On the Remote & Local Sub-station HMI the object has to be selected first. In case of a blocking or interlocking conditions are not met, the selection shall not be possible and an appropriate alarm annunciation shall occur. If a selection is valid the position indication will show the possible direction, and the appropriate control execution button shall be pressed in order to close or open the corresponding object. Control operation from other places (e.g. REMOTE) shall not be possible in this operating mode. There will be provision for sending pre-specified events to Load Dispatch Centres (LDC), real time power data and displaying of important instruction to be issued by LDC on the monitor at OWS. The analogue values/real time power data shall be updated every 2seconds.

IX. **Remote and Local Station HMI**

All the stations being controlled by remote control center should be displayed in the RCC simultaneously with appreciable resolution and a hot standby system shall also be provided. The VDU shall show overview diagrams (Single Line Diagrams) and complete details of the switchgear with a color display. All event and alarm annunciation shall be selectable in the form of lists. Operation shall be by a user friendly function keyboard and a cursor positioning device. The user interface shall be based on WINDOWS concepts with graphics & facility for panning, scrolling, zooming, de-cluttering etc.

The display shall be TFT (Thin Film Technology) and shall accommodate resolution of 1280 X 1024 pixels with a screen size of minimum 21 inches. One **Laser** printer should be provided to take printouts of log sheets and these log sheets shall be stored in the hard disk of computer also. One **Laser** colored printer shall be provided with EWS. Printer shall be capable of printing A-3 size paper. Configuration of HMI shall such that it should be capable of smooth working in the

SAS to be provided at various substations & retaining the data as per specification. HMIs/RHMI make shall be PGCIL approved.

The mass storage unit shall be built-in to the Remote and Local Station HMI. The capacity of hard disk shall be selected such that the following requirement should occupy less than 50% of disk space:

- a) Storage of all analogue data (at 30 Minutes interval) and digital data including alarm, event and trend data for thirty Six months,
- b) Storage of all necessary software,
- c) 20GB space for Employer's use.

Supplier shall demonstrate that the capacity of hard disk is sufficient to meet the above requirement.

The object status shall be indicated using different status colors for:

- Selected object under command
- Selected on the screen
- Not updated, obsolete values, not in use or not sampled
- Alarm or faulty state
- Warning or blocked
- Update blocked or manually updated
- Control blocked
- Normal state

Existing Battery and battery charger may be used for backup purpose. However in the event of Power failure, necessary safeguard software shall be built for proper shutdown.

- X. The SAS supplied as per this specification shall be designed and constructed to meet all specification requirements for **10 years**. Further, the Bidder should guarantee for software support for **10 years** to guard against obsolescence. SAS equipment or components that cannot meet this life expectancy or specified design and operational requirements or likely to become obsolete during the entire service life shall be identified and their expected failure rate/obsolescence period with corrective action shall be indicated by the bidder in his proposal. When no such information is furnished, the SAS shall be deemed to be suitable for above service life and requirements.
- XI. Each bay control IED shall be independent from each other and its functioning shall not be affected by any fault occurring in any of the other bay control units of the station. The data exchange between the electronic devices on bay and station level shall take place via the communication infrastructure. This shall be realized using fibre optic cables, thereby guaranteeing disturbance free communication. The fibre optic cables shall be run in G.I conduit pipes. Data exchange is to be realized using IEC 61850 protocol with a redundant managed switched Ethernet communication infrastructure.
- XII. For security reasons the command is always to be given in two parts **viz.** selection of the object and command for operation under all mode of operation except emergency

operation. Final execution shall take place only when selection and command are actuated.

- XIII. There will be provision for generating log sheets as prevalent in sub-stations of PSTCL automatically at the end of day. The format will be editable.
- XIV. The event list shall contain events that are important for the control and monitoring of the substation, shall be automatically uploaded to a dedicated computer. And this list shall be available in chronological order.
- XV. There will be **wired** (or optical) IP based & latest technology video monitoring of equipment installed in switchyard in local station and it shall be possible to have this monitoring at remote sub-station as and when required by means of weather proof PTZ (Pan Tilt Zoom) cameras of 4CIF quality having resolution of 704x576 with 18X zoom. Cameras should produce pictures of very good definition to observe contacts of equipments to the extent of fasteners used in contacts using zoom features. There shall not be any instance of broken pixels in pictures. Video surveillance shall continue 24 hrs i.e. in day light, night, bad light etc. Of course yard lights shall be available in the nights but cameras shall have feature of night vision. Cameras shall be located in such a way that complete high quality views of equipment shall be available on the display unit in control rooms. The equipment of video monitoring shall be of PGCIL approved make and shall be of state-of-art technology and have capability to store the recordings for at least a week.

It shall be possible to retain some selected pieces of recording for long period (memory space **2TB** min.) and provision should be there to obtain these recording in the form of DVDs and VCDs & through USB. Video monitoring provision shall not affect the performance of SAS. Open protocol shall be used for integration of cameras so that all type/ make of cameras can be integrated with the system to be provided by the contractor and the firm will submit the ONVIF compliance certificate for cameras as well as software in this regard. Complete video monitoring solution shall be in scope of bidder/ contractor. Apart from other features of video recording the cameras shall also have features like BLC (Back Light Compensation), WDR (wide dynamic range) and IR (Infra red) & array combination for night vision. The bidder shall provide 32" LED display of PGCIL approved make for display of camera feed.

The display for video monitoring shall provide real time display upto 16 cameras.

NVR (Network Video Recorder) shall contain 16 channels so that 16 cameras may be attached to NVR.

Note:-

NVR and its supporting software should have the feature to programed Cameras in such a way that on selecting a specific element (isolator/circuit breaker/ LE switch/ transformer etc) the camera should focus on that particular element so that monitoring and controlling of the substation elements can be done effectively. Above feature should be programed for every element of substation. Bidder will

proposed the nos of cameras for effective monitoring of every elements of the substation after survey while detail engineering of the project on award.

Quantity of cameras as given in Annexure-III may increase or decrease as per site requirement. However the Bidder shall prepare his offer as per material given in **Annexure-III**.

- XVI. For security reasons the command is always to be given in two stages: selection of the object and command for operation under all mode of operation except emergency operation. Final execution shall take place only when selection and command are actuated.
- XVII. There should be provision to create various authority levels to access the control and other functions.
- XVIII. SAS supplied by the bidder should be inter-operable with other make SAS i.e. if so desired the sub-station can control the other sub-station having other make SAS or vice versa.
- XIX. Ethernet Switches: The Ethernet switches shall be compliant to make in India and cyber security guidelines issued by GOI time to time. Firm shall submit the certification in respect of Make in India and GOI authorized labs in this regard.

B) Gateway and Communication Link:

The SAS shall have the capability to support simultaneous communications with remote control centre and load dispatch centre. Existing Power Line Carrier Communication (PLCC) Link / optical fibre cable will be used for control of sub-stations from RCC and other data communication. The contractor will also verify the capability of interfacing its proposed communication equipment/ gateways etc. with existing PLCC equipment at the proposed sub-stations. The SAS shall have independent redundant Gateways (Hardware as well as Software) for communication to RCC & LDC. Each Gateway shall have minimum two communication ports for Remote Control Centre and minimum two ports for load dispatch centre.

The communication protocol for gateway to control centre must be open protocol and shall support IEC 61850 Ed1/Ed2 for all levels of communication for sub-station automation and bay level and IEC 60870-5-101 & 104 for substation to RCC.

The bidder is to provide necessary interfacing equipment at the local substations to facilitate connection of Gateways, VMS, DR cum EWS etc. with communication rack to effect communication on IEC-60870-5-104 or 101 protocol whichever is available at the substation. Similarly at RCCs/SLDC any interfacing equipment required to connect communication rack to the OWS/Servers/VMS etc. shall be in the scope of bidder. The bidder is to ensure that data related to cameras, DR workstations and SAS of the local substations are routed through two no. ports in the communication rack

Connectivity between local substations & remote control centres: The end to end communication medium between local substations and remote control centers is not in the scope of bidder.

Note:- Any modem required for transmission of data from Local substation to RCC & Local Substation to SLDC will be in the scope of bidder.

C) Bay control units:

Dedicated numerical Bay Control Units (BCUs) if not already installed on the existing panels shall be provided for each 220/132/66 kV bay for Control functionality on IEC-61850 Ed1/Ed2 standard.

1. The BCUs shall be able to communicate with all types of IEC 61850 compliant other and similar make BCUs and the local and remote work stations via optical fibre communication.
2. The BCU shall have compatibility/ interoperability with all makes of SAS and all types of IEC 61850 compliant IEDs.
3. The BCU have sufficient number of self programmable binary input and output contacts (**along with 3 Nos. of spare potential free BIs and BOs**) to execute various commands to control transformer/ line bays and auxiliaries on the sub-station. **The tenderer shall provide minimum 10 nos. spare potential free BIs and BOs in case of multiple bay control.** Transformer tap change control and temperature (oil/ winding) monitoring signals shall be done by BCU installed on transformer bay only. It shall have sufficient number of analogue inputs and transducers also.
4. BCU shall have feature for selection of single phase (**for 220kV level only**) and three phase auto reclosing scheme. (**Only for BCU for Line bays**).
5. There shall be local display on BCU to display mimic diagram of the bay and status of switchgears, settings, measurements (power data etc.) and local control panel to control bay from BCU.
6. The bay unit shall acquire and process all data for the bay (Equipment status, fault indications, measured values, alarms etc.) and transmit these to the other devices in sub-station automation system. This shall receive the operation commands from station HMI and control centre. The bay unit shall have the capability to store all the data for at least 24 hours.
7. Inbuilt LBB feature with adjustable minimum time delay of 200 ms and with minimum current setting of 200 mA. Also, it should have reset ratio of 95% or better.
8. ***The BCUs shall have one RS-232 / RJ-45 port at the front for local parameter setting and data downloading etc. and two optical ports at the rear for Parallel Redundancy (In compliance to IEC 62439 – 3) in networking on IEC 61850 protocols.***
9. BCU shall have inbuilt feature of synchro-check.
10. BCU shall have facility of time synchronization (SNTP).
11. BCU shall be capable of being connected to various make/type transducers (**6 analog 4-20ma inputs**) directly for signals of temperatures, battery charger current and voltage, temperatures, transformer tap positions etc. (**for transformer BCU only**).
12. BCU shall include multi color LEDs with different colors for alarm and trip purposes.

- 13. BCU shall support all control signals plus all back up protections.
- 14. Deleted.
- 15. BCUs shall have sufficient number of NO/NC contacts for the signals.
- 16. ***BCU shall have minimum 10 Nos. of LEDs and minimum 6 Nos. of analogue input channels for 3CTs+3PTs.***

D) Distance protection:

Three Phase Numerical multi-loop (Non-switched) type relay with separate measurements for all phase-phase & phase-ground faults having following features:-

- i) Four independent Zones of protection with stepped time distance characteristics out of which three shall be forward and one shall be reverse looking zone (meant for carrier inter-tripping/blocking schemes or bus protection).
- ii) Quadrilateral characteristics with independent R & X settings for each zone.
- iii) Minimum of two setting groups for line parameters and with minimum value of 1st zone reactance reach not exceeding 0.1 ohms per phase and to be incremented in steps of 0.01 ohms per phase. Max value shall not be less than 150 ohms. The resistance setting should be able to look after the arc resistance, tower footing resistance & load encroachment.
- iv) Measurement accuracy better than or equal to 5% of set value for reach measurement in Zone-I and better than or equal to 10% of set value for Zone 2, 3 and reverse zone.
- v) Suitable for 220 V DC Aux. supply with variation of (-) 20% to (+) 10%, PT secondary voltage of 110 V, CT Secondary current of 1A & Frequency 50 Hz.
- vi) An adjustable characteristic angle setting range of 45 to 85 degree (in steps of 1 Degree)
- vii) Shall include the PSB (Power Swing Block) feature so as to avoid unnecessary tripping during power swings and also should be capable of differentiating between actual fault and power swing, hence release the blocking in the event of the actual fault.
- viii) Shall have inbuilt under frequency protection scheme with frequency settings.
- ix) Shall have zero sequence compensation for earth faults for all the zones or at least zone-1 and zone-2.
- x) Operating time including tripping time should not be more than 50ms & resetting time of less than 55 ms including resetting time of trip relay.
- xi) Two independent continuously variable time settings range of 0-3 sec for zone 2 & 0-5 seconds for Zone 3 & 4 with accuracy of better than or equal to 5% of set value in time measurement of Zone 2, 3& 4.
- xii) Three phase as well as single phase tripping features available.
- xiii) Channel aided protection (Basic/PUR/POR Zone Extension/Acceleration options).
- xiv) Broken conductor detection by measurement of negative sequence imbalance or any other principal.
- xv) Instantaneous operation for three phase fault and switch on to fault.
- xvi) VT & CT supervision.
- xvii) Continuous self-monitoring& diagnostic features and circuit breaker status monitoring.

- xviii) The relay shall have:-
 - i) Minimum 25 no. of self-configurable output relay contacts
 - ii) Minimum 20 no. of self-configurable input relays.
 - iii) Minimum 8 no. LEDs for fault indication.
 Heavy duty internal/external contacts suitable to handle direct tripping of 220 kV circuit breakers should be provided. There should be 3 Nos. of I/P & O/P spare self-configurable potential free contact each for future use.
- xix) Continuous current rating of two times of rated current. The voltage circuit shall be capable of operation of 1.2 times rated voltage. The relay shall also be capable of carrying a high short time current of 70 times rated current without damage for a period of 1 sec.
- xx) Suitable number of potential free contacts for carrier aided tripping, CB failure, DR and Data acquisition system.
- xxi) Triple pole local breaker backup Protection (Breaker Failure Protection).
- xxii) For Single phase & three phase auto reclosing with check synchronizing & dead line charging features. For DPRs to be used on **132 kV & 66 kV** auto reclosing feature is not required.
- xxiii) Fault recorder, disturbance recorder and fault locator available from serial communication port/**FO port/RJ 45** port in front panel or rear panel of the relay. Fault locator should display directly in percent of line length or kilo-meters in all zones and should have a minimum accuracy of 5% for a line length of 1 km and above.
- xxiv) ***Interfacing with numerical relays : Every protection provided on the unit should be accessible for checking of the menu, setting and DR etc. in following ways:***
 - a) ***HMI on front of the relay.***
 - b) ***The scheme should have provision of RS-232/RJ-45 port on front of the panel for accessing by using personal computer to go through the Menu, Setting measurements and Disturbance records etc. This may be on the propriety Protocol. The supply of software for this purpose will be deemed to be included in the relays.***
 - c) ***Two optical ports at the rear of IED for Parallel Redundancy (In compliance to IEC 62439 – 3) in Networking on IEC 61850 protocol.***
- xxv) The Numerical relays should display the menu, setting, DR/Events etc. in alpha-numeric on the front of the relay. These functions will be selected through the keyboard provided on the front of relay itself.
- xxvi) Should have facility of time synchronization (SNTP).
- xxvii) IEC 61850 compliant as mentioned in clause 2.09.
- xxviii) **Directional IDMT O/C & E/F protection.**

- E) The requisite technical Data for material required for provision of SAS at sub-stations given in schedule of requirement (Annexure-II) is given in above paras. Detailed calculations/comments justifying the suitability of the protection scheme relays, bay

control units etc. offered by the contractor must be given. The tenderer shall also indicate the Guaranteed Technical particulars as per Annexure-IV.

F) Over Current & Earth Fault relays:

It shall include the following features:

- i. Should have facility of turning on/off the directional feature.
- ii. Three over current elements and one earth fault element.
- iii. Have all the standard inverse characteristics and have a variable setting range of 50-200% & 10-80% of rated current for over-current and for earth fault respectively.
- iv. Have current setting steps of 1% variation.
- v. Have low transient over reach high set instantaneous unit of continuously variable setting range 400-1600% of rated current.
- vi. Inbuilt LBB feature with adjustable minimum time delay of 200 ms and with minimum current setting of 200 mA. Also, it should have Reset ratio of 95% or better.
- vii. Include electrically as well as hand reset indicator LEDs.
- viii. Should have facility of time synchronization (SNTP)
- ix. IEC 61850 compliant as mentioned in clause 2.09.
- x. Provision of Event logger for fault/disturbances.
- xi. Sufficient number of self-configurable contacts for giving signals to BCU, Tripping relay, Annunciator and 2 spare self-configurable potential free contacts.
- xii. ***One RS-232/RJ-45 port at the front for local parameter setting and data downloading etc. and two optical ports at the rear for Parallel Redundancy (In compliance to IEC 62439 – 3) in networking on IEC 61850 protocols.***
- xiii. Time Multiplier Setting range from 0-1sec in steps of 0.01.

G) Firewall and Router:

There shall be two sets of Firewall and Routers which shall be connected to a LAN. This LAN shall be different than the IEC 61850 LAN. The substation firewall and router shall be suitable for the substation environment and shall comply with the requirements for IEC 61850-3.

The substation firewall shall have the following features:

- IP firewall features such as Address/port inspection and filtering
- Shall be stateful firewall
- Shall support upto 8 Ethernet switches 10/100 Mbps
- Shall support IPv4 and IPv6
- Shall have IP sec/VPN with 3DES/AES encryption
- Shall have NAT

- Shall have syslog capability
- Shall be NERC compliant
- Shall have hot- standby operation with similar router
- Shall support SNTP & SNMPv3 protocols.

The substation routers shall have the following features:

- Routing protocols such as OSPF and support for IPv4 and IPv6
- 8 Ethernet interfaces of 10/100 Mbps
- 2 E1 interfaces
- Hot standby operation with a similar router
- Support IEEE 802.3u, 802.1p, 802.1Q, 802.1d, 802.1w,
- Traffic prioritization for routed IP flows/ports

The substation firewall and router can be a single device.

1.14 At Site Training for PSTCL Officers/Officials:

The successful tenderer will be required to impart onsite training at each substation (free of cost) to up to 2 Engineers and 5 SSOs so as to fully acquaint them with Design, Testing and commissioning, including fault detection of protection schemes covered in this tender so that they are able to handle the equipment in a better way. Duration of this training should be at least 15 days at each Sub Station which can be extended depending on the need of PSTCL with mutual consent of PSTCL and the successful bidder without any extra charges. At least one engineer shall be deputed by the firm on each sub-station till the staff gets the skill to operate and maintain the system.

Apart from the above, exhaustive training shall be imparted to Engineers which shall include

- i. Computer System Hardware (including but not limited to System Hardware Overview, equipment maintenance, system expansion, system and subsystem maintenance, operational training regarding preventive and/or corrective maintenance etc.)
- ii. Computer system software (including but not limited to System programming, operating system, System initialization and failover diagnostics, software documentation etc.)
- iii. Application software (including but not limited to application functions/algorithms design, software generation and development etc.)

1.15 SUPPLY, ERECTION, TESTING & COMMISSIONING:-

“The supply of all material, erection, testing and commissioning thereof shall be completed within stipulated time of stages as detailed below:

1. **Stage 1-** *Erection and Commissioning of SAS at 220 kV Budhlada along with RCC equipment installation commissioning at 220kV S/s Mansa shall be completed within 4 months from the approval of detailed engineering drawings.*
2. **Stage 2-** *Erection and Commissioning of SAS at 220 kV Gurdaspur along with RCC etherneequipment installation commissioning at 220kV S/s Sarna shall be completed within 4 months from the approval of detailed engineering drawings after intimation from PSTCL.*

The contractor shall submit schedule of shut downs required for retrofitting of IEDs etc. to the nodal officer 15 days in advance in writing and confirmation regarding approval of shut downs shall be given to the contractor in writing 5 days before the shut down by the nodal officer with intimation to DESIGN OFFICE. If any delay occurs in approval of shutdowns, that period of delay shall be excluded while calculating the total time taken by the contractor for commissioning of SAS. If the contractor fails to avail the approved shut down for a particular job, the time taken for granting approval of next shut down for the same job (including delay occurred, if any, in approval of shut down which is not availed by the contractor) shall be included for calculation of commissioning time.”

For this project concerned Sr. XEN/ASE, Grid Const. Divn., PSTCL will be nodal officer to supervise & coordinate the erection, testing & commissioning of SAS and issue the satisfactory testing & commissioning reports after successful testing of SAS by concerned protection team, along with verification of material utilized per Substation.

SAS will be deemed as Commissioned when the contractor demonstrates the operation of complete SAS on the respective sub-station as per specification.

1.16 **Cyber Security:**

The system shall be remotely accessed for collection of disturbance records and hence shall be provided with a firewall/router to comply at least with the requirements of CIP-005, CIP-007 (Critical infrastructure protection) standard as per NERC (North American Electric Reliability Council).

Software structure

The software package shall be structured according to the SAS architecture and strictly divided in various levels. Necessary firewall shall be provided at suitable points in software to protect the system. An extension of the station shall be possible with lowest possible efforts. Maintenance, modification or an extension of components of any feeder may not force a shut-down of the parts of the system which are not affected by the system adaptation.

1 Station level software

1.1 Human-machine interface (HMI)

The base HMI software package for the operator station shall include the main SAS functions and it shall be independent of project specific hardware version and operating system. It shall further include tools for picture editing, engineering and system configuration. The system shall be easy to use, to maintain, and to adapt according to specific user requirements.

Systems shall contain a library with standard functions and applications.

2 Bay level software

2.1 System software

The system software shall be structured in various levels. This software shall be placed in a non-volatile memory. The lowest level shall assure system performance and contain basic functions, which shall not be accessible by the application and maintenance engineer for modifications. The system shall support the generation of typical control macros and a process database for user specific data storage. In case of restoration of links after failure, the software along with hardware shall be capable of automatically synchronising with the remaining system without any manual interface. This shall be demonstrated by contractor during integrated system test.

Application software

In order to ensure robust quality and reliable software functions, the main part of the application software shall consist of standard software modules built as functional block elements. The functional blocks shall be documented and thoroughly tested. They form part of a library.

The application software within the control/protection devices shall be programmed in a functional block language.

3 Network Management System:

The contractor shall provide network management system software for following management functions:

- a. Configuration Management
- b. Fault Management
- c. Performance Monitoring

This system shall be used for management of communication devices and other IEDs in the system. This NMS can be loaded in DR work-station and shall be easy to use, user friendly and menu based. The NMS shall monitor all the devices in the SAS and report if there is any communication fault/problem in the monitored devices. The NMS shall

(a) Maintain performance, resource usage, and error statistics for all managed links and devices and present this information via displays, periodic reports and on demand reports.

(b) Maintain a graphical display of SAS connectivity and device status.

(c) Issue alarms when error conditions occurs

(d) Provide facility to add and delete addresses and links

4 Operating System

The Operating system of the Servers, HMIs and Gateways shall be hardened in line with the following suggested guidelines to reduce its vulnerability to cyber-attacks.

4.1 Secure Build Strategy

Packages unnecessary for system operation are not to be installed during the initial build of the servers and workstations, reducing the amount of post-build hardening required. Any package that must be installed but is not required to be actively running have to be disabled.

The software to be removed and/or disabled includes, but is not limited to:

- Games
- Messaging services
- Servers or clients for unused Internet services
- Software compilers (except where required, i.e. development platform)
- Unused networking and communication protocols
- Unused operating system features
- free utilities delivered with OS

4.2 Generic and Default Accounts

Disable or remove all unnecessary generic and default user accounts from the operating system and third party applications. Application accounts (such as daemon) that exist strictly for identification and ownership are disabled from all interactive, network, or other access to prevent unauthorized access.

Required accounts and their functions have to be documented.

4.3 Insecure Protocol

Insecure protocols such as telnet, FTP, RSH, and RCP have to be disabled from operation.

4.4 Malicious Software Prevention

Implementation of anti-virus and other malicious software prevention tools to detect, prevent, deter, and mitigate the introduction, exposure, and propagation of malware. Supplier shall verify that commercially available antimalware products do not cause

harm to the product. Provide procedures on how to update the signature database of the antimalware software, if provided.

4.5 System Whitelisting

System whitelisting is to be done i.e. the software takes an inventory of the host in a known good state, and any applications not present at that time (such as viruses, malware, games, portable applications, etc.) are prevented from executing.

4.6 Ports and Services

The system shall be configured by the supplier to only use those ports and services required for normal and emergency operations. The ports and services required for operation are documented and supplied to the customer as part of the deliverable system documentation.

4.7 Host-Based Firewalls

The host-based firewalls shall be configured with a standardized set of rules as an additional layer of security if the network firewall to fail. The host-based firewalls are configured with a default deny rule that logs any traffic not explicitly allowed.

In the case where a service cannot be disabled but does not require communication with hosts external to itself, this host-based firewall also serves to prevent any communication to the port(s) used by that service.

4.8 Removable Media

Removable media (CD and DVD, USB Drives, etc.) is not required for the operation of the SAS and may be inhibited from operation except in case of data back up on CD/DVD as per specification.

5 The contractor shall provide each software in two copies in CD to load into the system in case of any problem related with Hardware/Communication etc.

Note:- Two nos. Disturbance Recorder/Engineering Work Station where atleast one workstation shall have Linux based operating system.

ANNEXURE – I (DELETED)

ANNEXURE – II

SCHEDULE OF REQUIREMENT

DETAILS OF SUBSTATIONS TO BE PROVIDED WITH SAS

The SAS shall be provided on the sub-stations mentioned in the table shown under this para. SAS shall be fully functional and complete in all respect.

	Name of Substation	No. of SAS compatible Bays/ Feeders to be integrated		
		220 kV	132 kV bays or 66 kV bays	11 kV
1.	220 kV S/s Bhudlada	4	2	0
2.	220 kV S/s Gurdaspur	5	20	20

Suitable provision in the software shall be made for non SAS compatible bays future bays detailed as under:-

	Name of Substation	Future bays		
		220 kV	132 kV bays & 66 kV bays	11 kV
1.	220 kV S/s Bhudlada	3	20	30
2.	220 kV S/s Gurdaspur	3	10	10

Note:- Bidder will supply erect and commission control server for SAS and VMS for remote operation form RCC stations.

ANNEXURE – III

DETAILS OF MATERIAL REQUIRED AT 220 kV SUBSTATIONS TO BE AUTOMATED

Sr. No.	Description	HSN Code	Qty. for 220kV S/s Bhudlada	Qty for RCC at 220kV S/s Mansa for 220 kV S/s Bhudlada	Qty. for 220kV S/s Gurdaspur	Qty for RCC at 220kV S/s Sarna for 220 kV S/s Gurdaspur	Total Qty. (Nos.)	Unit of quantity
1	Operating Workstation (HMIs)		2	0	2	0	4	no.
2	Engineering workstation at substation with software		1	0	1	0	2	no.
3	operating station cum Engineering workstation at RCC along with common DR retrieval software for all make control & protection IEDs (RHMI) with standalone license with IEC104 & 101 master protocol		0	1	0	1	2	no.
4	Operating Workstation (RHMI) and make of local HMI with standalone license with IEC104 & 101 master protocol		0	1	0	1	2	
5	Server cum Gateway with software		2	0	2	0	4	no.
6	Cyber security (hardware base firewall and networking cum intrusion detection tool for double ring SAS architecture)		1	0	1	0	2	set

7	BCU for controlling and monitoring of auxillary systems		1	0	1	0	2	lot
8	Camera		4	0	4	0	8	no.
9	Video monitoring system other than camera and LED		1	0	1	0	2	no.
10	LED (32 inch)		1	1	1	1	4	no.
11	Video monitoring system server (software and harware) for RCC (if applicable)		0	1	0	1	2	no.
12	Fibre Optic Cables (All Types, with connectors for SAS equipment)		1	1	1	1	4	lot
13	Ethernet Switch with min 16 FO 2 RJ 45 port		4	0	8	0	8	no.
	Ethernet Switch with min 4 FO 12 RJ 45 port		4	2	4	2	12	no.
14	Printer i) With OWS		1	1	1	1	4	no.
	ii) With EWS		1	1	1	1	4	no.
15	Furniture as per clause no. 1.03 VII of technical specification		3	2	3	2	10	set
16	Red box		1	0	1	0	2	no.
17	suitable Modem pair required in case of PLCC connectivity		1	1	0	0	2	set
18	Inverter for suitable capacity (separate inverter for main & standby system)		1	1	1	1	4	set.
	Total							

Note:

- 1. In addition to bays given above Bus Bar protection scheme panels existing at 220 kV substations i.e. at 220kV S/s Budhlada shall also to be incorporated in SAS scheme. Bus Bar***

protection scheme shall be commissioned on all 220 kV substations of PSTCL and contractor shall make provision for that for each substation.

- 2.** *Contact multiplication & items other than above which are required for SAS to be fully operational shall be provided by the contractor without any additional cost and same shall be deemed to be included in the contractor's scope of supply. Quantity shown in the above table is tentative which includes material to integrate the additional bays that may be commissioned after floating of this Tender Enquiry. The variation in quantity of bays and cameras only shall be paid/deducted as per quoted prices in schedule of prices (Annexure-IX A) on verification of the same by Nodal Officer. However, if any expansion takes place on any substation before commissioning of SAS, the contractor shall be required to supply the additional equipment needed for such expansion in the SAS and the cost for the additional equipment/material from point (a) to (j) of Schedule of Prices (Annexure-IX A) shall be payable.*
- 3.** All the systems (such as Gateways, Servers, HMIs, Engineering Workstation, etc) and IEDs should be time synchronized with GPS server.
- 4.** Successful Bidder will provide the detail cable survey report as per site requirement and control cables will be provided by the PSTCL.

ANNEXURE-IV

SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS FOR SAS

Sr. No.	Description	Remarks of supplier
7.	<u>GATEWAY</u>	
i)	Make and type	
ii)	Incoming Protocol	
iii)	Outgoing Protocol	
iv)	Data Speed	
v)	Compatibility with PLCC equipment	
vi)	Compatibility with Optical network	
vii)	No. of ports	
8.	<u>VIDEO MONITORING EQUIPMENTS</u>	
i)	Make and type	
ii)	Place of manufacturing	
iii)	Resolution	
iv)	Outdoor type suitable for different climatic conditions	
v)	Power requirement	
vi)	Suitability to operate in case of power failure	
vii)	Shall open Protocol be used for integration of Cameras? Give type of Protocol.	
viii)	Video Surveillance system is IP based or any other technology.	
ix)	Other allied equipment	
10.	<u>HUMAN MACHINE INTERFACE</u>	
i)	Make and model	
ii)	a) Memory of Hard Disc and RAM b) Whether memory is sufficient as per specification? c) Printer (make and type)	
iii)	Processor details	

iv)	Display unit a) Make and type b) Resolution c) Size	
11.	Inverter	
i)	Make, type and capacity	
12. a)	Ethernet Switch with min 16 FO 2 RJ 45 port Make and model	
b)	Ethernet Switch with min 4 FO 12 RJ 45 port Make and model	
12.	Firewall	
i)	Make, type	
13.	Router	
i)	Make, type	

Note:

1. In addition, tenderer may give all the relevant technical particulars and guaranteed particulars for the ratings and protection scheme offered by him.
2. Detailed literature of all auxiliary relays, timer etc. installed on the main relay be supplied.

ANNEXURE-V

TECHNO-COMMERCIAL DETAILS

1. Prices (whether Firm or Variable):
2. Quantity offered:
3. Other Levies (if any):
4. Delivery:
5. Validity:
6. Place of Manufacture:

ANNEXURE-VI

PERFORMA FOR MSMED FIRMS

1. Name of the firm:
2. PAN No.:
3. UAN (Udyog Adhar No.) :
4. Type of Enterprises/Firm:
As per MSMED (Micro/Small/Medium):
5. Social Category:
6. Major Activity: Manufacturing/Services
7. Copy of registration Certificate (Attached): Yes/No
8. Validity of certificate: From _____ to _____
9. (A) Investment in plant machinery or equipment (Rs. In Crores)
 - (a) Manufacturing
 - (b) Services

ANNEXURE-VII & VIII (DELETED)

ANNEXURE-IX

BID PROPOSAL SHEETS

Sr. No.	Clause	Bidder's remarks
1.	Scope	
2.	Salient features of offer	
3.	Works of contractor from where SAS are intended to be supplied	
4.	Whether facilities for complete testing of SAS as per the scope of specification are available at the place mentioned above?	
5.	Has the contractor ever executed the SAS to PSTCL/PSPCL/other utilities? If yes, give details of the Purchase order(s).	
6.	Prices (Firm or Variable)	
7.	EMD/PEMD	
8.	GST and other levies	
9.	Any other comments	

ANNEXURE-IX A

Validity: -----

Prices: Firm

Schedule-I

SCHEDULE OF PRICES FOR SUPPLY OF MATERIAL

Sr. No.	Description	HSN Code	Qty. for 220kV S/s Bhudlada	Qty for RCC at 220kV S/s Mansa for 220 kV S/s Bhudlada	Qty. for 220kV S/s Gurdaspur	Qty for RCC at 220kV S/s Sarna for 220 kV S/s Gurdaspur	Total Qty. (Nos.)	Unit of quantity	Unit Ex-Works Price (Rs)	GST @ in %	FOR Destination excluding GST (Rs)	GST amount
1	Operating Workstation (HMI)		2	0	2	0	4	no.			0	0
2	Engineering workstation at substation with software		1	0	1	0	2	no.			0	0
3	operating station cum Engineering workstation at RCC along with common DR retrieval software for all make control & protection IEDs (RHMI) with standalone license with IEC104 & 101 master protocol		0	1	0	1	2	no.			0	0

4	Operating Workstation (RHMs) are made of local HMI with standalone license with IEC104 & 101 master protocol			1	0	1	2				0	0
5	Server cum Gateway with software		2	0	2	0	4	no.			0	0
6	Cyber security (hardware base firewall and networking cum intrusion detection tool for double ring SAS architecture)		1	0	1	0	2	set			0	0
7	BCU for controlling and monitoring of auxiliary systems		1	0	1	0	2	lot			0	0
8	Camera		4	0	4	0	8	no.			0	0
9	Video monitoring system other than camera and LED		1	0	1	0	2	no.			0	0
10	LED (32 inch)		1	1	1	1	4	no.			0	0

11	Video monitoring system server (software and hardware) for RCC (if applicable)		0	1	0	1	2	no.			0	0
12	Fibre Optic Cables (All Types, with connectors for SAS equipment)		1	1	1	1	4	lot			0	0
13	Ethernet Switch with min 16 FO 2 RJ 45 port		4	0	8	0	12	no.			0	0
	Ethernet Switch with min 4 FO 12 RJ 45 port		4	2	4	2	12	no.			0	0
14	Printer i) With OWS		1	1	1	1	4	no.			0	0
	ii) With EWS		1	1	1	1	4	no.			0	0
15	Furniture as per clause no. 1.03 VII of technical specification		3	2	3	2	10	set			0	0
16	Red box		1	0	1	0	2	no.			0	0
17	Suitable Modem pair required in case of PLCC connectivity		1	1	0	0	2	set			0	0

	ity											
18	Inverter for suitable capacity (separate inverter for main & standby system)		1	1	1	1	4	set.			0	0
	Total										0	0

Schedule – II

SCHEDULE OF Local Transportation, In-transit Insurance, Loading and Unloading charges

Sr. No.	Description	HSN Code	Total quantity	Unit of Qty.	All inclusive unit freight, insurance, In land Local Transportation lading and unloading charges in Rs	All inclusive freight, insurance, In land Local Transportation lading and unloading charges in Rs
1	Operating Workstation (HMIs)		4	no.		0
2	Engineering workstation at substation with software		2	no.		0
3	operating station cum Engineering workstation at RCC along with common DR retrieval software for all make control & protection IEDs (RHMI) with standalone license with IEC104 & 101 master protocol		2	no.		0
4	Operating Workstation (RHMI) ame make of local HMI with standalone license with IEC104 & 101 master protocol		2	no.		0
5	Server cum Gateway with software		4	no.		0
6	Cyber security (hardware base firewall and networking cum intrusion detection tool for double ring SAS architecture)		2	set		0
7	BCU for controlling and monitoring of auxillary systems		2	lot		0

8	Camera		8	no.		0
9	Video monitoring system other than camera and LED		2	no.		0
10	LED (32 inch)		4	no.		0
11	Video monitoring system server (software and hardware) for RCC (if applicable)		2	no.		0
12	Fibre Optic Cables (All Types, with connectors for SAS equipment)		4	lot		0
13	Ethernet Switch with min 16 FO 2 RJ 45 port		12	no.		0
	Ethernet Switch with min 4 FO 12 RJ 45 port		12	no.		0
14	Printer i) With OWS		4	no.		0
	ii) With EWS		4	no.		0
15	Furniture as per clause no. 1.03 VII of technical specification		10	set		0
16	Red box		2	no.		0
17	suitable Modem pair required in case of PLCC connectivity		2	set		0
18	Inverter for suitable capacity (separate inverter for main & standby system)		4	set		0
Total						0

Schedule-III

SCHEDULE OF PRICES FOR ERECTION, TESTING & COMMISSIONING

Sr. No.	Description	HSN Code	Quantity as per Specification	Unit erection, testing & commissioning prices for unit scheme (Rs)	GST @ in %	All inclusive erection, testing & commissioning prices excluding GST (Rs)	GST amount
1	Complete Erection, testing & Commissioning Charges of SAS at new stations including any other item, if required.		2			0	0

2	Complete Erection, testing & Commissioning Charges of RCC including any other item, if required.		2			0	0
3	Erection, testing and commissioning of unit 220kV bay along with accessories		9			0	0
4	Erection, testing and commissioning of unit 132kV/66kV bay along with accessories		22			0	0
5	Erection, testing and commissioning of unit 11kV bay along with accessories		20			0	0
Total						0	0

Schedule –IV

SCHEDULE OF Tax and dutes

Sr No.	Item No.	Total prices (in INR)
1	Total GST on Goods to be supplied from within India	
	Total GST for supply of Plant & Equipment	0.00
2	Total GST on Services to be supplied from within India	
	Total GST on Erection, testing & Commissioning Charges	0.00
	Grand TOTAL (1+2)	0.00

Schedule –V

Grand total

Sr. No.	Description	Total Price (in Rs.)
1	TOTAL SCHEDULE NO . 1	
	Plant & Equipment to be supplied including Type Test Charges	0.00
2	TOTAL SCHEDULE NO . 2	
	All inclusive Local transportation , In- transit Insurance , loading & Unloading Charges	0.00
3	TOTAL SCHEDULE NO .3	

	Erection, testing & Commissioning Charges including Dismantling of equipemnt, all civil works and any other item, if required.	0.00
4	TOTAL SCHEDULE NO .4	
	Taxes and duties	0.00
	GRAND TOTAL (1+2+3)	0.00

Note:

1. Reverse auction will be carried out on the grand total i.e total of Schedule V.
2. In addition, tenderer may give all the relevant technical particulars, guaranteed particulars, ratings and protection scheme offered by him.
3. Detailed literature of all equipment including auxiliary relays, timer etc, installed on the panel be supplied.
4. Successful Bidder will provide the detail cable survey report as per site requirement and control cables will be provided by the PSTCL.

ANNEXURE-IX B

SCHEDULE OF PRICES FOR OR RECOMMENDED SPARES

Prices: Firm

Sr. No.	Brief Description of material	Qty. (Nos.)	Unit FOR destination price (Rs.)	(Item type) Direct/Bought Out
		(per substation)		
+	ADD HERE			

Note:

1. The reimbursement of Excise Duty, Sales Tax/VAT and other levies shall be only against those items for which the Mode of Transaction indicated above is 'Direct'. In case of those items mentioned above against which the mode of transaction has been mentioned as 'Direct/Bought-out' or has been left blank, the same deemed to be 'Bought-out' for the purpose of Evaluation and award of Contract and the price indicated above against such items shall be deemed to be inclusive of all such taxes, duties and levies.

ANNEXURE-X A

**Certification by the Bidder per order no. F.No.6/18/2019-PPD dated 23/07/2020 issued by
Public Procurement Division, Department of Expenditure, Ministry of Finance,
Government of India(DoE Order)**

*(In case of a Joint Venture bid, the declaration/certification shall be given by all partners of the Joint
Venture)*

Bidder's Name and Address: To:
Name:..... CE/TS,
Address:..... PSTCL, 3rd floor Shakti Sadan,
Patiala- 147001

.....

Dear Sir,

We have read and understood the provisions of Order no. F.No.6/18/2019-PPD(Order Public Procurement no.1) dated 23/07/2020 regarding "Restriction under Rule 144(xi) of General Financial Rules" and F.No.6/18/2019-PPD (Order Public Procurement no.2) dated 23/07/2020 regarding "Exclusion from Restriction under Rule 144(xi) of General Financial Rules" issued by Public Procurement Division, Department of Expenditure, Ministry of Finance, Government of India [hereinafter collectively "**DoE Order**"] and any subsequent modifications/Amendments, if any.

Particularly, we, the Bidder, have read the clause regarding restrictions on procurement from a 'Bidder of a country which shares a land border with India' and on sub-contracting to contractors from such countries.

We certify that we, the bidder is/are not from such a country or, if from such a country, has been registered with the Competent Authority and will not subcontract any work to a subcontractor/sub vendor from such countries unless such subcontractor/sub vendor fulfills all requirement in this regard and is eligible to be considered. [*Where applicable, evidence of valid registration by the Competent Authority shall be attached.*]

We further declare that any misrepresentation or submission of false/forged document/information in this regard shall be dealt with as per the provisions of Integrity Pact and/or Bidding Documents and/or PSTCL's policy and procedures.

Date: Printed Name:

Place: Designation:

ANNEXURE-X B

Certificate from statutory auditor or cost auditor of the company (in the case of companies) or from a practicing cost accountant or practicing chartered accountant (in respect of suppliers other than companies) giving the percentage of Local Content, in line with PPP-MII order and DoT order, if applicable [to be submitted on the letter head of the issuer.]

Dear Sir,

We have read and understood the provisions of “Public Procurement (Preference to Make in India) Order, 2017” dated 15/06/2017, its revision dated 16.09.2020 & 16.11.2021 [hereinafter, “PPP-MII Order”] issued by Department for promotion of Industry and Internal Trade (DPIIT), Ministry of Commerce and Industry, Government of India,

and any subsequent modifications/Amendments, if any.

In line with the provisions of the PPP-MII Order and DoT Order, M/s.[Enter the name of the Bidder] [hereinafter, “Class-I Local Supplier”/“Class-II Local Supplier”(choose as applicable)] have submitted an Affidavit of self-certification to Punjab State Transmission Corporation Ltd, [hereinafter, PSTCL] regarding Local Content in Goods/Services/Works to be supplied by the “Class-I Local Supplier”/“Class-II Local Supplier”(choose as applicable) for [Enter the name of the package], wherein they have agreed to abide by the terms and conditions of the PPP-MII Order and DoT Order.

Further, in line with the PPP-MII Order, the statutory auditor or cost auditor of the company (in the case of companies) or a practicing cost accountant or practicing chartered accountant (in respect of suppliers other than companies) shall provide a certificate giving the percentage of Local Content in the Goods/Service/Works to be supplied by the “Class-I Local Supplier”/“Class-II Local Supplier”(choose as applicable)for [Enter the name of the package].

Accordingly, we, the Statutory Auditor(s) / Cost auditor of the “Class-I Local Supplier”/“Class-II Local Supplier”/ a practicing cost accountant or practicing chartered accountant [choose as applicable], certify that the Local Content as defined under the PPP-MII and DoT Order, in the Goods/Service/Works to be supplied by the “Class-I Local Supplier”/“Class-II Local Supplier”(choose as applicable) for [Enter the name of the package] is percentage [specify the percentage of Local content].

For and on behalf of,

Date:

Statutory Auditor’s/ Cost auditor’s/ Cost accountant’s/ Chartered accountant’s attestation

Firm Reg No. Membership No.

Note: This is a guiding format. In case the bidder submits the certificate in a format different from the above, the same may be considered provided it meets the intent and purpose, as may be ascertained by PSTCL.

choose as applicable while preparing bidding documents

ANNEXURE-XI

PROFORMA FOR SELF APPRAISAL/WORKS APPRAISAL

1.	A)	Name of Tendering firm.	
	i)	Complete address of the office.	
	ii)	Telegraphic address:	
	iii)	Telephone Number(s):	
	iv)	Fax No.	
	v)	Name of two responsible Officers with Designation: (Managing	
	B) i)	Director/Partner/Chief Engineer/Works Engineer etc.)	
	ii)	Day on which weekly holiday is observed.	
	C)	Complete address of the works:	
	i)	Telegraphic address:	
	ii)	Telephone Number(s):	
	iii)	Fax No.	
	iv)	Name of two responsible Officers with Designation: (Managing Director/Partner/Chief Engineer/Works Engineer etc.)	
	v)	Day on which weekly holiday is observed.	
	D)	Name, address & telephone numbers of two references having facilities of P&T Telephones.	
	a) i)	Name	b) i) Name
	ii)	Address	ii)Address
	iii)	Telephone No.	i) Telephone No.
2.		Year of Establishment.	
3.		Constitution of the firm.	
	a)	Private or Public Limited	

	b)	Registered under the companies Act or any other Act, give Registration No. & Date.
4.		Financial Position.
	i) a	Land (Area & Value)
	b	Building (Covered Area and Value)
	c	Plant & Machinery:
	d	Total drawing Limit from Banks
	ii)	Annual Financial Turnover (duly audited for the last two years):
	iii)	Latest Income Tax clearance certificates:
5.		Man Power:
	a)	Graduate Engineer(s):
	b)	Diploma Holder(s):
	c)	Skilled Workers:
	d)	Un-Skilled Workers:
6.		Production capacity per month of the item covered in your quotation and justification for assessment.
	a)	Details of Plant & machinery installed (Please attach separate sheets, if necessary).
	b)	Details of raw material required:
	c)	Source of raw material
	d)	Stock of raw material
	e)	In case, any raw materials are required to be imported, indicate arrangements of its procurement.
	f)	Quality Controls exercised in procurement of raw materials.
7.	a)	Details of manufacturing process:
	b)	Scheme of quality controls:

	i)	During manufacturing process:
	ii)	At the finished stage
	c)	Whether, any record is being maintained in respect of quality controls exercised.
8.		Details of testing facilities available with the firm.
9.		Details of orders executed/under execution during the last three years. Photo copies of work orders of similar material supplied to other state utilities by them to the standard specified in these tender documents must be submitted.
	a)	With PSTCL
	b)	Other State Electricity Boards/State Govt. /Govt. of India & other Institutions/undertaking:
	c)	Other important customers.
10.	a)	Whether the item (s) are on Punjab Govt./DGS&D/Central Govt. Approved Rate Contracts (Attach copies of Rate contracts)
	b)	Whether item offered conforms to ISS or any other internationally recognized Standards, if so, give reference:
	c)	Whether the firm is licensed to use ISI Mark of any other Govt. Quality Mark (copies of latest Test Certificates issued by Govt. Laboratories/Any recognized Test House be attached.)

SIGNATURE OF AUTHORISED

SIGNATORY OF THE FIRM

WITH OFFICE STAMP

NOTE:

1. Please attach additional sheets, wherever required.
2. Copies of documents, attached with the Performa should be attested by the firm's authorized stamp mark of the firm.

ANNEXURE - XII

a) SCHEDULE OF COMMERCIAL DEVIATIONS

All deviations and exceptions in respect of commercial clauses to the tender specification shall be clearly brought out by the tender as per the format given hereunder. The details shall be exhaustive in all respects.

Sr. No	Clause No.	Page no. of Tender Spec.	Exceptions & Deviations from the tender Spec.	Remarks
<hr/>				
<hr/>				

Certified that the above listed deviations and exceptions are exhaustive and the contract shall be executed as per the tender specifications except for the above deviations and exceptions in the event of placing an order on us.

Date:

For M/s

Place

Signature

(By its constituted attorney)

Seal

b) SCHEDULE OF TECHNICAL DEVIATIONS

All deviations from technical clauses shall be clearly brought out by the tenderer as per the format given hereunder. The details shall be exhaustive in all respects.

Sr. No	Clause	Page no. of Technical	Deviations/ Exceptions	Remarks
	Spec.			

Certified that the above listed deviations and exceptions are exhaustive and the contract shall be executed as per the tender specifications except for the above deviations and exceptions in the event of placing an order on us.

Date: For M/s

Place Signature
(By its constituted attorney)
Seal

ANNEXURE - XIII

PERFORMANCE SCHEDULE

(SEPARATELY FOR BIDDER)

Sr. No.	Size & brief description of equipment	Order No. & date	Name of purchaser	Qty.(Nos.)	Value	Date since the equipment supplied is in service	Remarks
1	2	3	4	5	6	7	8

Date_____

Signature:

Name:

Status:

Whether authorized

Attorney of the

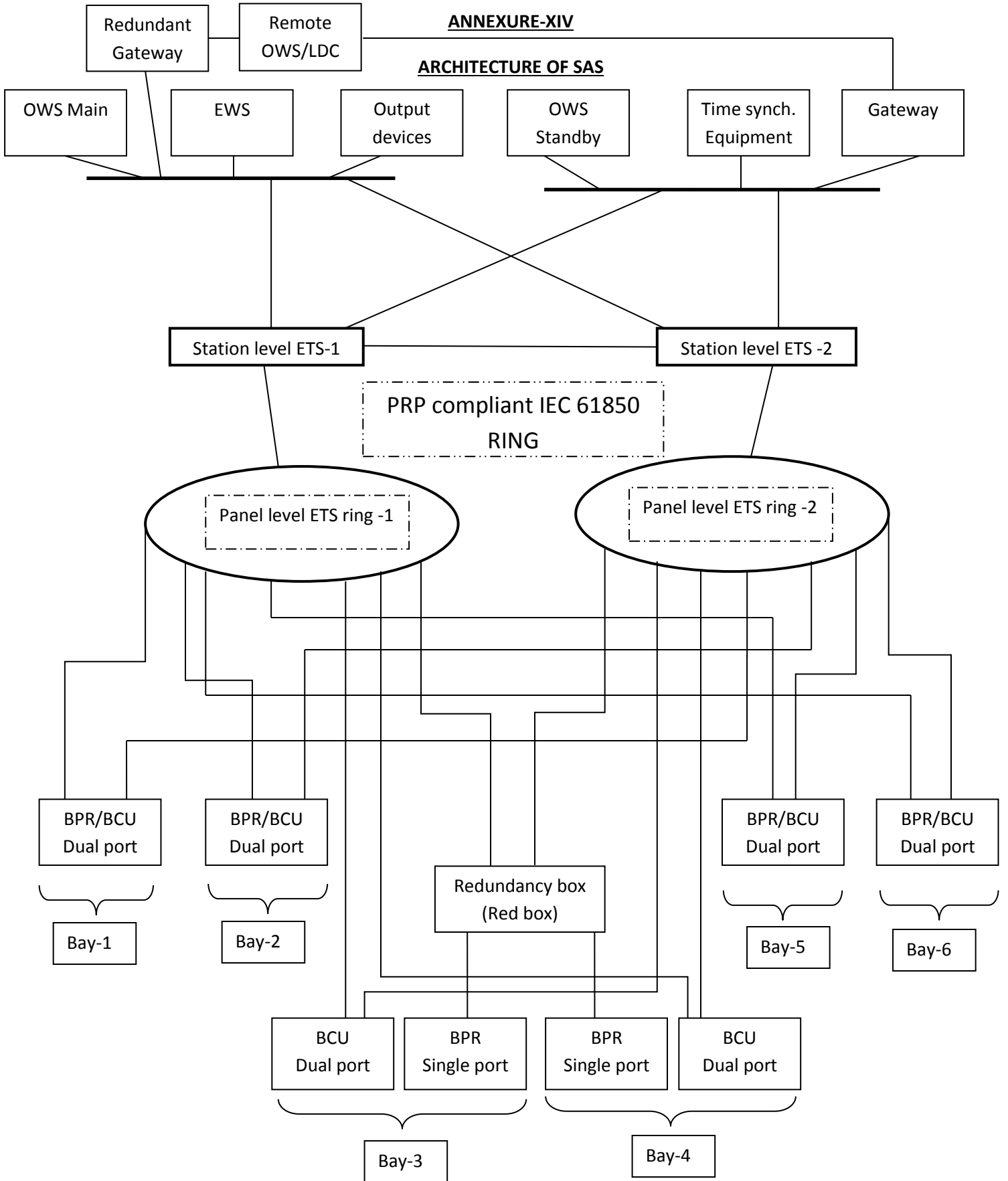
Tendering Co.:

Name of the tendering

Company:

ANNEXURE-XIV

ARCHITECTURE OF SAS



ARCHITECTURE OF SAS

Note: *In case the architecture offered by the bidder calls for the requirement of a Server to the extent whatsoever, the same shall be supplied by the bidder in the “Hot-Standby” mode and the price of the same shall be deemed to be included in the rates quoted by the bidder without any additional cost arising towards PSTCL.*

Annexure-XV (DELETED)

Annexure-XVI

Format for Bid Security

(To be stamped in accordance with Stamp Act, the Non-Judicial Stamp Paper should be in the name of the issuing Bank)

Bank Guarantee No.:

Date:

Name of the Package:

Specification No.:

To: *(insert Name and Address of Employer)*

WHEREAS M/s. *(Insert name of Bidder)*..... having its Registered/Head Office at *(Insert address of the Bidder)* (Hereinafter called "the Bidder") has submitted its Bid for the performance of the above-named Contract (hereinafter called "the Bid")

KNOW ALL PERSONS by these present that WE *(Insert name & address of the issuing bank)* having its Registered/Head Office at *(Insert address of registered office of the bank)*..... (Hereinafter called "the Bank"), are bound unto *(Insert name of Employer)*..... (hereinafter called "the Employer") in the sum of*(insert amount of Bid Security in figures & words)*..... for which payment well and truly to be made to the said Employer, the Bank binds itself, its successors and assigns by these presents.

Sealed with the Common Seal of the said Bank this day of 20....

THE CONDITIONS of this obligation are:

- (1) If the Bidder withdraws its bid during the period of bid validity specified by the Bidder in the Bid Form; or
- (2) In case the Bidder does not withdraw the deviations proposed by him, if any, at the cost of withdrawal stated by him in the bid; or
- (3) If the Bidder does not accept the corrections to arithmetical errors identified during preliminary evaluation of his bid pursuant to ITB Clause 27.2; or
- (4) If, as per the requirement of Qualification Requirements the Bidder is required to submit a Deed of Joint Undertaking and he fails to submit the same, duly attested by Notary Public of the place(s) of the respective executant(s) or registered with the Indian Embassy/High Commission in that Country, within ten days from the date of intimation of post – bid discussion; or
- (5) in the case of a successful Bidder, if the Bidder fails within the specified time limit

- (i) to sign the Contract Agreement, in accordance with ITB Clause 33, or
 - (ii) to furnish the required performance security, in accordance with ITB Clause 34.
- or

(6) In any other case specifically provided for in ITB.

WE undertake to pay to the Employer up to the above amount upon receipt of its first written demand, without the Employer having to substantiate its demand, provided that in its demand the Employer will note that the amount claimed by it is due to it, owing to the occurrence of any of the above-named CONDITIONS or their combination, and specifying the occurred condition or conditions.

This guarantee will remain in full force up to and including *(Insert date, which shall be the date 30 days after the period of bid validity)*..... and any demand in respect thereof must reach the Bank not later than the above date.

For and on behalf of the Bank

.....
(Signature)

in the capacity of

.....
Common Seal of the Bank

Note: In case the bid is submitted by a Joint Venture, the bid security shall be in the name of the Joint Venture and not in the name of the Lead Partner or any other Partner(s) of the Joint Venture.

Annexure-XVII

Format for Performance Bank Guarantee

Bank Guarantee No.

Date.....

Contract No.....

.....[Name of Contract].....

To: [Name and address of the Employer]

Dear Ladies and/or Gentlemen,

We refer to the Contract ("the Contract") signed on(insert date of the Contract)..... between you and M/s (Name of Contractor), having its Principal place of business at(Address of Contractor) and Registered Office at(Registered address of Contractor) ("the Contractor") concerning (Indicate brief scope of work) for the complete execution of the (insert name of Package along with name of the Project)..... [Applicable for Bank Guarantees issued by Contractor/Associate for those Contracts awarded to them]

Or

We refer to the Contract signed on(insert date of the Contract)..... between you and M/s (Name of Contractor), having its Principal place of business at(Address of Contractor) and Registered Office at(Registered address of Contractor) ("the Contractor") and the Contract ("the Contract") signed on(insert date of the Contract)..... between you and M/s (Name of Associate), having its Principal place of business at(Address of Associate) and Registered Office at(Registered address of Associate), the Associate of the Contractor for executing the Facilities concerning (Indicate brief scope of work) for the complete execution of the (insert name of Package along with name of the Project)..... [Applicable for Bank Guarantees to be issued by Contractor against those Contracts awarded to their Associate]

By this letter we, the undersigned,(insert name & address of the issuing bank), a Bank (which expression shall include its successors, administrators, executors and assigns) organized under the laws of and having its Registered/Head Office at(insert address of registered office of the bank)..... do hereby irrevocably guarantee payment to you up to i.e., Five percent (5%) of the Contract Price until ninety (90) days beyond the Defect Liability Period i.e., upto and inclusive of (dd/mm/yy).

We undertake to make payment under this Letter of Guarantee upon receipt by us of your first written demand signed by your duly authorized officer declaring the Contractor to be in default under the Contract and without cavil or argument any sum or sums within the above named limits, without your need to prove or show grounds or reasons for your demand and without the right of the Contractor to dispute or question such demand.

Our liability under this Letter of Guarantee shall be to pay to you whichever is the lesser of the sum so requested or the amount then guaranteed hereunder in respect of any demand duly made hereunder prior to expiry of the Letter of Guarantee, without being entitled to inquire whether or not this payment is lawfully demanded.

This letter of Guarantee shall remain in full force and shall be valid from the date of issue until ninety (90) days beyond the Defect Liability Period of the Facilities i.e. upto and inclusive of (dd/mm/yy) and shall be extended from time to time for such period (not exceeding one year), as may be desired by M/s. on whose behalf this Letter of Guarantee has been given.

Except for the documents herein specified, no other documents or other action shall be required, notwithstanding any applicable law or regulation.

Our liability under this Letter of Guarantee shall become null and void immediately upon its expiry, whether it is returned or not, and no claim may be made hereunder after such expiry or after the aggregate of the sums paid by us to you shall equal the sums guaranteed hereunder, whichever is the earlier.

All notices to be given under shall be given by registered (airmail) posts to the addressee at the address herein set out or as otherwise advised by and between the parties hereto.

We hereby agree that any part of the Contract may be amended, renewed, extended, modified, compromised, released or discharged by mutual agreement between you and the Contractor, and this security may be exchanged or surrendered without in any way impairing or affecting our liabilities hereunder without notices to us and without the necessity for any additional endorsement, consent or guarantee by us, provided, however, that the sum guaranteed shall not be increased or decreased.

No action, event or condition which by any applicable law should operate to discharge us from liability hereunder shall have any effect and we hereby waive any right we may have to apply such law so that in all respects our liability hereunder shall be irrevocable and, except as stated herein, unconditional in all respects.

Yours truly,

Name of the Bank

.....
Authorized Signature

Signature of Witness.....

Name.....

Address.....

Note :

1. The non-judicial stamp papers of appropriate value shall be purchased in the name of Bank who issues the 'Bank Guarantee' and the date of purchase should not be earlier than six months of issuance of the Bank Guarantee by the Bank.
2. The Bank Guarantee shall be signed on all the pages by the Bank Authorities indicating their POA nos. and should invariably be witnessed.

Annexure-XVIII

Format for Taking over Certificate

Date.....

Name of Contract.....

Contract No.....

To :

(Name and address of the Contractor)

Dear Ladies and/or Gentlemen,

Pursuant to GCC 20 (Completion of the Facilities) of the General Conditions of the Contract entered into between yourselves and the Employer dated relating to the (*insert brief description of the Facilities*)..... we hereby notify you that the following part(s) of the Facilities was (were) complete on the date specified below, and that, in accordance with the terms of the Contract, the Employer hereby takes over the said part(s) of the Facilities, together with the responsibility for care and custody and the risk of loss thereof on the date mentioned below :

1. Description of the Facilities or part thereof.....
.....

2. Date of Completion:.....

However, you are required to complete the outstanding items listed in the attachment hereto as soon as practicable.

This letter does not relieve you of your obligation to complete the execution of the Facilities in accordance with the Contract nor of your obligations during the Defects Liability Period.

Very truly yours,

Title
(Project Manager)

Annexure-XIX

Format for Indemnity bond

FORM OF INDEMNITY BOND TO BE EXECUTED BY THE CONTRACTOR FOR THE EQUIPMENT HANDED OVER IN ONE LOT BY(abbreviated name of the Employer)..... FOR PERFORMANCE OF ITS CONTRACT

INDEMNITY BOND

THIS INDEMNITY BOND is made this..... day of 20..... by a Company registered under the Companies Act, 1956/Partnership firm/ proprietary concern having its Registered Office at.....(hereinafter called as 'Contractor' or "Obligor" which expression shall include its successors and permitted assigns) in favour of (*insert name of the Employer*)....., a Company incorporated under the Companies Act, 1956 having its Registered Office at(*insert registered address of the Employer*) and its project at (hereinafter called "*.....(abbreviated name of the Employer).....*") which expression shall include its successors and assigns):

WHEREAS(*abbreviated name of the Employer*)..... has awarded to the Contractor a Contract for..... vide its Notification of Award/Contract No..... dated..... and its Amendment No. (applicable when amendments have been issued) (hereinafter called the "Contract") in terms of which(*abbreviated name of the Employer*)..... is required to hand over various Equipment to the Contractor for execution of the Contract.

And WHEREAS by virtue of Clause No.....of the said Contract, the Contractor is required to execute an Indemnity Bond in favour of(*abbreviated name of the Employer*)..... for the Equipment handed over to it by(*abbreviated name of the Employer*)..... for the purpose of performance of the Contract/Erection portion of the contract (hereinafter called the "Equipment").

AND THEREFORE, This Indemnity Bond witnesseth as follows:

1. That in consideration of various Equipment as mentioned in the Contract, valued at (amount in words.....) handed over to the Contractor for the purpose of performance of the Contract, the Contractor hereby undertakes to indemnify and shall keep(*abbreviated name of the Employer*)..... indemnified, for the full value of the Equipment. The Contractor hereby acknowledges receipt of the Equipment as per despatch title documents handed over to the Contractor duly endorsed in their favour and detailed in the Schedule appended hereto. It is expressly understood by the Contractor that handing over of the despatch title documents in respect of the said Equipments duly endorsed by(*abbreviated name of the Employer*)..... in favour of the Contractor shall be construed as handing over of the Equipment purported to be covered by such title documents and the Contractor shall hold such Equipment in trust as a Trustee for and on behalf of(*abbreviated name of the Employer*).....
2. That the Contractor is obliged and shall remain absolutely responsible for the safe transit/protection and custody of the Equipment at(*abbreviated name of the Employer*)..... project Site against all risks

whatsoever till the Equipment are duly used/erected in accordance with the terms of the Contract and the Plant/Package duly erected and commissioned in accordance with the terms of the Contract, is taken over by(*abbreviated name of the Employer*)..... The Contractor undertakes to keep(*abbreviated name of the Employer*)..... harmless against any loss or damage that may be caused to the Equipment.

3. The Contractor undertakes that the Equipment shall be used exclusively for the performance/execution of the Contract strictly in accordance with its terms and conditions and no part of the equipment shall be utilised for any other work of purpose whatsoever. it is clearly understood by the Contractor that non-observance of the obligations under this Indemnity Bond by the Contractor shall inter-alia constitute a criminal breach of trust on the part of the Contractor for all intents and purpose including legal/penal consequences.
4. That(*abbreviated name of the Employer*)..... is and shall remain the exclusive Employer of the Equipment free from all encumbrances, charges or liens of any kind, whatsoever. The equipment shall at all times be open to inspection and checking by the Employee or Employer's Representative in this regard. Further,(*abbreviated name of the Employer*)..... shall always be free at all times to take possession of the Equipment in whatever form the equipment may be, if in its opinion, the Equipment are likely to be endangered, misutilised or converted to uses other than those specified in the Contract, by any acts of omission or commission on the part of the Contractor or any other person or on account of any reason whatsoever and the Contractor binds himself and undertakes to comply with the directions of demand of(*abbreviated name of the Employer*)..... to return the equipment without any demur or reservation.
5. That this indemnity Bond is irrevocable. If at any time any loss or damage occurs to the Equipment or the same or any part thereof is misutilised in any manner whatsoever, then the Contractor hereby agrees that the decision of the Employer's Representative as to assessment of loss or damage to the Equipment shall be final and binding on the Contractor. The Contractor binds itself and undertakes to replace the lost and/or damaged Equipment at his own cost and/or shall pay the amount of loss to(*abbreviated name of the Employer*)..... without any demur, reservation or protest. This is without prejudice to any other right or remedy that may be available to(*abbreviated name of the Employer*)..... against the Contractor under the Contract and under this Indemnity Bond.
6. NOW THE CONDITION of this Bond is that if the Contractor shall duly and punctually comply with the terms and conditions of this Bond to the satisfaction of(*abbreviated name of the Employer*)....., THEN, the above Bond shall be void, but otherwise, it shall remain in full force and virtue.

IN WITNESS WHEREOF, the Contractor has hereunto set its hand through its authorised representative under the common seal of the Company, the day, month and year first above mentioned.

SCHEDULE

Particulars of the Equipment handed over	Quantity	Particulars of Despatch title Documents		Value of the Equipment	Signature of the Attorney in token of receipt
		RR/GR No.	Carrier		
		date of lading			

For and on behalf of
M/s.....

WITNESS

1. Signature.....

Signature.....

Name.....

Name.....

Address.....

Address.....

2. Signature.....

Authorised representative

Name.....

(Common Seal)

Address.....

(In case of Company)

Indemnity Bonds are to be executed by the authorised person and (i) in case of contracting Company under common seal of the Company or (ii) having the power of attorney issued under common seal of the company with authority to execute Indemnity Bonds, (iii) In case of (ii), the original Power of Attorney if it is specifically for this Contract or a Photostat copy of the Power of Attorney if it is General Power of Attorney and such documents should be attached to Indemnity Bond.

Annexure-XX

Format for Indemnity bond

**FORM OF INDEMNITY BOND TO BE EXECUTED BY THE CONTRACTOR FOR THE EQUIPMENT HANDED OVER IN
INSTALLMENTS BY(abbreviated name of the Employer)..... FOR PERFORMANCE OF ITS
CONTRACT**

INDEMNITY BOND

THIS INDEMNITY BOND is made this day of 20..... by a Company registered under the Companies Act, 1956/Partnership firm/proprietary concern having its Registered Office at(hereinafter called as 'Contractor' or 'Obligor' which expression shall include its successors and permitted assigns) in favour of(insert name of the Employer)....., a company incorporated under the Companies Act, 1956 having its Registered Office at(insert registered address of the Employer)..... and its project at (hereinafter called ".....(abbreviated name of the Employer)....." which expression shall include its successors and assigns):

WHEREAS(abbreviated name of the Employer)..... has awarded to the Contractor a Contract forvide its Notification of Award/Contract No.datedand Amendment No. (applicable when amendments have been issued) (hereinafter called the "Contract") in terms of which(abbreviated name of the Employer)..... is required to handover various Equipment to the Contractor for execution of the Contract.

AND WHEREAS by virtue of Clause No.....of the said Contract, the Contractor is required to execute an Indemnity Bond in favour of(abbreviated name of the Employer)..... for the Equipment handed over to it by(abbreviated name of the Employer)..... for the purpose of performance of the contract/Erection portion of the Contract (hereinafter called the "Equipment".)

NOW THEREFORE, This Indemnity Bond witnesseth as follows:

1. That in consideration of various Equipments as mentioned in the Contract, valued at (amount in words _____) to be handed over to the Contractor in installments from time to time for the purpose of performance of the contract, the Contractor hereby undertakes to indemnify and shall keep(abbreviated name of the Employer)..... indemnified, for the full value of Equipment. The Contractor hereby acknowledges receipt of the initial installment of the equipment per details in the schedule appended hereto. Further, the Contractor agrees to acknowledge receipt of the subsequent installments of the Equipment as required by(abbreviated name of the Employer)..... in the form of Schedules consecutively numbered which shall be attached to this Indemnity bond so as to form integral parts of this Bond. It is expressly understood by the Contractor that handing over the despatch title documents in respect of the said Equipments duly endorsed by(abbreviated name of the Employer)..... in favour of the Contractor shall be construed as handing over the Equipment purported to be covered by such title documents and the Contractor shall hold such Equipments in trust as a Trustee for and on behalf of(abbreviated name of the Employer).....

2. That the Contractor is obliged and shall remain absolutely responsible for the safe transit/protection and custody of the Equipment at(abbreviated name of the Employer)..... project Site against all risks whatsoever till the Equipment are duly used/erected in accordance with the terms of the Contract and the Plant/Package duly erected and commissioned in accordance with the terms of the Contract, is taken over by(abbreviated name of the Employer)..... The Contractor undertakes to keep(abbreviated name of the Employer)..... harmless against any loss or damage that may be caused to the Equipment.
3. The Contractor undertakes that the Equipment shall be used exclusively for the performance/execution of the Contract strictly in accordance with its terms and conditions and no part of the equipment shall be utilised for any other work or purpose whatsoever. It is clearly understood by the Contractor that non-observance of the obligations under this Indemnity Bond by the Contractor shall inter-alia constitute a criminal breach of trust on the part of the Contractor for all intents and purpose including legal/penal consequences.
4. That(abbreviated name of the Employer)..... is and shall remain the exclusive Employer of the Equipment free from all encumbrances, charges or liens of any kind, whatsoever. The equipment shall at all times be open to inspection and checking by the Employer or Employer's Representative in this regard. Further,(abbreviated name of the Employer)..... shall always be free at all times to take possession of the Equipment in whatever form the Equipment may be, if in its opinion, the Equipment are likely to be endangered, misutilised or converted to uses other than those specified in the Contract, by any acts of omission or commission on the part of the Contractor or any other person or on account of any reason whatsoever and the Contractor binds himself and undertakes to comply with the directions of demand of(abbreviated name of the Employer)..... to return the equipment without any demur or reservation.
5. That this indemnity Bond is irrevocable. If at any time any loss or damage occurs to the Equipment or the same or any part thereof is misutilised in any manner whatsoever, then the Contractor hereby agrees that the decision of the Employer's Representative as to assessment of loss or damage to the Equipment shall be final and binding on the Contractor. The Contractor binds itself and undertakes to replace the lost and/or damaged Equipment at its own cost and/or shall pay the amount of loss to(abbreviated name of the Employer)..... without any demur, reservation or protest. This is without prejudice to any other right or remedy that may be available to(abbreviated name of the Employer)..... against the Contractor under the Contract and under this Indemnity Bond.
6. NOW THE CONDITION of this Bond is that if the Contractor shall duly and punctually comply with the terms and conditions of this Bond to the satisfaction of(abbreviated name of the Employer)....., THEN, the above Bond shall be void, but otherwise, it shall remain in full force and virtue.

IN WITNESS WHEREOF, the Contractor has hereunto set its hand through its authorised representative under the common seal of the Company, the day, month and year first above mentioned.

SCHEDULE No. 1

Particulars of the Equipment handed over	Quantity	Particulars of Despatch title Documents		Value of the Equipment	Signature of the Attorney in token of receipt
		RR/GR No. date of lading	Carrier		

For and on behalf of
M/s.....

WITNESS

1. Signature.....

Signature.....

Name.....

Name.....

Address.....

Address.....

2. Signature.....

Authorised representative

Name.....

(Common Seal)

Address.....

(In case of Company)

Indemnity Bonds are to be executed by the authorised person and (i) in case of contracting Company under common seal of the Company or (ii) having the power of attorney issued under common seal of the company with authority to execute Indemnity Bonds, (iii) In case of (ii), the original Power of Attorney if it is specifically for this Contract or a photostate copy of the Power of Attorney if it is General Power of Attorney and such documents should be attached to Indemnity Bond.

Annexure-XXI

Format for Trust Receipt for Plant, Equipment and Materials

We M/s.(*insert name of the Contractor*) having our Principal place of business at having been awarded a Contract No. dated for (*insert Package name along with name of the Project*)..... by(*insert name of the Employer*)

We do hereby acknowledge the receipt of the Plant, Equipment and Materials as are fully described and mentioned under Documents of Title/RR/LR etc. and in the schedule annexed hereto, which shall form an integral part of this receipt as "Trustee" of..... (*insert name of the Employer*)..... The aforesaid materials etc. so received by us shall be exclusively used in the successful performance of the aforesaid Contract and for no other purpose whatsoever. We undertake not to create any charge, lien or encumbrance over the aforesaid materials etc, in favour of any other person/institution(s)/Banks.

For M/s.....
(Contractor's Name)

Dated:

(AUTHORISED SIGNATORY)

Place:

SEAL OF COMPANY