POWER GRID COMPANY OF BANGLADESH LIMITED

Procurement of Plant
Design, Supply and Install

Single-Stage, Two-Envelope
Bidding Procedure

BIDDING DOCUMENT
FOR
PROCUREMENT
OF
PACKAGE-1: DESIGN, SUPPLY, ERECTION, TESTING &
COMMISSIONING OF 132KV TRANSMISSION LINES AND SUBSTATIONS
ON TURNKEY BASIS

[CONTRACT NO.PSEEIP/ADB/PGCB/SS]

LOT-2: SUBSTATIONS

VOLUME 3 OF 3

BID PRICES AND SCHEDULES

MAY 2013

POWER GRID COMPANY OF BANGLADESH LIMITED

BIDDING DOCUMENT
FOR
PACKAGE-1: DESIGN, SUPPLY, ERECTION, TESTING & COMMISSIONING OF 132KV TRANSMISSION LINES AND SUBSTATIONS ON TURNKEY BASIS
Lot-2: Substation

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POWER GRID COMPANY OF BANGLADESH LIMITED

BIDDING DOCUMENT

FOR

PACKAGE-1: DESIGN, SUPPLY, ERECTION, TESTING & COMMISSIONING OF 132KV TRANSMISSION LINES AND SUBSTATIONS ON TURNKEY BASIS

Lot-2: Substation

SCHEDULE A

INTRODUCTION & PREAMBLE TO THE PRICE & TECHNICAL SCHEDULES

POWER GRID COMPANY OF BANGLADESH LIMITED

BIDDING DOCUMENT

FOR

PACKAGE-1: DESIGN, SUPPLY, ERECTION, TESTING & COMMISSIONING OF 132KV TRANSMISSION LINES AND SUBSTATIONS ON TURNKEY BASIS

Lot-2: Substation

[CONTRACT NO. PSEEIP/ADB/PGCB/SS]

SCHEDULE A

INTRODUCTION & PREAMBLE TO THE PRICE & TECHNICAL SCHEDULES

BRIEF DESCRIPTION OF THE WORKS

The bidder shall be deemed to have visited site, inspected, gathered data and verified details of the as-built system in order to design, supply and interface their new equipment. All necessary materials, adjustments, dismantling, remedial and tiding-up work in order to complete the work specified shall be included in the contract price. **The contractor is responsible for ensuring that all and/or and any item(s) of work required for the safe, efficient and satisfactory completion and functioning of the works, are included in the Bid Price whether they be described in the specification or not. In case of extension & renovation works all required as-built drawings may not be available for the existing plants & equipment which are required to be modified/renovated; the contractor is also responsible to make drawings as required to complete the works.**

The scope of work comprises the following: -

DESCRIPTION OF WORKS

The scope of work under this turnkey bid is design, supply, delivery, installation, testing & commissioning of four new 132/33kV Air Insulated Switchgear (AIS) substation at Rangamati, Khagrachari, Bianibazar & Sunamganj and extension/renovation of existing 132/33kV substation at Chandroghona, Narsingdi, Brahmanbaria, Mymensingh(RPCL), Tangail and Chatak substations.

The scope of work also includes design, supply, delivery, installation, testing & commissioning of 132/33kV power transformer and associated control, automation, protection, fiber optic multiplexer equipment for communication & protection, and civil works.

1) Rangamati 132/33kV AIS Substation

Rangamati is situated at the south-east hilly region and about 80km away from the main sea port Chittagong.

The configuration of the 132kV busbar shall be double busbar scheme. Switchyard layout shall be designed such as to accommodate double bus (U type) configuration.

132kV Air Insulated Switchgears (AIS):

132kV AIS switchyard for four(4) 132kV overhead line bays in order to connect two 132kV double circuit overhead line (Chandragona-1 & 2 and Khagrachori- 1 & 2) ; two(2) 132/33kV transformer bays for two sets of 132/33kV, 25/41MVA, three phase transformers; one(1) bus coupler bay. Space provision with busbar, gantry structure & switchyard finished surface without equipment is to be kept for extension of two(2) future 132kV line bays & one (1) future transformer bay(132kV Side).

33kV Air Insulated Switches and Connection:

33kV AIS switchyard single bus configuration and switches for two(2) LV side of 132/33kV power transformer bays and two(2) 33/.415kV aux. transformer bays in order to facilitate station power supply.

132/33kV three phase power transformer:

Two(2) sets of 25/41MVA(ONAN/ONAF), 132/33kV, three phase power transformers.

33/0.415kV auxiliary transformer:

Two (2) sets of 33/0.415kV, 200kVA, outdoor type auxiliary transformers to supply the substation auxiliary loads.

Control, Protection, Substation Automation & Metering:

Associated control, metering, protection equipment, synchronizing scheme and substation automation system for complete substation.

Fibre Optic Multiplexer Equipment for Communication and Protection:

Indoor type Fibre Optic Multiplexer and communication Equipment for protection & communication and integration with existing communication network of PGCB.

DC and LVAC System:

Complete set of 110V DC & 48V DC and LVAC system with all necessary materials required for the plant being installed with 50% spares for future use. The system shall be comprises with a backup/standby set.

Land Development, Civil Works, Building and Foundation:

Complete design, supply and construction of all civil items required for land development.

Complete design, supply and construction of all civil items required for the outdoor works suitable for switchyard gantry & equipment foundations, transformer foundations, blast walls, oil pit, entrance & internal roads, outdoor lighting system, cable trenches, septic tank, earth filling, surfacing, drainage, security fences, guard house, earthing & lightning protection, switchyard lighting, etc.

Complete design, supply and construction of all civil items including all necessary architecture & structural requirements; cable trays, fittings and flooring & finishes; air-conditioning and lighting for a new two storied main control room building.

SCADA system for Telecontrol and Telemetering:

Complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol & telemetering facilities required at the existing National Load Despatch Center(NLDC) at Rampura for integration of complete new 132/33kV substation. All required electrical signals shall be transmitted to the NLDC through the Industrial Gateway of the substation automation system. All HV breakers, motorized disconnectors, tap changer, etc. shall be controlled form NLDC through the Gateway of the substation automation system using IEC 60870-5-104 protocol. All necessary modification works in the software of master station of NLDC are to be carried out.

Mandatory Spares, Maintenance tools & Test Equipment:

Supply of complete mandatory spare and spare parts of transformer, switchgear, control equipment, protection relays, meters, maintenance tools & test equipment. The materials shall have to be handed over to the designated store as per instruction of the Engineer.

2) Khagrachori 132/33kV AIS Substation

Khagrachori is situated at the south-east hilly region and about 80km away from the main sea port Chittagong.

The configuration of the 132kV busbar shall be double busbar scheme. Switchyard layout shall be designed such as to accommodate double bus (U type) configuration.

132kV Air Insulated Switchgears (AIS):

132kV AIS switchyard for two(2) 132kV overhead line bays in order to connect one 132kV double circuit overhead line (Rangamati-1 & 2); two(2) 132/33kV transformer bays for two sets of 132/33kV, 25/41MVA, three phase transformers; one(1) bus coupler bay. Space provision with busbar, gantry structure & switchyard finished surface without equipment is to be kept for extension of two(2) future 132kV line bays & one (1) future transformer bay(132kV Side).

33kV Air Insulated Switches and Connection:

33kV AIS switchyard single bus configuration and switches for two(2) LV side of 132/33kV power transformer bays and two(2) 33/.415kV aux. transformer bays in order to facilitate station power supply.

132/33kV three phase power transformer:

Two(2) sets of 25/41MVA(ONAN/ONAF), 132/33kV, three phase power transformers.

33/0.415kV auxiliary transformer:

Two (2) sets of 33/0.415kV, 200kVA, outdoor type auxiliary transformers to supply the substation auxiliary loads.

Control, Protection, Substation Automation & Metering:

Associated control, metering, protection equipment, synchronizing scheme and substation automation system for complete substation.

Fibre Optic Multiplexer Equipment for Communication and Protection:

Indoor type Fibre Optic Multiplexer and communication Equipment for protection & communication and integration with existing communication network of PGCB.

DC and LVAC System:

Complete set of 110V DC & 48V DC and LVAC system with all necessary materials required for the plant being installed with 50% spares for future use. The system shall be comprises with a backup/standby set.

Land Development, Civil Works, Building and Foundation:

Complete design, supply and construction of all civil items required for land development.

Complete design, supply and construction of all civil items required for the outdoor works suitable for switchyard gantry & equipment foundations, transformer foundations, blast walls, oil pit, entrance & internal roads, outdoor lighting system, cable trenches, septic tank, earth filling, surfacing, drainage, security fences, guard house, earthing & lightning protection, switchyard lighting, etc.

Complete design, supply and construction of all civil items including all necessary architecture & structural requirements; cable trays, fittings and flooring & finishes; air-conditioning and lighting for a new two storied main control room building.

SCADA system for Telecontrol and Telemetering:

Complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol & telemetering facilities required at the existing National Load Despatch Center(NLDC) at Rampura for integration of complete new 132/33kV substation. All required electrical signals shall be transmitted to the NLDC through the Industrial Gateway of the substation automation system. All HV breakers, motorized disconnectors, tap changer, etc. shall be controlled form NLDC through the Gateway of the substation automation system using IEC 60870-5-101/104 protocol. All necessary modification works in the software of master station of NLDC are to be carried out.

Mandatory Spares, Maintenance tools & Test Equipment:

Supply of complete mandatory spare and spare parts of transformer, switchgear, control equipment, protection relays, meters, maintenance tools & test equipment. The materials shall have to be handed over to the designated store as per instruction of the Engineer.

3) Bianibazar 132/33kV AIS Substation

Bianibazari is situated at the north-east region and about 280km away from the capital city Dhaka.

The configuration of the 132kV busbar shall be double busbar scheme. Switchyard layout shall be designed such as to accommodate double bus (U type) configuration.

132kV Air Insulated Switchgears (AIS):

132kV AIS switchyard for one(1) 132kV overhead line bays in order to connect one 132kV single circuit overhead line (tee off of Sylhet-Fenchuganj line-1); two(2) 132/33kV transformer bays for two sets of 132/33kV, 25/41MVA, three phase transformers; one(1) bus coupler bay. Space provision with busbar, gantry structure & switchyard finished surface without equipment is to be kept for extension of two(2) future 132kV line bays & one (1) future transformer bay(132kV Side).

33kV Air Insulated Switches and Connection:

33kV AIS switchyard single bus configuration and switches for two(2) LV side of 132/33kV power transformer bays and two(2) 33/.415kV aux. transformer bays in order to facilitate station power supply.

132/33kV three phase power transformer:

Two(2) sets of 25/41MVA(ONAN/ONAF), 132/33kV, three phase power transformers.

33/0.415kV auxiliary transformer:

Two (2) sets of 33/0.415kV, 200kVA, outdoor type auxiliary transformers to supply the substation auxiliary loads.

Control, Protection, Substation Automation & Metering:

Associated control, metering, protection equipment, synchronizing scheme and substation automation system for complete substation.

Fibre Optic Multiplexer Equipment for Communication and Protection:

Indoor type Fibre Optic Multiplexer and communication Equipment for protection & communication and integration with existing communication network of PGCB.

DC and LVAC System:

Complete set of 110V DC & 48V DC and LVAC system with all necessary materials required for the plant being installed with 50% spares for future use. The system shall be comprises with a backup/standby set.

Land Development, Civil Works, Building and Foundation:

Complete design, supply and construction of all civil items required for land development.

Complete design, supply and construction of all civil items required for the outdoor works suitable for switchyard gantry & equipment foundations, transformer foundations, blast walls, oil pit, entrance & internal roads, outdoor lighting system, cable trenches, septic tank, earth filling, surfacing, drainage, security fences, guard house, earthing & lightning protection, switchyard lighting, etc.

Complete design, supply and construction of all civil items including all necessary architecture & structural requirements; cable trays, fittings and flooring & finishes; air-conditioning and lighting for a new two storied main control room building.

SCADA system for Telecontrol and Telemetering:

Complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol & telemetering facilities required at the existing National Load Despatch Center(NLDC) at Rampura for integration of complete new 132/33kV substation. All required electrical signals shall be transmitted to the NLDC through the Industrial Gateway of the substation automation system. All HV breakers, motorized disconnectors, tap changer, etc. shall be controlled form NLDC through the Gateway of the substation automation system using IEC 60870-5-101/104 protocol. All necessary modification works in the software of master station of NLDC are to be carried out.

Mandatory Spares, Maintenance tools & Test Equipment:

Supply of complete mandatory spare and spare parts of transformer, switchgear, control equipment, protection relays, meters, maintenance tools & test equipment. The materials shall have to be handed over to the designated store as per instruction of the Engineer.

4) Sunamganj 132/33kV AIS Substation

Sunamganj is situated at the north-east region and about 290km away from the capital city Dhaka.

The configuration of the 132kV busbar shall be double busbar scheme. Switchyard layout shall be designed such as to accommodate double bus (U type) configuration.

132kV Air Insulated Switchgears (AIS):

132kV AIS switchyard for one(1) 132kV overhead line bays in order to connect one 132kV single circuit overhead line (Chatak-1); two(2) 132/33kV transformer bays for two sets of 132/33kV, 25/41MVA, three phase transformers; one(1) bus coupler bay. Space provision with busbar, gantry structure & switchyard finished surface without equipment is to be kept for extension of two(2) future 132kV line bays & one (1) future transformer bay(132kV Side).

33kV Air Insulated Switches and Connection:

33kV AIS switchyard single bus configuration and switches for two(2) LV side of 132/33kV power transformer bays and two(2) 33/.415kV aux. transformer bays in order to facilitate station power supply.

132/33kV three phase power transformer:

Two(2) sets of 25/41MVA(ONAN/ONAF), 132/33kV, three phase power transformers.

33/0.415kV auxiliary transformer:

Two (2) sets of 33/0.415kV, 200kVA, outdoor type auxiliary transformers to supply the substation auxiliary loads.

Control, Protection, Substation Automation & Metering:

Associated control, metering, protection equipment, synchronizing scheme and substation automation system for complete substation.

Fibre Optic Multiplexer Equipment for Communication and Protection:

Indoor type Fibre Optic Multiplexer and communication Equipment for protection & communication and integration with existing communication network of PGCB.

DC and LVAC System:

Complete set of 110V DC & 48V DC and LVAC system with all necessary materials required for the plant being installed with 50% spares for future use. The system shall be comprises with a backup/standby set.

Land Development, Civil Works, Building and Foundation:

Complete design, supply and construction of all civil items required for land development.

Complete design, supply and construction of all civil items required for the outdoor works suitable for switchyard gantry & equipment foundations, transformer foundations, blast walls, oil pit, entrance & internal roads, outdoor lighting system, cable trenches, septic tank, earth filling, surfacing, drainage, security fences, guard house, earthing & lightning protection, switchyard lighting, etc.

Complete design, supply and construction of all civil items including all necessary architecture & structural requirements; cable trays, fittings and flooring & finishes; air-conditioning and lighting for a new two storied main control room building.

SCADA system for Telecontrol and Telemetering:

Complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol & telemetering facilities required at the existing National Load Despatch Center(NLDC) at Rampura for integration of complete new 132/33kV substation. All required electrical signals shall be transmitted to the NLDC through the Industrial Gateway of the substation automation system. All HV breakers, motorized disconnectors, tap changer, etc. shall be controlled form NLDC through the Gateway of the substation automation system using IEC 60870-5-101/104 protocol. All necessary modification works in the software of master station of NLDC are to be carried out.

Mandatory Spares, Maintenance tools & Test Equipment:

Supply of complete mandatory spare and spare parts of transformer, switchgear, control equipment, protection relays, meters, maintenance tools & test equipment. The materials shall have to be handed over to the designated store as per instruction of the Engineer.

5) Extension & Renovation of existing 132/33kV AIS Substation at Chandroghona

Chandroghona is situated about 50km away from the main sea port Chittagong.

The configuration of the existing 132kV busbar is ring bus arrangement and consists of two(2) line bays and two(2) transformer bays. The existing ring bus arrangement is to be converted to double bus configuration to accommodate total six(6) line bays, two(2) transformer bays & one(1) bus tie bay.

132kV Air Insulated Switchgears (AIS):

132kV AIS switchyard for extension of new four(4) 132kV overhead line bays in order to connect 132kV overhead line (Rangamati-1 & 2; Madunaghat-1; Kaptai-1), one(1) new bustie bay; and renovation of existing two(2) line bays (Madunaghat-2; Kaptai-2) & existing two(2) 132/33kV transformer bays.

Control, Protection, Substation Automation & Metering:

Associated control, metering, protection equipment, synchronizing scheme and substation automation system for new four(4) 132kV overhead line bays, one(1) new bustie bay and replacement of existing two(2) line bays and existing two(2) 132/33kV transformer bays.

Fibre Optic Multiplexer Equipment for Communication and Protection:

Indoor type Fibre Optic Multiplexer and communication Equipment for protection & communication and integration with existing communication network of PGCB.

DC and LVAC System:

Replacement of existing DCDB system by a complete new set of 110V & 48V DC system and LVAC system with all necessary materials required for the plant being installed with 50% spares for future use. The system shall be comprises with a backup/standby set.

Civil Works, Building and Foundation:

Complete design, supply and construction of all civil items required for the outdoor works suitable for switchyard gantry & equipment foundations, cable trenches, surfacing, drainage, outdoor lighting system, security fences, including earthing & lightning protection, switchyard lighting, etc to accommodate new bays and renovation of existing bays. The existing control room building shall be renovated internally with all civil items and facilities as required including placing of new floor tiles.

SCADA system for Telecontrol and Telemetering:

Complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol & telemetering facilities required at the existing

National Load Despatch Center (NLDC) at Rampura for integration of four(4) new 132kV line bays. All required electrical signals shall be transmitted to the NLDC through the Remote terminal units (RTU). All HV breakers, motorized disconnectors etc. shall be controlled form NLDC through the Remote terminal units (RTU) using IEC 60870-5-104 protocol. All necessary modification works in the software of master station of NLDC are to be carried out. The existing RTUs are AREVA, France made MiCOM C264 type.

Mandatory Spares, Maintenance tools & Test Equipment:

Supply of complete mandatory spare for switchgear, control equipment, protection relays, meters, maintenance tools & test equipment. The materials shall have to be handed over to the designated store as per instruction of the Engineer.

6) Extension & Renovation of existing 132/33kV AIS Substation at Narshindi

Narshindi is situated about 60km away from the capital city Dhaka.

The configuration of the existing 132kV busbar is single bus arrangement and consists of two(2) line bays and one(1) transformer bay and a sectionalizer breaker bay. The existing single bus arrangement is to be converted to double bus configuration to accommodate total six(6) line bays, two(2) transformer bays & one(1) bus tie bay.

132kV Air Insulated Switchgears (AIS):

132kV AIS switchyard for extension of new four(4) 132kV overhead line bays in order to connect 132kV overhead line (Bhulta; Gorashal-2; Brahamanbaria-1 &2), new one(1) 132/33kV, 50/75MVA transformer and renovation of existing two(2) line bays (Haripur-1; Ghorashal-1) & existing one(1) 132/33kV transformer bay, existing one(1) bus tie bay.

33kV Air Insulated Switchgear and Connection:

The existing 33kV indoor type AIS single bus shall be extended to accommodate one(1) bustie bay for connecting new outdoor bus. A complete new 33kV outdoor type switchyard with single bus configuration is to be constructed with one(1) bay for LV side of 132/33kV, 50/75MVA transformer and one(1) bay for bus tie which shall be connected to existing indoor bus with underground XLPE insulated, copper cable, rated current 1500A.

The new one 33/.415kV auxilliary transformer bay shall be connected to the 33kV new outdoor bus in order to facilitate station power supply.

132/33kV three phase power transformer:

One(1) sets of 50/75MVA(ONAN/ONAF), 132/33kV, three phase power transformer.

33/0.415kV auxiliary transformer:

One(1) set of 33/0.415kV, 200kVA, outdoor type auxiliary transformers to supply the substation auxiliary loads.

Control, Protection, Substation Automation & Metering:

Associated control, metering, protection equipment, synchronizing scheme and substation automation system for new four(4) 132kV overhead line bays, and replacement of existing two(2) line bays, existing one(1) transformer bay and existing one bus tie bay.

Fibre Optic Multiplexer Equipment for Communication and Protection:

Indoor type Fibre Optic Multiplexer and communication Equipment for protection & communication and integration with existing communication network of PGCB.

DC and LVAC System:

Replacement of existing DCDB system by a complete new set of 110V & 48V DC system and LVAC system with all necessary materials required for the plant being installed with 50% spares for future use. The system shall be comprises with a backup/standby set.

Land Development, Civil Works, Building and Foundation:

Complete design, supply and construction of all civil items required for land development (filling by carried earth) for new area to be extended under this turnkey bid.

Complete design, supply and construction of all civil items required for the outdoor works suitable for switchyard gantry & equipment foundations, transformer foundations, blast walls, oil pit, entrance & internal roads, outdoor lighting system, cable trenches, septic tank, surfacing, drainage, security fences, guard house, earthing & lightning protection, switchyard lighting, etc.

Complete design, supply and construction of all civil items required for the outdoor works suitable for switchyard gantry & equipment foundations, cable trenches, surfacing, drainage, outdoor lighting system, security fences, including earthing & lightning protection, switchyard lighting, etc to accommodate new bays and renovation of existing bays. The existing control room building shall be renovated internally with all civil items and facilities as required including placing of new floor tiles.

SCADA system for Telecontrol and Telemetering:

Complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol & telemetering facilities required at the existing National Load Despatch Center (NLDC) at Rampura for integration of four(4) new 132kV line bays & one 132kV transformer bay. All required electrical signals shall be transmitted to the NLDC through the Remote terminal units (RTU). All HV breakers, motorized disconnectors etc. shall be controlled form NLDC through the remote terminal units (RTU) using IEC 60870-5-104 protocol. All necessary modification works in the software of master station of NLDC are to be carried out. The existing RTUs are AREVA, France made MiCOM C264 type.

Mandatory Spares, Maintenance tools & Test Equipment:

Supply of complete mandatory spare and spare parts of transformer, switchgear, control equipment, protection relays, meters, maintenance tools & test equipment. The

materials shall have to be handed over to the designated store as per instruction of the Engineer.

7) Extension of existing 132/33kV AIS Substation at Brahamanbaria

Brahamanbaria is situated at the south-east side, about 140km away from the capital city Dhaka.

The configuration of the existing 132kV busbar is main & transfer bus arrangement and consists of four(4) line bays, three(3) transformer bays and one(1) bus tie bay. The existing bus shall be extended to accommodate two overhead line bays.

132kV Air Insulated Switchgears (AIS):

132kV AIS switchyard for extension of new two(2) 132kV overhead line bays in order to connect 132kV overhead line (Narshindi-1 & 2).

Control, Protection, & Metering:

Associated control, metering, protection equipment, synchronizing scheme for new two(2) 132kV overhead line bays.

Fibre Optic Multiplexer Equipment for Communication and Protection:

Extension of existing Fibre Optic Multiplexer and communication equipment for protection & communication. The existing Fiber optic multiplexer and communication equipment is AREVA, France made MSE 5001 type.

DC and LVAC System:

Extension of existing DCDB & LVAC system by necessary materials required for the plant being installed.

Civil Works, Building and Foundation:

Complete design, supply and construction of all civil items required for the outdoor works suitable for switchyard gantry & equipment foundations, internal roads, outdoor lighting system, cable trenches, surfacing, drainage, security fences, earthing & lightning protection, etc to accommodate new bays.

SCADA system for Telecontrol and Telemetering:

Complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol & telemetering facilities required at the existing National Load Despatch Center (NLDC) at Rampura for integration of two new 132kV line bays. All required electrical signals shall be transmitted to the NLDC through the Remote terminal units (RTU). All HV breakers, motorized disconnectors etc. shall be controlled form NLDC through the remote terminal units (RTU) using IEC 60870-5-104 protocol. All necessary modification works in the software of master station of NLDC are to be carried out. The existing RTUs are AREVA, France made MiCOM C264 type.

8) Extension of existing 132kV AIS Substation at Mymensingh(RPCL)

Mymensingh is situated at the north side, about 120km away from the capital city Dhaka..

The configuration of the existing 132kV busbar is double bus arrangement and consists of two(2) line bays, two(2) power station bays and a bus tie bay. The existing bus shall be extended to accommodate two overhead line bays.

132kV Air Insulated Switchgears (AIS):

132kV AIS switchyard for extension of new two(2) 132kV overhead line bays in order to connect 132kV overhead line (Tangail-1 & 2).

Control, Protection, & Metering:

Associated control, metering, protection equipment, synchronizing scheme for new two(2) 132kV overhead line bays.

Fibre Optic Multiplexer Equipment for Communication and Protection:

Indoor type Fibre Optic Multiplexer and communication Equipment for protection & communication and integration with existing communication network of PGCB.

DC and LVAC System:

Extension of existing DCDB & LVAC system by necessary materials required for the plant being installed.

Civil Works, Building and Foundation:

Complete design, supply and construction of all civil items required for the outdoor works suitable for switchyard gantry & equipment foundations, internal roads, outdoor lighting system, cable trenches, surfacing, drainage, security fences, earthing & lightning protection, etc to accommodate new bays.

SCADA system for Telecontrol and Telemetering:

Complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol & telemetering facilities required at the existing National Load Despatch Center (NLDC) at Rampura for integration of two new 132kV line bays. All required electrical signals shall be transmitted to the NLDC through the Remote terminal units (RTU). All HV breakers, motorized disconnectors etc. shall be controlled form NLDC through the remote terminal units (RTU) using IEC 60870-5-104 protocol. All necessary modification works in the software of master station of NLDC are to be carried out. The existing RTUs are AREVA, France made MiCOM C264 type.

9) Extension of existing 132/33kV AIS Substation at Tangail

Tangail is situated at the western side, about 100km away from the capital city Dhaka.

The configuration of the existing 132kV busbar is main & transfer bus arrangement and consists of two(2) line bays, two(2) transformer bays and one(1) bus tie bay. The existing bus shall be extended to accommodate two overhead line bays.

132kV Air Insulated Switchgears (AIS):

132kV AIS switchyard for extension of new two(2) 132kV overhead line bays in order to connect 132kV overhead line (Mymensing-1 & 2).

Control, Protection, & Metering:

Associated control, metering, protection equipment and synchronizing scheme for new two(2) 132kV overhead line bays.

Fibre Optic Multiplexer Equipment for Communication and Protection:

Extension of existing Fibre Optic Multiplexer and communication equipment for protection & communication. The existing Fiber optic multiplexer and communication equipment is AREVA, France made MSE 5001 type.

DC and LVAC System:

Extension of existing DCDB & LVAC system by necessary materials required for the plant being installed.

Land Development, Civil Works, Building and Foundation:

Complete design, supply and construction of all civil items required for land development (filling by carried earth) for new area to be extended under this turnkey bid.

Complete design, supply and construction of all civil items required for the outdoor works suitable for switchyard gantry & equipment foundations, internal roads, outdoor lighting system, cable trenches, surfacing, drainage, security fences, earthing & lightning protection, etc to accommodate new bays.

SCADA system for Telecontrol and Telemetering:

Complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol & telemetering facilities required at the existing National Load Despatch Center (NLDC) at Rampura for integration of two new 132kV line bays. All required electrical signals shall be transmitted to the NLDC through the Remote terminal units (RTU). All HV breakers, motorized disconnectors etc. shall be controlled form NLDC through the remote terminal units (RTU) using IEC 60870-5-104 protocol. All necessary modification works in the software of master station of NLDC are to be carried out. The existing RTUs are AREVA, France made MiCOM C264 type.

10) Extension of existing 132/33kV AIS Substation at Chatak

Chatak is situated at the north-east region, about 265km away from the capital city Dhaka.

The configuration of the existing 132kV busbar is double bus arrangement and consists of two(2) line bays, three(3) transformer bay and a bus tie bay. The existing bus shall be extended to accommodate two(2) overhead line bays (one shall be fully equipped and the other shall be kept unequipped as future provision).

132kV Air Insulated Switchgears (AIS):

132kV AIS switchyard for extension of new one(1) 132kV overhead line bays in order to connect 132kV overhead line (Sunamganj-1).

Control, Protection, & Metering:

Associated control, metering, protection equipment and synchronizing scheme for new one(1) 132kV overhead line bay.

Fibre Optic Multiplexer Equipment for Communication and Protection:

Extension of existing Fibre Optic Multiplexer and communication equipment for protection & communication. The existing Fiber optic multiplexer and communication equipment is AREVA, France made MSE 5001 type.

DC and LVAC System:

Replacement of existing DCDB system by a complete new set of 110V & 48V DC system and LVAC system with all necessary materials required for the plant being installed with 50% spares for future use. The system shall be comprises with a backup/standby set.

Land Development, Civil Works, Building and Foundation:

Complete design, supply and construction of all civil items required for land development (filling by carried earth) for new area to be extended under this turnkey bid.

Complete design, supply and construction of all civil items required for the outdoor works suitable for switchyard gantry & equipment foundations, internal roads, outdoor lighting system, cable trenches, surfacing, drainage, security fences, earthing & lightning protection, etc to accommodate new bays.

SCADA system for Telecontrol and Telemetering:

Complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol & telemetering facilities required at the existing National Load Despatch Center (NLDC) at Rampura for integration of one(1) new 132kV line bays. All required electrical signals shall be transmitted to the NLDC through the Remote terminal units (RTU). All HV breakers, motorized disconnectors etc. shall be controlled form NLDC through the remote terminal units (RTU) using IEC 60870-5-104 protocol. All necessary modification works in the software of master station of NLDC are to be carried out. The existing RTUs are AREVA, France made MiCOM C264 type.

SCHEDULE A

REQUIREMENTS

1) Rangamati 132/33kV AIS Substation

The equipment to be designed, supplied, installed, tested & commissioned as stipulated in bid specification and shown in bid drawings:

Item	Description
1A	**145kV Air Insulated Switchgear (AIS)**
	The 145kV AIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included as Appendix A1 to this section and bid drawings; shall comprise the following:-
1A1.1	One(1) set of 145kV, 2000A, 31.5kA/1sec, 50Hz, 650kVp BIL, live tank type, gang operated, SF6 gas circuit breaker with spring-stored energy operating mechanism (for bus coupler).
1A1.2	Two(2) sets of 145kV, 1250A, 31.5kA/1sec, 50Hz, 650kVp BIL, live tank type, gang operated, SF6 gas circuit breaker with spring-stored energy operating mechanism (for Transformer bays).
1A1.3	Four(4) sets of 145kV, 1250A, 31.5kA/1sec, 50Hz, 650kVp BIL, live tank type, single pole operated, SF6 gas circuit breaker with spring-stored energy operating mechanism (for Transsmission line bays).
1A2.1	Two(2) sets of 145kV, 2000A, 31.5kA/1sec, 50Hz, 650kVp BIL, double side break, post type, motor operated disconnectors with manual earthing switch (for bus coupler).
1A2.2	Six(6) sets of 145kV, 1250A, 31.5kA/1sec, 50Hz, 650kVp BIL, double side break, post type, motor operated disconnectors with manual earthing switch
1A2.3	Twelve(12) sets of 145kV, 1250A, 31.5kA/1sec, 50Hz, 650kVp BIL, double side break, post type, motor operated disconnectors without earthing switch.
1A3.1	Six(6) nos. of single-phase, 2-core, multi ratio, 145kV, 31.5kA/1sec, 50Hz, 650kVp BIL, post type current transformer (for bus coupler bay, 2000/1A).
1A3.2	Twelve(12) nos. of single-phase, 4-core, multi ratio, 145kV, 31.5kA/1sec, 50Hz, 650kVp BIL, post type current transformer(for line bays).
1A3.3	Six(6) nos. of single-phase, 4-core, multi ratio, 145kV, 31.5kA/1sec, 50Hz, 650kVp BIL, post type current transformer(for Transformer bays).
1A4.1	Eighteen(18) nos. of single-phase, 2-core, 145kV, 31.5kA/1sec, 50Hz, 650kVp BIL, Capacitor voltage transformers (CVT).

1A4.2 Six(6) nos. of single-phase, 2-core, 145kV, 31.5kA/1sec, 50Hz, 650kVp BIL, inductive voltage transformers (IVT).

1A5 Eighteen(18) nos. of 120kV rated voltage, 102kV(rms) continuous operating voltage at 50^0c, 10kA nominal discharge current, 50Hz, Heavy duty station class, gapless metal oxide type, single phase surge arresters.

1A6 Six(6) nos. single phase 145kV post type support insulators required for completing 145kV busbar and switchgear connections.

1A7 One(1) lot of flexible conductors for busbar[ACSR, Twin Finch(1113MCM)] & jackbus, jumper, equipment connections[ACSR, Single Grosbeak(636 MCM)], including all necessary clamps & connectors required for completing 145kV busbar and switchgear connection.

1A8 One (1) lot of insulators and fittings including all necessary accessories required to complete 132kV switchyard

1A9 One(1) lot of steel structures for gantry and equipment supports including nuts & bolts and cable tray including all necessary fitting & fixing accessories required to complete 132kV switchyard.

1B 33kV Air Insulated Switches and Connection for Auxiliary Transformers

The 33kV AIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included as Appendix A1 to this section and bid drawings; shall comprise the following:-

1B1 Two (2) sets of 36kV, 2000A, 25kA/1sec, 50Hz, 170kVp BIL, outdoor Vacuum Circuit Breakers(VCB) with spring-stored energy operating mechanism.

1B2 Seven(7) sets of 36kV, 2000A, 25kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, disconnectors.

1B3 Six(6) nos. of single-phase, 3-core, multi ratio, 36kV, 25kA/1sec, 50Hz, 170kVp BIL, post type current transformer.

1B4 Twelve(12) nos. of single-phase, 2-core, 36kV, 25kA/1sec, 50Hz, 650kVp BIL, voltage transformers.

1B5 Twelve(12) nos. of 30kV rated voltage, 10kA nominal discharge current, 50Hz, Heavy duty station class, single phase surge arresters.

1B6 One(1) lot of flexible conductors for busbar, jackbus, jumper, equipment connections[ACSR, Twin Finch(1113MCM)], including all necessary clamps & connectors required for completing 33kV busbar and switchgear connection.

1B7 One (1) lot of insulators and fittings including all necessary accessories required to complete 33kV switchyard

1B8 One(1) lot of steel structures for gantry and equipment supports including nuts & bolts and cable tray including all necessary fitting & fixing accessories required for completing 33kV switchyard.

1C Power Transformers & Earthing/Auxiliary Transformers

1C1 Two (2) sets of 132/33kV, 25/41 MVA (ONAN/ONAF), three phase outdoor type power transformers with associated bushing CTs including all necessary connections, insulators & fittings.

1C2 Two(2) sets 33/0.415kV, 200kVA three phase outdoor type station auxiliary transformers with associated bushing CTs and steel support structures including all necessary connections, insulators & fittings.

1D Control, Protection, Substation Automation & Metering

132 kV Circuits

The equipment to be designed, supplied, installed and commissioned is shown in bid drawings are comprising of :-

1D1 Control, Protection, Metering & Substation Automation System including event recording function for four(4) sets of overhead line circuits to Chandroghona (Chandroghona-1 & 2) and Khagrachori (Khagrachori-1 & 2).

1D2 Control, Protection, Metering & Substation Automation System including event recording function for two(2) sets of 132/33 kV power transformer circuits including transformer tap changer control.

1D3 Control, Protection, metering & Substation Automation System including event recording function for one(1) set of bus coupler circuit.

1D4 Busbar protection system for complete 132kV bus; one(1) lot.

1D5 Tariff metering panel to accommodate programmable & recordable digital 3-phase, 4-wire import and export MWh and MVArh meters (accuracy class 0.2) for four(4) 132 kV line and two(2) transformer feeder. For each feeder minimum two meters (main & check). The scope of works also includes supply of software(s) & connection cords of the above energy meters for future re-configuration.

33 kV Circuits

The equipment to be supplied, installed and commissioned is shown in bid drawings are comprising of:-

1D5 Control, Protection, Metering & Substation Automation System including event recording function for two sets of power transformer circuits

1D6 Tariff metering panel to accommodate programmable & recordable digital 3-phase, 4-wire import and export MWh and MVArh meters (accuracy class 0.2) for two transformer feeder circuits (Power X-former-I & II). For each feeder minimum two meters (main & check). The scope of works also includes supply of software(s) of the above energy meters for future re-configuration.

1E Multicore Cables

1E1 One (1) lot complete set of multicore low voltage 0.6/1.1kV, XLPE insulated power and control cables (IEC 60502) shall be supplied, installed, glanded, terminated and

have individual cores identified to be used for connection of all equipment supplied under the Contract. The overall substation cable routing and core schedules shall also be provided.

1F Earthing and Lightning Protection

1F1 One (1) lot of design, supply and installation of earthing system and lightning protection screen including connections, connectors and clamps, to suit the substation overall arrangement and provide supporting design calculations.

1F2 One (1) set of 3-phase portable (maintenance) earthing equipment devices with connectors and telescopic glass fibre operating pole suitable for plant supplied.

1G Batteries, Chargers and DC Distribution

1G1 110V substation NiCad batteries complete with chargers and distribution switchboard to be supplied, installed and commissioned to provide all DC supplies to equipment being supplied.

The system shall generally be as shown in bid drawing and shall include:

(a) Two (2) sets of 100% batteries complete, each capacity shall not be less than 250Ah at the 5-hour rate of discharge.

(b) Two (2) sets of battery chargers complete, each charger shall not be less than 75A rating.

(c) One (1) set of DC distribution board. The DC distribution board shall be with 50% overall spare switches for future use.

(d) Two(2) sets of online UPS, 3kVA for Substation Automation system panels.

1G2 48V DC system and distribution equipment complete with NiCad batteries chargers to be supplied, installed and commissioned in the main control building for the new fibre optic multiplexer equipment for communication and protection. One set shall be used as standby supply.

The system shall generally be as shown in bid drawing and shall include:

(a) Two (2) sets of 100% batteries complete, each capacity shall not be less than 150 Ah at the 5-hour rate of discharge

(b) Two (2) sets of battery chargers of output 48V DC, 30A and input voltage three pahse 50Hz, 415 V AC.

(c) One (1) lot of DC distribution board. The DC distribution board shall be suitable to connect the new fibre optic multiplexer equipment for communication and protection with 50% overall spare switches for future use.

1H LVAC Distribution

1H1 One (1) lot of LVAC switchboard for substation services to be supplied, installed and commissioned, to provide the 415/240V supplies to all equipment being supplied under this turnkey Bid.

1H2 One (1) lot of Tariff metering panel to accommodate programmable & recordable digital 3-phase, 4-wire import and export MWh and MVArh meters (accuracy class 0.2) for two 33/0.415 kV station auxiliary transformer feeder circuits. For each feeder minimum two meters (main & check).

The system and requirements shall generally be as shown in Bid drawing and technical specification of Volume 2 and shall include one 125A outdoor weatherproof 3-phase with neutral and earth switched socket outlet and plug as per IEC 309; to be installed, cabled and connected adjacent to the auxiliary transformers.

1I Civil Works, Building and Foundation

1I1 Complete earth filling by imported carried earth free from foreign solid particles and organic materials in addition to the earth recovered from digging of foundation, to make the top of the final ground level of substation 0.5m high from highest flood level and final compaction to be achieved 95% for total volume 60,800 cubic meter. The volume of earth filling may be varied but the payment shall be as per actual measurement of work done.

1I2 One (1) lot of complete design, supply and construction of all civil items required for the outdoor works suitable for switchyard gantry & equipment foundations, transformer foundations, blast walls, oil pit, entrance & internal roads, cable trenches, septic tank, soak way, surfacing, gravel laying, drainage, security fences, boundary wall, sentry post, guard house, car port, etc.

1I3 One (1) lot of complete design, supply and construction of all civil items and facilities required for the two storied main control building including cable basement.

1J Lighting, Small Power, Air Conditioning and Ventilation

1J1 One (1) lot of complete design, supply, installation and commissioning of equipment to provide lighting, LV power supply, air conditioning system, ventilation system and emergency DC lighting for the main control building.

1J2 One (1) lot of complete set of design, supply, installation and commissioning of equipment to provide lighting (flood light LED type) for security, roadway, switchyard and emergency DC lighting at strategic locations for equipment operation and inspection.

1K Fibre Optic Multiplexer Equipment for Communication and Protection

1K1 The equipment to be supplied, installed and commissioned shall be as shown on bid drawing. One(1) lot complete set of design, supply, installation and commissioning of fibre optic multiplexer equipment including necessary works to interface with existing system is to be provided for:

- 87 or 21 relay for each transmission line protection (through fibre cores)
- 21 relay carrier signal (main and back-up)
- SCADA data from switchgear and control system
- Digital Telephone exchange including hot-line telephone system

1K2 Underground optical fibre cables (24cores for 132kV switchyard) from terminal box gantry structure at each 132kV double circuit transmission line termination point to MDF (Main distribution Frame) to be installed in control room. The Contract includes supply and installation of MDF and pigtail cables with adequate length.

1L SCADA system for Telecontrol and Telemetering

1L1 One (1) lot of complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol & telemetering facilities required at the existing National Load Despatch Center (NLDC) at Rampura for integration of complete new 132/33kV substation. All required electrical signals shall be transmitted to the NLDC through the Industrial Gateway of the substation automation system. All HV breakers, motorized disconnectors, tap changer, etc. shall be controlled form NLDC through the Gateway of the substation automation system using IEC 60870-5-104 protocol. All necessary modification works in the software of master station of NLDC are to be carried out.

1M Mandatory Spares, Erection & Test Equipment

Supply of complete spares and spare parts of transformer, switchgear, control equipment, protection relays, meters, erection & test equipment as per quantity mentioned in Schedule B. Test equipment are to be supplied from Europe, USA or Japan origin. Printed catalogue, operation and service manual are to be provided. The materials shall have to be handed over to the designated store as per instruction of the Engineer.

2) Khagrachori 132/33kV AIS Substation

The equipment to be designed, supplied, installed, tested & commissioned as stipulated in bid specification and shown in bid drawings:

Item Description

2A 145kV Air Insulated Switchgear (AIS)

The 145kV AIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included as Appendix A1 to this section and bid drawings; shall comprise the following:-

2A1.1 One(1) set of 145kV, 2000A, 31.5kA/1sec, 50Hz, 650kVp BIL, live tank type, gang operated, SF6 gas circuit breaker with spring-stored energy operating mechanism (for bus coupler).

2A1.2 Two(2) sets of 145kV, 1250A, 31.5kA/1sec, 50Hz, 650kVp BIL, live tank type, gang operated, SF6 gas circuit breaker with spring-stored energy operating mechanism (for Transformer bays).

2A1.3 Two(2) sets of 145kV, 1250A, 31.5kA/1sec, 50Hz, 650kVp BIL, live tank type, single pole operated, SF6 gas circuit breaker with spring-stored energy operating mechanism (for Transsmission line bays).

2A2.1 Two(2) sets of 145kV, 2000A, 31.5kA/1sec, 50Hz, 650kVp BIL, double side break, post type, motor operated disconnectors with manual earthing switch (for bus coupler).

2A2.2 Four(4) sets of 145kV, 1250A, 31.5kA/1sec, 50Hz, 650kVp BIL, double side break, post type, motor operated disconnectors with manual earthing switch

2A2.3 Eight(8) sets of 145kV, 1250A, 31.5kA/1sec, 50Hz, 650kVp BIL, double side break, post type, motor operated disconnectors without earthing switch.

2A3.1 Six(6) nos. of single-phase, 2-core, multi ratio, 145kV, 31.5kA/1sec, 50Hz, 650kVp BIL, post type current transformer (for bus coupler bay, 2000/1A).

2A3.2 Six(6) nos. of single-phase, 4-core, multi ratio, 145kV, 31.5kA/1sec, 50Hz, 650kVp BIL, post type current transformer(for line bays).

2A3.3 Six(6) nos. of single-phase, 4-core, multi ratio, 145kV, 31.5kA/1sec, 50Hz, 650kVp BIL, post type current transformer(for Transformer bays).

2A4.1 Twelve(12) nos. of single-phase, 2-core, 145kV, 31.5kA/1sec, 50Hz, 650kVp BIL, Capacitor voltage transformers(CVT).

2A4.2 Six(6) nos. of single-phase, 2-core, 145kV, 31.5kA/1sec, 50Hz, 650kVp BIL, inductive voltage transformers(IVT).

2A5 Twelve(12) nos. of 120kV rated voltage, 102kV(rms) continuous operating voltage at 50^0c, 10kA nominal discharge current, 50Hz, Heavy duty station class, gapless metal oxide type, single phase surge arresters.

2A6 Six(6) nos. single phase 145kV post type support insulators required for completing 145kV busbar and switchgear connections.

2A7 One(1) lot of flexible conductors for busbar[ACSR, Twin Finch(1113 MCM)] & jackbus, jumper, equipment connections[ACSR, Single Grosbeak(636 MCM)], including all necessary clamps & connectors required for completing 145kV busbar and switchgear connection.

2A8 One (1) lot of insulators and fittings including all necessary accessories required to complete 132kV switchyard

2A9 One(1) lot of steel structures for gantry and equipment supports including nuts & bolts and cable tray including all necessary fitting & fixing accessories required to complete 132kV switchyard.

2B 33kV Air Insulated Switches and Connection for Auxiliary Transformers

The 33kV AIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included as Appendix A1 to this section and bid drawings; shall comprise the following:-

2B1 Two (2) sets of 36kV, 2000A, 25kA/1sec, 50Hz, 170kVp BIL, outdoor Vacuum Circuit Breakers(VCB) with spring-stored energy operating mechanism.

2B2 Seven(7) sets of 36kV, 2000A, 25kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, disconnectors.

2B3 Six(6) nos. of single-phase, 3-core, multi ratio, 36kV, 25kA/1sec, 50Hz, 170kVp BIL, post type current transformer.

2B4 Twelve(12) nos. of single-phase, 2-core, 36kV, 25kA/1sec, 50Hz, 650kVp BIL, voltage transformers.

2B5 Twelve(12) nos. of 30kV rated voltage, 10kA nominal discharge current, 50Hz, Heavy duty station class, single phase surge arresters.

2B6 One(1) lot of flexible conductors for busbar, jackbus, jumper, equipment connections[ACSR, Twin Finch(1113 MCM)], including all necessary clamps & connectors required for completing 33kV busbar and switchgear connection.

2B7 One (1) lot of insulators and fittings including all necessary accessories required to complete 33kV switchyard

2B8 One(1) lot of steel structures for gantry and equipment supports including nuts & bolts and cable tray including all necessary fitting & fixing accessories required for completing 33kV switchyard.

2C Power Transformers & Earthing/Auxiliary Transformers

2C1 Two (2) sets of 132/33kV, 25/41 MVA (ONAN/ONAF), three phase outdoor type power transformers with associated bushing CTs including all necessary connections, insulators & fittings.

2C2 Two(2) sets 33/0.415kV, 200kVA three phase outdoor type station auxiliary transformers with associated bushing CTs and steel support structures including all necessary connections, insulators & fittings.

2D Control, Protection, Substation Automation & Metering

132 kV Circuits

The equipment to be designed, supplied, installed and commissioned is shown in bid drawings are comprising of :-

2D1 Control, Protection, Metering & Substation Automation System including event recording function for two(2) sets of overhead line circuits to Rangamati (Rangamati-1 & 2).

2D2 Control, Protection, Metering & Substation Automation System including event recording function for two(2) sets of 132/33 kV power transformer circuits including transformer tap changer control.

2D3 Control, Protection, metering & Substation Automation System including event recording function for one(1) set of bus coupler circuit.

2D4 Deleted.

2D5 Tariff metering panel to accommodate programmable & recordable digital 3-phase, 4-wire import and export MWh and MVArh meters (accuracy class 0.2) for two(2) 132 kV line and two(2) transformer feeder. For each feeder minimum two meters (main & check). The scope of works also includes supply of software(s) & connection cords of the above energy meters for future re-configuration.

33 kV Circuits

The equipment to be supplied, installed and commissioned is shown in bid drawings are comprising of:-

2D6 Control, Protection, Metering & Substation Automation System including event recording function for two sets of power transformer circuits

2D7 Tariff metering panel to accommodate programmable & recordable digital 3-phase, 4-wire import and export MWh and MVArh meters (accuracy class 0.2) for two transformer feeder circuits (Power X-former-I & II). For each feeder minimum two meters (main & check). The scope of works also includes supply of software(s) of the above energy meters for future re-configuration.

2E Multicore Cables

2E1 One (1) lot complete set of multicore low voltage 0.6/1.1kV, XLPE insulated power and control cables (IEC 60502) shall be supplied, installed, glanded, terminated and have individual cores identified to be used for connection of all equipment supplied under the Contract. The overall substation cable routing and core schedules shall also be provided.

2F Earthing and Lightning Protection

2F1 One (1) lot of design, supply and installation of earthing system and lightning protection screen including connections, connectors and clamps, to suit the substation overall arrangement and provide supporting design calculations.

2F2 One (1) set of 3-phase portable (maintenance) earthing equipment devices with connectors and telescopic glass fibre operating pole suitable for plant supplied.

2G Batteries, Chargers and DC Distribution

2G1 110V substation NiCad batteries complete with chargers and distribution switchboard to be supplied, installed and commissioned to provide all DC supplies to equipment being supplied.

The system shall generally be as shown in bid drawing and shall include:

(a) Two (2) sets of 100% batteries complete, each capacity shall not be less than 250Ah at the 5-hour rate of discharge.

(b) Two (2) sets of battery chargers complete, each charger shall not be less than 75A rating.

(c) One (1) set of DC distribution board. The DC distribution board shall be with 50% overall spare switches for future use.

(d) Two(2) sets of online UPS, 3kVA for Substation Automation System panels.

2G2 48V DC system and distribution equipment complete with NiCad batteries chargers to be supplied, installed and commissioned in the main control building for the new fibre optic multiplexer equipment for communication and protection. One set shall be used as standby supply.

The system shall generally be as shown in bid drawing and shall include:

(a) Two (2) sets of 100% batteries complete, each capacity shall not be less than 150 Ah at the 5-hour rate of discharge

(b) Two (2) sets of battery chargers of output 48V DC, 30A and input voltage three phase 50Hz, 415 V AC.

(c) One (1) lot of DC distribution board. The DC distribution board shall be suitable to connect the new fibre optic multiplexer equipment for communication and protection with 50% overall spare switches for future use.

2H LVAC Distribution

2H1 One (1) lot of LVAC switchboard for substation services to be supplied, installed and commissioned, to provide the 415/240V supplies to all equipment being supplied under this turnkey Bid.

2H2 One (1) lot of Tariff metering panel to accommodate programmable & recordable digital 3-phase, 4-wire import and export MWh and MVArh meters (accuracy class 0.2) for two 33/0.415 kV station auxiliary transformer feeder circuits. For each feeder minimum two meters (main & check).

The system and requirements shall generally be as shown in Bid drawing and technical specification of Volume 2 and shall include one 125A outdoor weatherproof 3-phase with neutral and earth switched socket outlet and plug as per IEC 309; to be installed, cabled and connected adjacent to the auxiliary transformers.

2I Civil Works, Building and Foundation

2I1 Complete earth filling by imported carried earth free from foreign solid particles and organic materials in addition to the earth recovered from digging of foundation, to make the top of the final ground level of substation 0.5m high from highest flood level and final compaction to be achieved 95% for total volume 50,600 cubic meter. The volume of earth filling may be varied but the payment shall be as per actual measurement of work done.

2I2 One (1) lot of complete design, supply and construction of all civil items required for the outdoor works suitable for switchyard gantry & equipment foundations, transformer foundations, blast walls, oil pit, entrance & internal roads, cable trenches, septic tank, soak way, surfacing, gravel laying, drainage, security fences, boundary wall, sentry post, guard house, car port, etc.

2I3 One (1) lot of complete design, supply and construction of all civil items and facilities required for the two storied main control building including cable basement.

2J Lighting, Small Power, Air Conditioning and Ventilation

2J1 One (1) lot of complete design, supply, installation and commissioning of equipment to provide lighting, LV power supply, air conditioning system, ventilation system and emergency DC lighting for the main control building.

2J2 One (1) lot of complete set of design, supply, installation and commissioning of equipment to provide lighting (flood light LED type) for security, roadway, switchyard and emergency DC lighting at strategic locations for equipment operation and inspection.

2K Fibre Optic Multiplexer Equipment for Communication and Protection

2K1 The equipment to be supplied, installed and commissioned shall be as shown on bid drawing. One (1) lot complete set of design, supply, installation and commissioning of fibre optic multiplexer equipment including necessary works to interface with existing system is to be provided for:

- 87 or 21 relay for each transmission line protection (through fibre cores)
- 21 relay carrier signal (main and back-up)
- SCADA data from switchgear and control system
- Hot-line telephone system

2K2 Underground optical fibre cables (24cores for 132kV switchyard) from terminal box gantry structure at each 132kV double circuit transmission line termination point to MDF (Main distribution Frame) to be installed in control room. The Contract includes supply and installation of MDF and pigtail cables with adequate length.

2L SCADA system for Telecontrol and Telemetering

2L1 One (1) lot of complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol & telemetering facilities required at the existing National Load Despatch Center (NLDC) at Rampura for integration of complete new 132/33kV substation. All required electrical signals shall be transmitted to the NLDC through the Industrial Gateway of the substation automation system. All HV breakers, motorized disconnectors, tap changer, etc. shall be controlled form NLDC through the Gateway of the substation automation system using IEC 60870-5-104 protocol. All necessary modification works in the software of master station of NLDC are to be carried out.

2M Mandatory Spares, Erection & Test Equipment

Supply of complete spares and spare parts of transformer, switchgear, control equipment, protection relays, meters, erection & test equipment as per quantity mentioned in Schedule B. Test equipment are to be supplied from Europe, USA or Japan origin. Printed catalogue, operation and service manual are to be provided. The materials shall have to be handed over to the designated store as per instruction of the Engineer.

3) Beanibazar 132/33kV AIS Substation

The equipment to be designed, supplied, installed, tested & commissioned as stipulated in bid specification and shown in bid drawings:

Item Description

3A 145kV Air Insulated Switchgear (AIS)

The 145kV AIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included as Appendix A1 to this section and bid drawings; shall comprise the following:-

3A1.1 One(1) set of 145kV, 2000A, 31.5kA/1sec, 50Hz, 650kVp BIL, live tank type, gang operated, SF6 gas circuit breaker with spring-stored energy operating mechanism or spring-hydraulic combination mechanism (for bus coupler).

3A1.2 Two(2) sets of 145kV, 1250A, 31.5kA/1sec, 50Hz, 650kVp BIL, live tank type, gang operated, SF6 gas circuit breakes with spring-stored energy operating mechanism (for Transformer bays).

3A1.3 One(1) set of 145kV, 1250A, 31.5kA/1sec, 50Hz, 650kVp BIL, live tank type, single pole operated, SF6 gas circuit breaker with spring-stored energy operating mechanism (for Transsmission line bay).

3A2.1 Two(2) sets of 145kV, 2000A, 31.5kA/1sec, 50Hz, 650kVp BIL, double side break, post type, motor operated disconnectors with manual earthing switch (for bus coupler).

3A2.2 Three(3) sets of 145kV, 1250A, 31.5kA/1sec, 50Hz, 650kVp BIL, double side break, post type, motor operated disconnectors with manual earthing switch

3A2.3 Six(6) sets of 145kV, 1250A, 31.5kA/1sec, 50Hz, 650kVp BIL, double side break, post type, motor operated disconnectors without earthing switch.

3A3.1 Six(6) nos. of single-phase, 2-core, multi ratio, 145kV, 31.5kA/1sec, 50Hz, 650kVp BIL, post type current transformer (for bus coupler bay, 2000/1A).

3A3.2 Three(3) nos. of single-phase, 4-core, multi ratio, 145kV, 31.5kA/1sec, 50Hz, 650kVp BIL, post type current transformer(for line bays).

3A3.3 Six(6) nos. of single-phase, 4-core, multi ratio, 145kV, 31.5kA/1sec, 50Hz, 650kVp BIL, post type current transformer(for Transformer bays).

3A4.1 Nine(9) nos. of single-phase, 2-core, 145kV, 31.5kA/1sec, 50Hz, 650kVp BIL, Capacitor voltage transformers(CVT).

3A4.2 Six(6) nos. of single-phase, 2-core, 145kV, 31.5kA/1sec, 50Hz, 650kVp BIL, inductive voltage transformers(IVT).

3A5 Nine(9) nos. of 120kV rated voltage, 102kV(rms) continuous operating voltage at 50^0c, 10kA nominal discharge current, 50Hz, Heavy duty station class, gapless metal oxide type, single phase surge arresters.

3A6 Three(3) nos. single phase 145kV post type support insulators required for completing 145kV busbar and switchgear connections.

3A7 One(1) lot of flexible conductors for busbar[ACSR, Twin Finch(1113 MCM)] & jackbus, jumper, equipment connections[ACSR, Single Grosbeak(636 MCM)], including all necessary clamps & connectors required for completing 145kV busbar and switchgear connection.

3A8 One (1) lot of insulators and fittings including all necessary accessories required to complete 132kV switchyard

3A9 One(1) lot of steel structures for gantry and equipment supports including nuts & bolts and cable tray including all necessary fitting & fixing accessories required to complete 132kV switchyard.

3B 33kV Air Insulated Switches and Connection for Auxiliary Transformers

The 33kV AIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included as Appendix A1 to this section and bid drawings; shall comprise the following:-

3B1 Two (2) sets of 36kV, 2000A, 25kA/1sec, 50Hz, 170kVp BIL, outdoor Vacuum Circuit Breakers(VCB) with spring-stored energy operating mechanism.

3B2 Seven(7) sets of 36kV, 2000A, 25kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, disconnectors.

3B3 Six(6) nos. of single-phase, 3-core, multi ratio, 36kV, 25kA/1sec, 50Hz, 170kVp BIL, post type current transformer.

3B4 Twelve(12) nos. of single-phase, 2-core, 36kV, 25kA/1sec, 50Hz, 650kVp BIL, voltage transformers.

3B5 Twelve(12) nos. of 30kV rated voltage, 10kA nominal discharge current, 50Hz, Heavy duty station class, single phase surge arresters.

3B6 One(1) lot of flexible conductors for busbar, jackbus, jumper, equipment connections[ACSR, Twin Finch(1113 MCM)], including all necessary clamps & connectors required for completing 33kV busbar and switchgear connection.

3B7 One (1) lot of insulators and fittings including all necessary accessories required to complete 33kV switchyard

3B8 One(1) lot of steel structures for gantry and equipment supports including nuts & bolts and cable tray including all necessary fitting & fixing accessories required for completing 33kV switchyard.

3C Power Transformers & Earthing/Auxiliary Transformers

3C1 Two (2) sets of 132/33kV, 25/41 MVA (ONAN/ONAF), three phase outdoor type power transformers with associated bushing CTs all necessary connections, insulators & fittings.

3C2 Two(2) sets 33/0.415kV, 200kVA three phase outdoor type station auxiliary transformers with associated bushing CTs and steel support structures including all necessary connections, insulators & fittings.

3D Control, Protection, Substation Automation & Metering

132 kV Circuits

The equipment to be designed, supplied, installed and commissioned is shown in bid drawings are comprising of :-

3D1 Control, Protection, Metering & Substation Automation System including event recording function for One(1) set of overhead line circuits to Sylhet - Fenchuganj T-off.

3D2 Control, Protection, Metering & Substation Automation System including event recording function for two(2) sets of 132/33 kV power transformer circuits including transformer tap changer control.

3D3 Control, Protection, metering & Substation Automation System including event recording function for one(1) set of bus coupler circuit.

3D4 Deleted.

3D5 Tariff metering panel to accommodate programmable & recordable digital 3-phase, 4-wire import and export MWh and MVArh meters (accuracy class 0.2) for One(1) 132kV line and two(2) transformer feeder. For each feeder minimum two meters (main & check). The scope of works also includes supply of software(s) & connection cords of the above energy meters for future re-configuration.

33 kV Circuits

The equipment to be supplied, installed and commissioned is shown in bid drawings are comprising of:-

3D6 Control, Protection, Metering & Substation Automation System including event recording function for two sets of power transformer circuits

3D7 Tariff metering panel to accommodate programmable & recordable digital 3-phase, 4-wire import and export MWh and MVArh meters (accuracy class 0.2) for two transformer feeder circuits (Power X-former-I & II). For each feeder minimum two meters (main & check). The scope of works also includes supply of software(s) of the above energy meters for future re-configuration.

3E Multicore Cables

3E1 One (1) lot complete set of multicore low voltage 0.6/1.1kV, XLPE insulated power and control cables (IEC 60502) shall be supplied, installed, glanded, terminated and have individual cores identified to be used for connection of all equipment supplied under the Contract. The overall substation cable routing and core schedules shall also be provided.

3F Earthing and Lightning Protection

3F1 One (1) lot of design, supply and installation of earthing system and lightning protection screen including connections, connectors and clamps, to suit the substation overall arrangement and provide supporting design calculations.

3F2 One (1) set of 3-phase portable (maintenance) earthing equipment devices with connectors and telescopic glass fibre operating pole suitable for plant supplied.

3G Batteries, Chargers and DC Distribution

3G1 110V substation NiCad batteries complete with chargers and distribution switchboard to be supplied, installed and commissioned to provide all DC supplies to equipment being supplied.

The system shall generally be as shown in bid drawing and shall include:

(a) Two (2) sets of 100% batteries complete, each capacity shall not be less than 250Ah at the 5-hour rate of discharge.

(b) Two (2) sets of battery chargers complete, each charger shall not be less than 75A rating.

(c) One (1) set of DC distribution board. The DC distribution board shall be with 50% overall spare switches for future use.

(d) Two(2) sets of online UPS, 3kVA for Substation Automation system panels.

3G2 48V DC system and distribution equipment complete with NiCad batteries chargers to be supplied, installed and commissioned in the main control building for the new fibre optic multiplexer equipment for communication and protection. One set shall be used as standby supply.

The system shall generally be as shown in bid drawing and shall include:

(a) Two (2) sets of 100% batteries complete, each capacity shall not be less than 150 Ah at the 5-hour rate of discharge

(b) Two (2) sets of battery chargers of output 48V DC, 30A and input voltage three phase 50Hz, 415 V AC.

(c) One (1) lot of DC distribution board. The DC distribution board shall be suitable to connect the new fibre optic multiplexer equipment for communication and protection with 50% overall spare switches for future use.

3H LVAC Distribution

3H1 One (1) lot of LVAC switchboard for substation services to be supplied, installed and commissioned, to provide the 415/240V supplies to all equipment being supplied under this turnkey Bid.

3H2 One (1) lot of Tariff metering panel to accommodate programmable & recordable digital 3-phase, 4-wire import and export MWh and MVArh meters (accuracy class 0.2) for two 33/0.415 kV station auxiliary transformer feeder circuits. For each feeder minimum two meters (main & check).

The system and requirements shall generally be as shown in Bid drawing and technical specification of Volume 2 and shall include one 125A outdoor weatherproof 3-phase with neutral and earth switched socket outlet and plug as per IEC 309; to be installed, cabled and connected adjacent to the auxiliary transformers.

3I Civil Works, Building and Foundation

3I1 Complete earth filling by imported carried earth free from foreign solid particles and organic materials in addition to the earth recovered from digging of foundation, to make the top of the final ground level of substation 0.5m high from highest flood level and final compaction to be achieved 95% for total volume 60,800 cubic meter. The volume of earth filling may be varied but the payment shall be as per actual measurement of work done.

3I2 One (1) lot of complete design, supply and construction of all civil items required for the outdoor works suitable for switchyard gantry & equipment foundations,

transformer foundations, blast walls, oil pit, entrance & internal roads, cable trenches, septic tank, soak way, surfacing, gravel laying, drainage, security fences, boundary wall, sentry post, guard house, car port, etc.

3I3 One (1) lot of complete design, supply and construction of all civil items and facilities required for the two storied main control building including cable basement.

3J Lighting, Small Power, Air Conditioning and Ventilation

3J1 One (1) lot of complete design, supply, installation and commissioning of equipment to provide lighting, LV power supply, air conditioning system, ventilation system and emergency DC lighting for the main control building.

3J2 One (1) lot of complete set of design, supply, installation and commissioning of equipment to provide lighting (flood light LED type) for security, roadway, switchyard and emergency DC lighting at strategic locations for equipment operation and inspection.

3K Fibre Optic Multiplexer Equipment for Communication and Protection

3K1 The equipment to be supplied, installed and commissioned shall be as shown on bid drawing. One (1) lot complete set of design, supply, installation and commissioning of fibre optic multiplexer equipment including necessary works to interface with existing system is to be provided for:

- 87 or 21 relay for each transmission line protection (through fibre cores)
- 21 relay carrier signal (main and back-up)
- SCADA data from switchgear and control system
- Hot-line telephone system

3K2 Underground optical fibre cables (24cores for 132kV switchyard) from terminal box gantry structure at each 132kV double circuit transmission line termination point to MDF (Main distribution Frame) to be installed in control room. The Contract includes supply and installation of MDF and pigtail cables with adequate length.

3L SCADA system for Telecontrol and Telemetering

3L1 One (1) lot of complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol & telemetering facilities required at the existing National Load Despatch Center (NLDC) at Rampura for integration of complete new 132/33kV substation. All required electrical signals shall be transmitted to the NLDC through the Industrial Gateway of the substation automation system. All HV breakers, motorized disconnectors, tap changer, etc. shall be controlled form NLDC through the Gateway of the substation automation system using IEC 60870-5-104 protocol. All necessary modification works in the software of master station of NLDC are to be carried out.

3M Mandatory Spares, Erection & Test Equipment

Supply of complete spares and spare parts of transformer, switchgear, control equipment, protection relays, meters, erection & test equipment as per quantity mentioned in Schedule B. Test equipment are to be supplied from Europe, USA or Japan origin. Printed catalogue, operation and service manual are to be

provided. The materials shall have to be handed over to the designated store as per instruction of the Engineer.

4) Sunamganj 132/33kV AIS Substation

The equipment to be designed, supplied, installed, tested & commissioned as stipulated in bid specification and shown in bid drawings:

Item	Description
4A	**145kV Air Insulated Switchgear (AIS)**
	The 145kV AIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included as Appendix A1 to this section and bid drawings; shall comprise the following:-
4A1.1	One(1) set of 145kV, 2000A, 31.5kA/1sec, 50Hz, 650kVp BIL, live tank type, gang operated, SF6 gas circuit breaker with spring-stored energy operating mechanism or spring-hydraulic combination mechanism (for bus coupler).
4A1.2	Two(2) sets of 145kV, 1250A, 31.5kA/1sec, 50Hz, 650kVp BIL, live tank type, gang operated, SF6 gas circuit breaker with spring-stored energy operating mechanism (for Transformer bays).
4A1.3	One(1) sets of 145kV, 1250A, 31.5kA/1sec, 50Hz, 650kVp BIL, live tank type, single pole operated, SF6 gas circuit breaker with spring-stored energy operating mechanism (for Transsmission line bays).
4A2.1	Two(2) sets of 145kV, 2000A, 31.5kA/1sec, 50Hz, 650kVp BIL, double side break, post type, motor operated disconnectors with manual earthing switch (for bus coupler).
4A2.2	Three(3) sets of 145kV, 1250A, 31.5kA/1sec, 50Hz, 650kVp BIL, double side break, post type, motor operated disconnectors with manual earthing switch
4A2.3	Six(6) sets of 145kV, 1250A, 31.5kA/1sec, 50Hz, 650kVp BIL, double side break, post type, motor operated disconnectors without earthing switch.
4A3.1	Six(6) nos. of single-phase, 2-core, multi ratio, 145kV, 31.5kA/1sec, 50Hz, 650kVp BIL, post type current transformer (for bus coupler bay, 2000/1A).
4A3.2	Three(3) nos. of single-phase, 4-core, multi ratio, 145kV, 31.5kA/1sec, 50Hz, 650kVp BIL, post type current transformer(for line bays).
4A3.3	Six(6) nos. of single-phase, 4-core, multi ratio, 145kV, 31.5kA/1sec, 50Hz, 650kVp BIL, post type current transformer(for Transformer bays).
4A4.1	Nine(9) nos. of single-phase, 2-core, 145kV, 31.5kA/1sec, 50Hz, 650kVp BIL, Capacitor voltage transformers (CVT).
4A4.2	Six(6) nos. of single-phase, 2-core, 145kV, 31.5kA/1sec, 50Hz, 650kVp BIL, inductive voltage transformers (IVT).

4A5 Nine(9) nos. of 120kV rated voltage, 102kV(rms) continuous operating voltage at 50^0c, 10kA nominal discharge current, 50Hz, Heavy duty station class, gapless metal oxide type, single phase surge arresters.

4A6 Three(3) nos. single phase 145kV post type support insulators required for completing 145kV busbar and switchgear connections.

4A7 One(1) lot of flexible conductors for busbar[ACSR, Twin Fince(1113 MCM)] & jackbus, jumper, equipment connections[ACSR, Grosbeak(636 MCM)], including all necessary clamps & connectors required for completing 145kV busbar and switchgear connection.

4A8 One (1) lot of insulators and fittings including all necessary accessories required to complete 132kV switchyard

4A9 One(1) lot of steel structures for gantry and equipment supports including nuts & bolts and cable tray including all necessary fitting & fixing accessories required to complete 132kV switchyard.

4B 33kV Air Insulated Switches and Connection for Auxiliary Transformers

The 33kV AIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included as Appendix A1 to this section and bid drawings; shall comprise the following:-

4B1 Two (2) sets of 36kV, 2000A, 25kA/1sec, 50Hz, 170kVp BIL, outdoor Vacuum Circuit Breakers(VCB) with spring-stored energy operating mechanism.

4B2 Seven(7) sets of 36kV, 2000A, 25kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, disconnectors.

4B3 Six(6) nos. of single-phase, 3-core, multi ratio, 36kV, 25kA/1sec, 50Hz, 170kVp BIL, post type current transformer.

4B4 Twelve(12) nos. of single-phase, 2-core, 36kV, 25kA/1sec, 50Hz, 650kVp BIL, voltage transformers.

4B5 Twelve(12) nos. of 30kV rated voltage, 10kA nominal discharge current, 50Hz, Heavy duty station class, single phase surge arresters.

4B6 One(1) lot of flexible conductors for busbar, jackbus, jumper, equipment connections[ACSR, Twin Finch(1113 MCM)], including all necessary clamps & connectors required for completing 33kV busbar and switchgear connection.

4B7 One (1) lot of insulators and fittings including all necessary accessories required to complete 33kV switchyard

4B8 One(1) lot of steel structures for gantry and equipment supports including nuts & bolts and cable tray including all necessary fitting & fixing accessories required for completing 33kV switchyard.

4C Power Transformers & Earthing/Auxiliary Transformers

4C1 Two (2) sets of 132/33kV, 25/41 MVA (ONAN/ONAF), three phase outdoor type power transformers with associated bushing CTs and steel support structures including all necessary connections, insulators & fittings.

4C2 Two(2) sets 33/0.415kV, 200kVA three phase outdoor type station auxiliary transformers with associated bushing CTs and steel support structures including all necessary connections, insulators & fittings.

4D Control, Protection, Substation Automation & Metering

132 kV Circuits

The equipment to be designed, supplied, installed and commissioned is shown in bid drawings are comprising of :-

4D1 Control, Protection, Metering & Substation Automation System including event recording function for One(1) set of overhead line circuits to Chatak(Chatak-1).

4D2 Control, Protection, Metering & Substation Automation System including event recording function for two(2) sets of 132/33 kV power transformer circuits including transformer tap changer control.

4D3 Control, Protection, metering & Substation Automation System including event recording function for one(1) set of bus coupler circuit.

4D4 Deleted.

4D5 Tariff metering panel to accommodate programmable & recordable digital 3-phase, 4-wire import and export MWh and MVArh meters (accuracy class 0.2) for One(1) 132kV line and two(2) transformer feeder. For each feeder minimum two meters (main & check). The scope of works also includes supply of software(s) & connection cords of the above energy meters for future re-configuration.

33 kV Circuits

The equipment to be supplied, installed and commissioned is shown in bid drawings are comprising of:-

4D6 Control, Protection, Metering & Substation Automation System including event recording function for two sets of power transformer circuits

4D7 Tariff metering panel to accommodate programmable & recordable digital 3-phase, 4-wire import and export MWh and MVArh meters (accuracy class 0.2) for two transformer feeder circuits (Power X-former-I & II). For each feeder minimum two meters (main & check). The scope of works also includes supply of software(s) of the above energy meters for future re-configuration.

4E Multicore Cables

4E1 One (1) lot complete set of multicore low voltage 0.6/1.1kV, XLPE insulated power and control cables (IEC 60502) shall be supplied, installed, glanded, terminated and have individual cores identified to be used for connection of all equipment supplied under the Contract. The overall substation cable routing and core schedules shall also be provided.

4F Earthing and Lightning Protection

4F1 One(1) lot of design, supply and installation of earthing system and lightning protection screen including connections, connectors and clamps, to suit the substation overall arrangement and provide supporting design calculations.

4F2 One(1) set of 3-phase portable (maintenance) earthing equipment devices with connectors and telescopic glass fibre operating pole suitable for plant supplied.

4G Batteries, Chargers and DC Distribution

4G1 110V substation NiCad batteries complete with chargers and distribution switchboard to be supplied, installed and commissioned to provide all DC supplies to equipment being supplied.

The system shall generally be as shown in bid drawing and shall include:

(a) Two (2) sets of 100% batteries complete, each capacity shall not be less than 250Ah at the 5-hour rate of discharge.

(b) Two (2) sets of battery chargers complete, each charger shall not be less than 75A rating.

(c) One (1) set of DC distribution board. The DC distribution board shall be with 50% overall spare switches for future use.

(d) Two(2) sets of online UPS, 3kVA for Substation Automation system panels.

4G2 48V DC system and distribution equipment complete with NiCad batteries chargers to be supplied, installed and commissioned in the main control building for the new fibre optic multiplexer equipment for communication and protection. One set shall be used as standby supply.

The system shall generally be as shown in bid drawing and shall include:

(a) Two (2) sets of 100% batteries complete, each capacity shall not be less than 150 Ah at the 5-hour rate of discharge

(b) Two (2) sets of battery chargers of output 48V DC, 30A and input voltage three phase 50Hz, 415 V AC.

(c) One (1) lot of DC distribution board. The DC distribution board shall be suitable to connect the new fibre optic multiplexer equipment for communication and protection with 50% overall spare switches for future use.

4H LVAC Distribution

4H1 One (1) lot of LVAC switchboard for substation services to be supplied, installed and commissioned, to provide the 415/240V supplies to all equipment being supplied under this turnkey Bid.

4H2 One (1) lot of Tariff metering panel to accommodate programmable & recordable digital 3-phase, 4-wire import and export MWh and MVArh meters (accuracy class 0.2) for two 33/0.415 kV station auxiliary transformer feeder circuits. For each feeder minimum two meters (main & check).

The system and requirements shall generally be as shown in Bid drawing and technical specification of Volume 2 and shall include one 125A outdoor weatherproof 3-phase with neutral and earth switched socket outlet and plug as per IEC 309; to be installed, cabled and connected adjacent to the auxiliary transformers.

4I Land Development, Civil Works, Building and Foundation

4I1 Complete earth filling by imported carried earth free from foreign solid particles and organic materials in addition to the earth recovered from digging of foundation, to make the top of the final ground level of substation 0.5m high from highest flood level and final compaction to be achieved 95% for total volume 60,800 cubic meter. The volume of earth filling may be varied but the payment shall be as per actual measurement of work done.

4I2 One (1) lot of complete design, supply and construction of all civil items required for the outdoor works suitable for switchyard gantry & equipment foundations, transformer foundations, blast walls, oil pit, entrance & internal roads, cable trenches, septic tank, soak way, surfacing, gravel laying, drainage, security fences, boundary wall, sentry post, guard house, car port, etc.

4I3 One (1) lot of complete design, supply and construction of all civil items and facilities required for the two storied main control building including cable basement.

4J Lighting, Small Power, Air Conditioning and Ventilation

4J1 One (1) lot of complete design, supply, installation and commissioning of equipment to provide lighting, LV power supply, air conditioning system, ventilation system and emergency DC lighting for the main control building.

4J2 One (1) lot of complete set of design, supply, installation and commissioning of equipment to provide lighting (flood light LED type) for security, roadway, switchyard and emergency DC lighting at strategic locations for equipment operation and inspection.

4K Fibre Optic Multiplexer Equipment for Communication and Protection

4K1 The equipment to be supplied, installed and commissioned shall be as shown on bid drawing. One (1) lot complete set of design, supply, installation and commissioning of fibre optic multiplexer equipment including necessary works to interface with existing system is to be provided for:

- 87 or 21 relay for each transmission line protection (through fibre cores)
- 21 relay carrier signal (main and back-up)
- SCADA data from switchgear and control system
- Hot-line telephone system

4K2 Underground optical fibre cables (24cores for 132kV switchyard) from terminal box gantry structure at each 132kV double circuit transmission line termination point to MDF (Main distribution Frame) to be installed in control room. The Contract includes supply and installation of MDF and pigtail cables with adequate length.

4L SCADA system for Telecontrol and Telemetering

4L1 One (1) lot of complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol & telemetering facilities required at the existing National Load Despatch Center (NLDC) at Rampura for integration of complete new 132/33kV substation. All required electrical signals shall be transmitted to the NLDC through the Industrial

Gateway of the substation automation system. All HV breakers, motorized disconnectors, tap changer, etc. shall be controlled form NLDC through the Gateway of the substation automation system using IEC 60870-5-104 protocol. All necessary modification works in the software of master station of NLDC are to be carried out.

4M **Mandatory Spares, Erection & Test Equipment**

Supply of complete spares and spare parts of transformer, switchgear, control equipment, protection relays, meters, erection & test equipment as per quantity mentioned in Schedule B. Test equipment are to be supplied from Europe, USA or Japan origin. Printed catalogue, operation and service manual are to be provided. The materials shall have to be handed over to the designated store as per instruction of the Engineer.

5) Extension & Renovation of existing 132/33kV AIS Substation at Chandroghona

The equipment to be designed, supplied, installed, tested & commissioned as stipulated in bid specification and shown in bid drawings:

Item **Description**

5A **145kV Air Insulated Switchgear (AIS)**

The 145kV AIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included as Appendix A1 to this section and bid drawings; shall comprise the following:-

5A1.1 One(1) set of 145kV, 2000A, 31.5kA/1sec, 50Hz, 650kVp BIL, live tank type, gang operated, SF6 gas circuit breaker with spring-stored energy operating mechanism (for bus coupler).

5A1.2 Four(4) sets of 145kV, 1250A, 31.5kA/1sec, 50Hz, 650kVp BIL, live tank type, single pole operated, SF6 gas circuit breaker with spring-stored energy operating mechanism (for Transmission line bays).

5A2.1 Two(2) sets of 145kV, 2000A, 31.5kA/1sec, 50Hz, 650kVp BIL, double side break, post type, motor operated disconnectors with manual earthing switch (for bus coupler).

5A2.2 Six(6) sets of 145kV, 1250A, 31.5kA/1sec, 50Hz, 650kVp BIL, double side break, post type, motor operated disconnectors with manual earthing switch.

5A2.3 Eight(8) sets of 145kV, 1250A, 31.5kA/1sec, 50Hz, 650kVp BIL, double side break, post type, motor operated disconnectors without earthing switch.

5A2.4 Eight(8) sets of 145kV, 1250A, 31.5kA/1sec, 50Hz, 650kVp BIL, single break, post type, motor operated disconnectors without earthing switch series type.

5A3.1 Six(6) nos. of single-phase, 2-core, multi ratio, 145kV, 31.5kA/1sec, 50Hz, 650kVp BIL, post type current transformer (for bus coupler bay, 2000/1A).

5A3.2 Twelve(12) nos. of single-phase, 4-core, multi ratio, 145kV, 31.5kA/1sec, 50Hz, 650kVp BIL, post type current transformer(for line bays).

5A4 Twelve(12) nos. of single-phase, 2-core, 145kV, 31.5kA/1sec, 50Hz, 650kVp BIL, Capacitor voltage transformers(CVT).

5A5 Twelve(12) nos. of 120kV rated voltage, 102kV(rms) continuous operating voltage at 50^0c, 10kA nominal discharge current, 50Hz, Heavy duty station class, gapless metal oxide type, single phase surge arresters.

5A6 Six(6) nos. single phase 145kV post type support insulators required for completing 145kV busbar and switchgear connections.

5A7 One(1) lot of flexible conductors for busbar[ACSR, Twin Fince(1113 MCM)] & jackbus, jumper, equipment connections[ACSR, Single Grosbeak(636 MCM)], including all necessary clamps & connectors required for completing 145kV busbar and switchgear connection. The existing conductor, clamps & connectors with all associated accessories are to be dismantled and handing over to store.

5A8 One (1) lot of insulators and fittings including all necessary accessories required to complete 145kV switchyard.

5A9 One(1) lot of steel structures for gantry and equipment supports including nuts & bolts and cable tray including all necessary fitting & fixing accessories required to complete 145kV switchyard. Some of existing gantry column, beam & equipment structure may be reused and the remaining are to be dismantled and handing over to store.

5A10.1 Relocation of existing four(4) sets of 145kV, dead tank type, SF6 gas circuit breakers with all associated accessories(two sets for two existing line bays and two sets for two existing Transformer bays).

5A10.2 Relocation of existing twelve(12) nos. Single phase 145kV voltage transformer with wave trap & all associated accessories(six nos. for two existing line bays and six nos. for bus).

5A10.3 Relocation of existing six(6) nos. Single phase 120kV lightning arrestors with all associated accessories.

5A10.4 Dismantle of existing ten(10) sets of disconnector switch with all associated accessories and handing over to the store.

5A10.5 Interim arrangement for transformer bay to reduce outage by temporary shifting the existing transformer to the new bus tie bay with all associated HV, LV & secondary connections; one(1) lot.

5A10.6 Interim arrangement for line bay to reduce outage by temporary shifting the existing line to the new bus tie or any other bay and re-shifting to final bay location with all associated HV & secondary connections; one(1) lot.

5D Control, Protection, Substation Automation & Metering

132 kV Circuits

The equipment to be designed, supplied, installed and commissioned is shown in bid drawings are comprising of :-

5D1.1 Control, Protection, Metering & Substation Automation System including event recording function for four(4) sets of overhead line circuits for four new line bays.

5D1.2 Control, Protection, Metering & Substation Automation System including event recording function for two(2) sets of existing overhead line circuits. The existing panels of two line bays shall be replaced by new sets and the recovered panels with all associated materials are to be handed over to the store.

5D2 Control, Protection, Metering & Substation Automation System including event recording function and transformer tap changer control for two(2) sets of existing transformer bays. The existing panels of two transformer bays shall be replaced by new sets and the recovered panels with all associated materials are to be handed over to the store.

5D3 Control, Protection, metering & Substation Automation System including event recording function for one(1) set of bus coupler circuit.

5D4 Busbar protection system for complete 132kV bus; one(1) lot.

5D5 Tariff metering panel to accommodate programmable & recordable digital 3-phase, 4-wire import and export MWh and MVArh meters (accuracy class 0.2) for four(4) 132 kV line. For each feeder minimum two meters (main & check). The scope of works also includes supply of software(s) & connection cords of the above energy meters for future re-configuration. The existing energy meters of the existing feeders are to be shifted to the new panel.

33 kV Circuits

The equipment to be supplied, installed and commissioned is shown in bid drawings are comprising of:-

5D6 Control, Protection, Metering & Substation Automation System including event recording function for two sets of existing 132/33kV transformer circuits. The existing panels of two transformer bays shall be replaced by new sets and the recovered panels with all associated materials are to be handed over to the store.

5E Multicore Cables

5E1 One (1) lot complete set of multicore low voltage 0.6/1.1kV, XLPE insulated power and control cables (IEC 60502) shall be supplied, installed, glanded, terminated and have individual cores identified to be used for connection of all equipment supplied under the Contract. The overall substation cable routing and core schedules shall also be provided. Some of the existing cables may be reused and the remaining are to be recovered and handing over to store.

5F Earthing and Lightning Protection

5F1 One (1) lot of design, supply and installation of earthing system and lightning protection screen including connections, connectors and clamps, to suit the substation overall arrangement and provide supporting design calculations.

5F2 One (1) set of 3-phase portable (maintenance) earthing equipment devices with connectors and telescopic glass fibre operating pole suitable for plant supplied.

5G Batteries, Chargers and DC Distribution

5G1 110V substation NiCad batteries complete with chargers and distribution switchboard to be supplied, installed and commissioned to provide all DC supplies to equipment being supplied. The existing Batteries, Chargers and DC Distribution panels are to be replaced by the new sets and handed over to the store with all recovered materials.

The system shall generally be as shown in bid drawing and shall include:

(a) Two (2) sets of 100% batteries complete, each capacity shall not be less than 250Ah at the 5-hour rate of discharge.

(b) Two (2) sets of battery chargers complete, each charger shall not be less than 75A rating.

(c) One (1) set of DC distribution board. The DC distribution board shall be with 50% overall spare switches for future use.

(d) Two(2) sets of online UPS, 3kVA for Substation Automation system panels.

5G2 48V DC system and distribution equipment complete with NiCad batteries chargers to be supplied, installed and commissioned in the main control building for the new fibre optic multiplexer equipment for communication and protection. One set shall be used as standby supply. The existing Batteries, Chargers and DC Distribution panels are to be replaced by the new sets and handed over to the store with all recovered materials.

The system shall generally be as shown in bid drawing and shall include:

(a) Two (2) sets of 100% batteries complete, each capacity shall not be less than 150 Ah at the 5-hour rate of discharge

(b) Two (2) sets of battery chargers of output 48V DC, 30A and input voltage three pahse 50Hz, 415 V AC.

(c) One (1) lot of DC distribution board. The DC distribution board shall be suitable to connect the new fibre optic multiplexer equipment for communication and protection with 50% overall spare switches for future use.

5H LVAC Distribution

5H1 One (1) lot of modification of existing LVAC switchboard for substation services including supply of all necessary MCBs, bus material, connection cables, lugs etc. to provide the 415/240V supplies to all equipment being supplied under this turnkey Bid.

5I Civil Works, Building and Foundation

5I1 One(1) lot of complete design, supply and construction of all civil items required for the outdoor works suitable for switchyard gantry & equipment foundations, entrance & internal roads, cable trenches, surfacing, gravel laying, drainage, security fences, etc.

5I2 One(1) lot of complete design, supply and construction of all civil items and facilities required for internal renovation of existing control room building including placing of new floor tiles.

5J Air Conditioning and Ventilation

5J1 One(1) lot of complete design, supply, installation and commissioning of equipment to renovate the existing air conditioning system & ventilation system for the main control building.

5J2 One(1) lot of complete set of design, supply, installation and commissioning of equipment to provide lighting (flood light LED type) for security, roadway, switchyard and emergency DC lighting at strategic locations for equipment operation and inspection to suit the substation overall arrangement.

5K Fibre Optic Multiplexer Equipment for Communication and Protection

5K1 The equipment to be supplied, installed and commissioned shall be as shown on bid drawing. One (1) lot complete set of design, supply, installation and commissioning of fibre optic multiplexer equipment including necessary works to interface with existing system is to be provided for:

- 87 or 21 relay for each transmission line protection (through fibre cores)
- 21 relay carrier signal (main and back-up)
- SCADA data from switchgear and control system
- Hot-line telephone system

5K2 Underground optical fibre cables (24cores for 132kV switchyard) from terminal box gantry structure at each 132kV double circuit transmission line termination point to MDF (Main distribution Frame) to be installed in control room. The Contract includes supply and installation of MDF and pigtail cables with adequate length.

5L SCADA system for Telecontrol and Telemetering

5L1 One(1) lot of complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol & telemetering facilities required at the existing National Load Despatch Center (NLDC) at Rampura for integration of complete 132/33kV substation. All required electrical signals shall be transmitted to the NLDC through the Industrial Gateway of the substation automation system. All HV breakers, motorized disconnectors, tap changer, etc. shall be controlled form NLDC through the Gateway of the substation automation system using IEC 60870-5-104 protocol. All necessary modification works in the software of master station of NLDC are to be carried out.

5M Mandatory Spares, Erection & Test Equipment

Supply of complete spares and spare parts of transformer, switchgear, control equipment, protection relays, meters, erection & test equipment as per quantity mentioned in Schedule B. Test equipment are to be supplied from Europe, USA or Japan origin. Printed catalogue, operation and service manual are to be provided. The materials shall have to be handed over to the designated store as per instruction of the Engineer.

6) Extension & Renovation of existing 132/33kV AIS Substation at Narshindi

The equipment to be designed, supplied, installed, tested & commissioned as stipulated in bid specification and shown in bid drawings:

Item	Description
6A	**145kV Air Insulated Switchgear (AIS)**
	The 145kV AIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included as Appendix A1 to this section and bid drawings; shall comprise the following:-
6A1.1	Four(4) sets of 145kV, 1250A, 31.5kA/1sec, 50Hz, 650kVp BIL, live tank type, single pole operated, SF6 gas circuit breaker with spring-stored energy operating mechanism (for Transmission line bays).
6A1.2	one(1) set of 145kV, 1250A, 31.5kA/1sec, 50Hz, 650kVp BIL, live tank type, gang operated, SF6 gas circuit breaker with spring-stored energy operating mechanism (for Transformer bays)
6A2.1	Two(2) sets of 145kV, 2000A, 31.5kA/1sec, 50Hz, 650kVp BIL, double side break, post type, motor operated disconnectors with manual earthing switch.
6A2.2	Six(6) sets of 145kV, 1250A, 31.5kA/1sec, 50Hz, 650kVp BIL, double side break, post type, motor operated disconnectors with manual earthing switch.
6A2.3	Eight(8) sets of 145kV, 1250A, 31.5kA/1sec, 50Hz, 650kVp BIL, double side break, post type, motor operated disconnectors without earthing switch.
6A2.4	Eight(8) sets of 145kV, 1250A, 31.5kA/1sec, 50Hz, 650kVp BIL, single break, post type, motor operated disconnectors without earthing switch series type.
6A3.1	Six(6) nos. of single-phase, 2-core, multi ratio, 145kV, 31.5kA/1sec, 50Hz, 650kVp BIL, post type current transformer(for bus tie bay, 2000/1A).
6A3.2	Six(6) nos. of single-phase, 4-core, multi ratio, 145kV, 31.5kA/1sec, 50Hz, 650kVp BIL, post type current transformer(for new line bays).
6A3.3	Three(3) nos. of single-phase, 4-core, multi ratio, 145kV, 31.5kA/1sec, 50Hz, 650kVp BIL, post type current transformer(for new transformer bays).
6A4.1	Twelve(12) nos. of single-phase, 2-core, 145kV, 31.5kA/1sec, 50Hz, 650kVp BIL, Capacitor voltage transformers(CVT).
6A4.2	Six(6) nos. of single-phase, 2-core, 145kV, 31.5kA/1sec, 50Hz, 650kVp BIL, Inductive Voltage Transformers(IVT).
6A5	Fifteen(15) nos. of 120kV rated voltage, 102kV(rms) continuous operating voltage at 50^0c, 10kA nominal discharge current, 50Hz, Heavy duty station class, gapless metal oxide type, single phase surge arresters.
6A6	Twelve(12) nos. single phase 145kV post type support insulators required for completing 145kV busbar and switchgear connections.

6A7 One(1) lot of flexible conductors for busbar[ACSR, Twin Finch(1113 MCM)] & jackbus, jumper, equipment connections[ACSR, Single Finch(1113 MCM)], including all necessary clamps & connectors required for completing 145kV busbar and switchgear connection. The existing rigid aluminium tube conductor, flexible conductor, clamps & connectors with all associated accessories are to be dismantled and handing over to store.

6A8 One (1) lot of insulators and fittings including all necessary accessories required to complete 145kV switchyard.

6A9 One(1) lot of steel structures for gantry and equipment supports including nuts & bolts and cable tray including all necessary fitting & fixing accessories required to complete 145kV switchyard. Some of existing gantry column, beam & equipment structure may be reused and the remaining are to be dismantled and handing over to store.

6A10.1 Relocation of existing one(1) set of 132/33kV, 50/75MVA, three phase transformer with all associated accessories.

6A10.2 Relocation of existing four(4) sets of 145kV, live tank type, SF6 gas circuit breakers with all associated accessories(two sets for two existing line bays, one set for one existing Transformer bay and one set for one existing bus tie bay).

6A10.3 Relocation of existing fifteen(15) nos. Single phase 145kV current transformer all associated accessories.

6A10.4 Relocation of existing twelve(12) nos. Single phase 145kV voltage transformer with wave trap & all associated accessories(six nos. for two existing line bays and six nos. for bus).

6A10.5 Relocation of existing nine(9) nos. Single phase 120kV lightning arrestors with all associated accessories.

6A10.6 Dismantle of existing seven(7) sets of disconnector switch with all associated accessories and handing over to the store.

6B 33kV Air Insulated Switches and Connection for Auxiliary Transformers

The 33kV AIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included as Appendix A1 to this section and bid drawings; shall comprise the following:-

6B1 Two (2) sets of 36kV, 2000A, 25kA/1sec, 50Hz, 170kVp BIL, outdoor Vacuum Circuit Breakers(VCB) with spring-stored energy operating mechanism.

6B2 Five(5) sets of 36kV, 2000A, 25kA/1sec, 50Hz, 170kVp BIL, single vertical break, post type, disconnectors.

6B3 Six(6) nos. of single-phase, 3-core, multi ratio, 36kV, 25kA/1sec, 50Hz, 170kVp BIL, post type current transformer.

6B4 Nine(9) nos. of single-phase, 2-core, 36kV, 25kA/1sec, 50Hz, 650kVp BIL, voltage transformers.

6B5 Twelve(12) nos. of 30kV rated voltage, 10kA nominal discharge current, 50Hz, Heavy duty station class, single phase surge arresters.

6B6.1 One(1) lot of flexible conductors for busbar, jackbus, jumper, equipment connections[ACSR, Twin Finch(1113 MCM)], including all necessary clamps & connectors required for completing 33kV busbar and switchgear connection.

6B6.2 XLPE insulated, single core, 500 sq.mm copper underground 33kV Cable; total length three thousand(3000) meter; required for completing connections for 33kV interbus, new transformer to new outdoor 33kV bus and from new location of existing transformer to existing indoor bus including all necessary clamps & connectors.

6B6.3 XLPE insulated, single core, 185 sq. mm copper underground 33kV Cable; total length three hundred(300) meter; required for completing connections for 33kV existing station aux. transformer to new location of existing 132/33kV transformer including all necessary clamps & connectors.

6B7 One (1) lot of insulators and fittings including all necessary accessories required to complete 33kV switchyard

6B8 One(1) lot of steel structures for gantry and equipment supports including nuts & bolts and cable tray including all necessary fitting & fixing accessories required for completing 33kV switchyard.

6B9 One(1) set of 36kV, 2000A, 25kA/1sec, 50Hz, 170kVp BIL, indoor type vacuum circuit breakers(VCB), spring-stored energy operating mechanism with associated disconnecting switches, earth switches, CT, PT, LA & bus coupling materials for extension of existing indoor type 33kV bus and connecting to new outdoor bus.

6B10 One(1) lot of dismantling of existing XLPE insulated, underground 33kV Cable including all necessary clamps & connectors location of existing transformer to existing indoor bus and handing over to store.

6C Power Transformers & Earthing/Auxiliary Transformers

6C1 One(1) set of 132/33kV, 50/75 MVA (ONAN/ONAF), three phase outdoor type power transformers with associated bushing CTs and steel support structures including all necessary connections, insulators & fittings.

6C2 One(1) set 33/0.415kV, 200kVA three phase outdoor type station auxiliary transformers with associated bushing CTs and steel support structures including all necessary connections, insulators & fittings.

6D Control, Protection, Substation Automation & Metering

132 kV Circuits

The equipment to be designed, supplied, installed and commissioned is shown in bid drawings are comprising of :-

6D1.1 Control, Protection, Metering & Substation Automation System including event recording function for four(4) sets of overhead line circuits for four new line bays.

6D1.2 Control, Protection, Metering & Substation Automation System including event recording function for two(2) sets of existing overhead line circuits. The existing

panels of two line bays shall be replaced by new sets and the recovered panels with all associated materials are to be handed over to the store.

6D2.1 Control, Protection, Metering & Substation Automation System including event recording function and transformer tap changer control for one(1) set of new transformer bay.

6D2.2 Control, Protection, Metering & Substation Automation System including event recording function and transformer tap changer control for one(1) sets of existing transformer bay. The existing panels of one transformer bay shall be replaced by new set and the recovered panels with all associated materials are to be handed over to the store.

6D3 Control, Protection, metering & Substation Automation System including event recording function for one(1) set of bus coupler circuit. The existing panels of one existing bus tie bay shall be replaced by new set and the recovered panels with all associated materials are to be handed over to the store.

6D4 Busbar protection system for complete 132kV bus; one(1) lot.

6D5 Tariff metering panel to accommodate programmable & recordable digital 3-phase, 4-wire import and export MWh and MVArh meters (accuracy class 0.2) for four(4) 132kV line and one transformer. For each feeder minimum two meters (main & check). The scope of works also includes supply of software(s) & connection cords of the above energy meters for future re-configuration. The existing energy meters of the existing feeders are to be shifted to the new panel.

33 kV Circuits

The equipment to be supplied, installed and commissioned is shown in bid drawings are comprising of:-

6D6.1 Control, Protection, Metering & Substation Automation System including event recording function for one(1) set of 132/33kV transformer circuit.

6D6.2 Control, Protection, Metering & Substation Automation System including event recording function for one(1) set of 33kV interbus bay circuit.

6D6.3 Control, Protection, Metering & Substation Automation System including event recording function for one(1) set of existing 132/33kV transformer circuit. The existing panels of one transformer bay shall be replaced by new sets and the recovered panels with all associated materials are to be handed over to the store.

6D4 Tariff metering panel to accommodate programmable & recordable digital 3-phase, 4-wire import and export MWh and MVArh meters (accuracy class 0.2) one transformer. For each feeder minimum two meters (main & check). The scope of works also includes supply of software(s) & connection cords of the above energy meters for future re-configuration. The existing energy meters of the existing feeders are to be shifted to the new panel.

6E Multicore Cables

6E1 One (1) lot complete set of multicore low voltage 0.6/1.1kV, XLPE insulated power and control cables (IEC 60502) shall be supplied, installed, glanded, terminated and have individual cores identified to be used for connection of all equipment supplied

under the Contract. The overall substation cable routing and core schedules shall also be provided. Some of the existing cables may be reused and the remaining are to be recovered and handing over to store.

6F Earthing and Lightning Protection

6F1 One (1) lot of design, supply and installation of earthing system and lightning protection screen including connections, connectors and clamps, to suit the substation overall arrangement and provide supporting design calculations.

6F2 One (1) set of 3-phase portable (maintenance) earthing equipment devices with connectors and telescopic glass fibre operating pole suitable for plant supplied.

6G Batteries, Chargers and DC Distribution

6G1 110V substation NiCad batteries complete with chargers and distribution switchboard to be supplied, installed and commissioned to provide all DC supplies to equipment being supplied. The existing Batteries, Chargers and DC Distribution panels are to be replaced by the new sets and handed over to the store with all recovered materials.

The system shall generally be as shown in bid drawing and shall include:

(a) Two (2) sets of 100% batteries complete, each capacity shall not be less than 250Ah at the 5-hour rate of discharge.

(b) Two (2) sets of battery chargers complete, each charger shall not be less than 75A rating.

(c) One (1) set of DC distribution board. The DC distribution board shall be with 50% overall spare switches for future use.

(d) Two(2) sets of online UPS, 3kVA for Substation Automation system panels.

6G2 48V DC system and distribution equipment complete with NiCad batteries chargers to be supplied, installed and commissioned in the main control building for the new fibre optic multiplexer equipment for communication and protection. One set shall be used as standby supply. The existing Batteries, Chargers and DC Distribution panels are to be replaced by the new sets and handed over to the store with all recovered materials.

The system shall generally be as shown in bid drawing and shall include:

(a) Two (2) sets of 100% batteries complete, each capacity shall not be less than 150 Ah at the 5-hour rate of discharge

(b) Two (2) sets of battery chargers of output 48V DC, 30A and input voltage three pahse 50Hz, 415 V AC.

(c) One (1) lot of DC distribution board. The DC distribution board shall be suitable to connect the new fibre optic multiplexer equipment for communication and protection with 50% overall spare switches for future use.

6H LVAC Distribution

6H1 One (1) lot of modification of existing LVAC switchboard for substation services including supply of all necessary MCBs, bus material, connection cables, lugs etc. to provide the 415/240V supplies to all equipment being supplied under this turnkey Bid.

6H2 One (1) lot of Tariff metering panel to accommodate programmable & recordable digital 3-phase, 4-wire import and export MWh and MVArh meters (accuracy class 0.2) for new aux. Transformer. For each feeder minimum two meters (main & check.

The system and requirements shall generally be as shown in Bid drawing and technical specification of Volume 2 and shall include one 125A outdoor weatherproof 3-phase with neutral and earth switched socket outlet and plug as per IEC 309; to be installed, cabled and connected adjacent to the auxiliary transformers.

6I Land Development, Civil Works, Building and Foundation

6I1 Complete earth filling by imported carried earth free from foreign solid particles and organic materials in addition to the earth recovered from digging of foundation, to make the top of the final ground level of substation 0.5m high from highest flood level and final compaction to be achieved 95% for total volume 16,500 cubic meter. The volume of earth filling may be varied but the payment shall be as per actual measurement of work done.

6I2 One(1) lot of complete design, supply and construction of all civil items required for the outdoor works suitable for switchyard gantry & equipment foundations, transformer foundations, blast walls, oil pit, entrance & internal roads, cable trenches, surfacing, gravel laying, drainage, security fences, etc.

6I3 One(1) lot of complete design, supply and construction of all civil items and facilities required for internal renovation of existing control room building including re-placing of floor tiles.

6J Lighting, Small Power, Air Conditioning and Ventilation

6J1 One(1) lot of complete design, supply, installation and commissioning of equipment to renovate the existing lighting, LV power supply, air conditioning system, ventilation system and emergency DC lighting for the main control building.

6J2 One(1) lot of complete set of design, supply, installation and commissioning of equipment to provide lighting (flood light LED type) for security, roadway, switchyard and emergency DC lighting at strategic locations for equipment operation and inspection to suit the substation overall arrangement.

6K Fibre Optic Multiplexer Equipment for Communication and Protection

6K1 The equipment to be supplied, installed and commissioned shall be as shown on bid drawing. One (1) lot complete set of design, supply, installation and commissioning of fibre optic multiplexer equipment including necessary works to interface with existing system is to be provided for:

- 87 or 21 relay for each transmission line protection (through fibre cores)
- 21 relay carrier signal (main and back-up)

- SCADA data from switchgear and control system
- Digital Telephone Exchange & hot-line telephone system

6K2 Underground optical fibre cables (24cores for 132kV switchyard) from terminal box gantry structure at each 132kV double circuit transmission line termination point to MDF (Main distribution Frame) to be installed in control room. The Contract includes supply and installation of MDF and pigtail cables with adequate length.

6L SCADA system for Telecontrol and Telemetering

6L1 One(1) lot of complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol & telemetering facilities required at the existing National Load Despatch Center (NLDC) at Rampura for integration of complete 132/33kV substation. All required electrical signals shall be transmitted to the NLDC through the Industrial Gateway of the substation automation system. All HV breakers, motorized disconnectors, tap changer, etc. shall be controlled form NLDC through the Gateway of the substation automation system using IEC 60870-5-104 protocol. All necessary modification works in the software of master station of NLDC are to be carried out.

6M Mandatory Spares, Erection & Test Equipment

Supply of complete spares and spare parts of transformer, switchgear, control equipment, protection relays, meters, erection & test equipment as per quantity mentioned in Schedule B. Test equipment are to be supplied from Europe, USA or Japan origin. Printed catalogue, operation and service manual are to be provided. The materials shall have to be handed over to the designated store as per instruction of the Engineer.

7) Extension of existing 132/33kV AIS Substation at Brahamanbaria

The equipment to be designed, supplied, installed, tested & commissioned as stipulated in bid specification and shown in bid drawings:

Item Description

7A 145kV Air Insulated Switchgear (AIS)

The 145kV AIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included as Appendix A1 to this section and bid drawings; shall comprise the following:-

7A1 Two(2) sets of 145kV, 1250A, 31.5kA/1sec, 50Hz, 650kVp BIL, live tank type, single pole operated, SF6 gas circuit breaker with spring-stored energy operating mechanism (for Transmission line bays).

7A2.1 Two(2) sets of 145kV, 1250A, 31.5kA/1sec, 50Hz, 650kVp BIL, single centre break, post type, motor operated disconnectors with manual earthing switch.

7A2.2 Four(4) sets of 145kV, 1250A, 31.5kA/1sec, 50Hz, 650kVp BIL, single centre break, post type, motor operated disconnectors without earthing switch.

7A3 Six(6) nos. of single-phase, 4-core, multi ratio, 145kV, 31.5kA/1sec, 50Hz, 650kVp BIL, post type current transformer(for line bays).

7A4 Six(6) nos. of single-phase, 2-core, 145kV, 31.5kA/1sec, 50Hz, 650kVp BIL, Capacitor voltage transformers(CVT).

7A5 Six(6) nos. of 120kV rated voltage, 102kV(rms) continuous operating voltage at 50^0c, 10kA nominal discharge current, 50Hz, Heavy duty station class, gapless metal oxide type, single phase surge arresters.

7A6 Two(2) nos. single phase 145kV post type support insulators required for completing 145kV busbar and switchgear connections.

7A7 One(1) lot of flexible conductors for busbar[ACSR, Twin Martin(1351 MCM)] & jackbus, jumper, equipment connections[ACSR, Grosbeak(636 MCM)], including all necessary clamps & connectors required for extension of busbar to accommodate two line bays.

7A8 One (1) lot of insulators and fittings including all necessary accessories required to complete 145kV switchyard.

7A9 One(1) lot of steel structures for gantry and equipment supports including nuts & bolts and cable tray including all necessary fitting & fixing accessories required to complete 145kV switchyard.

7D Control, Protection & Metering

132 kV Circuits

The equipment to be designed, supplied, installed and commissioned is shown in bid drawings are comprising of :-

7D1 Control, Protection & Metering for two(2) sets of overhead line circuits for two new line bays.

7D2 Extension of existing Busbar protection system to accommodate two line bays; one(1) lot.

7D3 Tariff metering to accommodate programmable & recordable digital 3-phase, 4-wire import and export MWh and MVArh meters (accuracy class 0.2) for two(2) 132kV line. For each feeder minimum two meters (main & check). The scope of works also includes supply of software(s) & connection cords of the above energy meters for future re-configuration.

7E Multicore Cables

7E1 One (1) lot complete set of multicore low voltage 0.6/1.1kV, XLPE insulated power and control cables (IEC 60502) shall be supplied, installed, glanded, terminated and have individual cores identified to be used for connection of all equipment supplied under the Contract. The cable routing and core schedules shall also be provided.

7F Earthing and Lightning Protection

7F1 One (1) lot of design, supply and installation of earthing system and lightning protection screen including connections, connectors and clamps for the portion to be extended under this turnkey bid and to suit the substation overall arrangement.

7G DC Distribution

7G1 One (1) lot of modification of existing DCDB system by necessary MCBs, cable, connectors etc. required for the plant being installed.

7H LVAC Distribution

7H1 One (1) lot of modification of existing LVAC switchboard for substation services including supply of all necessary MCBs, bus material, connection cables, lugs etc. to provide the 415/240V supplies to all equipment being supplied under this turnkey Bid.

7I Civil Works, Building and Foundation

7I1 One(1) lot of complete design, supply and construction of all civil items required for the outdoor works suitable for switchyard gantry & equipment foundations, internal roads, cable trenches, surfacing, gravel laying, drainage, security fences, etc.

7J Lighting, Small Power

7J1 One(1) lot of complete set of design, supply, installation and commissioning of equipment to provide lighting (flood light LED type) for security, roadway, switchyard and emergency DC lighting at strategic locations for equipment operation and inspection to suit the substation overall arrangement for the plant & equipment to be installed under this turnkey bid.

7K Fibre Optic Multiplexer Equipment for Communication and Protection

7K1 The equipment to be supplied, installed and commissioned shall be as shown on bid drawing. One(1) lot complete set of design, supply, installation and commissioning for extension of existing fibre optic multiplexer & communication equipment(AREVA, France made MSE 5001 type) including necessary works to interface with existing system is to be provided to accommodate new bays:

7K2 Underground optical fibre cables (24cores for 132kV switchyard) from terminal box gantry structure at each 132kV double circuit transmission line termination point to MDF (Main distribution Frame) to be installed in control room. The Contract includes supply and installation of MDF and pigtail cables with adequate length.

7L SCADA system for Telecontrol and Telemetering

7L1 One(1) lot of complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol & telemetering facilities required at the existing National Load Despatch Center (NLDC) at Rampura for integration of complete 132/33kV substation. All required electrical signals shall be transmitted to the NLDC through the Industrial Gateway of the substation automation system. All HV breakers, motorized disconnectors, tap changer, etc. shall be controlled form NLDC through the Gateway of the substation automation system using IEC 60870-5-104 protocol. All necessary modification works in the software of master station of NLDC are to be carried out.

8) Extension of existing 132/33kV AIS Substation at RPCL Mymensingh

The equipment to be designed, supplied, installed, tested & commissioned as stipulated in bid specification and shown in bid drawings:

Item	Description
8A	**145kV Air Insulated Switchgear (AIS)**
	The 145kV AIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included as Appendix A1 to this section and bid drawings; shall comprise the following:-
8A1	Two(2) sets of 145kV, 1250A, 31.5kA/1sec, 50Hz, 650kVp BIL, live tank type, single pole operated, SF6 gas circuit breakers with spring-stored energy operating mechanism (for Transmission line bays).
8A2.1	Two(2) sets of 145kV, 1250A, 31.5kA/1sec, 50Hz, 650kVp BIL, single centre break, post type, motor operated disconnectors with manual earthing switch.
8A2.2	Four(4) sets of 145kV, 1250A, 31.5kA/1sec, 50Hz, 650kVp BIL, single centre break, post type, motor operated disconnectors without earthing switch.
8A3	Six(6) nos. of single-phase, 4-core, multi ratio, 145kV, 31.5kA/1sec, 50Hz, 650kVp BIL, post type current transformer(for line bays).
8A4	Six(6) nos. of single-phase, 2-core, 145kV, 31.5kA/1sec, 50Hz, 650kVp BIL, Capacitor voltage transformers(CVT).
8A5	Six(6) nos. of 120kV rated voltage, 102kV(rms) continuous operating voltage at 50^0c, 10kA nominal discharge current, 50Hz, Heavy duty station class, gapless metal oxide type, single phase surge arresters.
8A6	Two(2) nos. single phase 145kV post type support insulators required for completing 145kV busbar and switchgear connections.
8A7	One(1) lot of flexible conductors for busbar[ACSR, Twin Fince(1113 MCM)] & jackbus, jumper, equipment connections[ACSR, Single Grosbeak(636 MCM)], including all necessary clamps & connectors required for extension of busbar to accommodate two line bays.
8A8	One (1) lot of insulators and fittings including all necessary accessories required to complete 145kV switchyard.
8A9	One(1) lot of steel structures for gantry and equipment supports including nuts & bolts and cable tray including all necessary fitting & fixing accessories required to complete 145kV switchyard.
8D	**Control, Protection & Metering**
	132 kV Circuits
	The equipment to be designed, supplied, installed and commissioned is shown in bid drawings are comprising of :-
8D1	Control, Protection & Metering for two(2) sets of overhead line circuits for two new line bays.

8D2 Extension of existing Busbar protection system to accommodate two line bays; one(1) lot.

8D3 Tariff metering to accommodate programmable & recordable digital 3-phase, 4-wire import and export MWh and MVArh meters (accuracy class 0.2) for two(2) 132kV line. For each feeder minimum two meters (main & check). The scope of works also includes supply of software(s) & connection cords of the above energy meters for future re-configuration.

8E Multicore Cables

8E1 One (1) lot complete set of multicore low voltage 0.6/1.1kV, XLPE insulated power and control cables (IEC 60502) shall be supplied, installed, glanded, terminated and have individual cores identified to be used for connection of all equipment supplied under the Contract. The cable routing and core schedules shall also be provided.

8F Earthing and Lightning Protection

8F1 One (1) lot of design, supply and installation of earthing system and lightning protection screen including connections, connectors and clamps for the portion to be extended under this turnkey bid and to suit the substation overall arrangement.

8G DC Distribution

8G1 One (1) lot of modification of existing DCDB system by necessary MCBs, cable, connectors etc. required for the plant being installed.

8H LVAC Distribution

8H1 One (1) lot of modification of existing LVAC switchboard for substation services including supply of all necessary MCBs, bus material, connection cables, lugs etc. to provide the 415/240V supplies to all equipment being supplied under this turnkey Bid.

8I Civil Works, Building and Foundation

8I1 One(1) lot of complete design, supply and construction of all civil items required for the outdoor works suitable for switchyard gantry & equipment foundations, internal roads, cable trenches, surfacing, gravel laying, drainage, security fences, etc.

8J Lighting, Small Power

8J1 One(1) lot of complete set of design, supply, installation and commissioning of equipment to provide lighting (flood light LED type) for security, roadway, switchyard and emergency DC lighting at strategic locations for equipment operation and inspection to suit the substation overall arrangement for the plant & equipment to be installed under this turnkey bid.

8K Fibre Optic Multiplexer Equipment for Communication and Protection

8K1 The equipment to be supplied, installed and commissioned shall be as shown on bid drawing. One(1) lot complete set of design, supply, installation and commissioning of fibre optic multiplexer equipment including necessary works to interface with existing system is to be provided for:

- 87 or 21 relay for each transmission line protection (through fibre cores)

- 21 relay carrier signal (main and back-up)
- SCADA data from switchgear and control system

- Hot-line telephone system

8K2 Underground optical fibre cables (24cores for 132kV switchyard) from terminal box gantry structure at each 132kV double circuit transmission line termination point to MDF (Main distribution Frame) to be installed in control room. The Contract includes supply and installation of MDF and pigtail cables with adequate length.

8L SCADA system for Telecontrol and Telemetering

8L1 One(1) lot of complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol & telemetering facilities required at the existing National Load Despatch Center (NLDC) at Rampura for integration of complete 132/33kV substation. All required electrical signals shall be transmitted to the NLDC through the Industrial Gateway of the substation automation system. All HV breakers, motorized disconnectors, tap changer, etc. shall be controlled form NLDC through the Gateway of the substation automation system using IEC 60870-5-104 protocol. All necessary modification works in the software of master station of NLDC are to be carried out.

9) Extension of existing 132/33kV AIS Substation at Tangail

The equipment to be designed, supplied, installed, tested & commissioned as stipulated in bid specification and shown in bid drawings:

Item Description

9A 145kV Air Insulated Switchgear (AIS)

The 145kV AIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included as Appendix A1 to this section and bid drawings; shall comprise the following:-

9A1 Two(2) sets of 145kV, 1250A, 31.5kA/1sec, 50Hz, 650kVp BIL, live tank type, single pole operated, SF6 gas circuit breaker with spring-stored energy operating mechanism (for Transmission line bays).

9A2.1 Two(2) sets of 145kV, 1250A, 31.5kA/1sec, 50Hz, 650kVp BIL, single centre break, post type, motor operated disconnectors with manual earthing switch.

9A2.2 Six(6) sets of 145kV, 1250A, 31.5kA/1sec, 50Hz, 650kVp BIL, single centre break, post type, motor operated disconnectors without earthing switch.

9A3 Six(6) nos. of single-phase, 4-core, multi ratio, 145kV, 31.5kA/1sec, 50Hz, 650kVp BIL, post type current transformer(for line bays).

9A4 Six(6) nos. of single-phase, 2-core, 145kV, 31.5kA/1sec, 50Hz, 650kVp BIL, Capacitor voltage transformers(CVT).

9A5 Six(6) nos. of 120kV rated voltage, 102kV(rms) continuous operating voltage at 50^0c, 10kA nominal discharge current, 50Hz, Heavy duty station class, gapless metal oxide type, single phase surge arresters.

9A6 Two(2) nos. single phase 145kV post type support insulators required for completing 145kV busbar and switchgear connections.

9A7 One(1) lot of flexible conductors for busbar[ACSR, Twin Mallard(795MCM)] & jackbus, jumper, equipment connections[ACSR, Single Grosbeak(636 MCM)], including all necessary clamps & connectors required for replacement of existing bus conductor(single Mallard(795MCM) and extension of busbar to accommodate two line bays.

9A8 One (1) lot of insulators and fittings including all necessary accessories required to complete 145kV switchyard.

9A9 One(1) lot of steel structures for gantry and equipment supports including nuts & bolts and cable tray including all necessary fitting & fixing accessories required to complete 145kV switchyard.

9D Control, Protection & Metering

132 kV Circuits

The equipment to be designed, supplied, installed and commissioned is shown in bid drawings are comprising of :-

9D1 Control, Protection, Metering for two(2) sets of overhead line circuits for two new line bays.

9D2 Tariff metering to accommodate programmable & recordable digital 3-phase, 4-wire import and export MWh and MVArh meters (accuracy class 0.2) for two(2) 132kV line. For each feeder minimum two meters (main & check). The scope of works also includes supply of software(s) & connection cords of the above energy meters for future re-configuration.

9E Multicore Cables

9E1 One (1) lot complete set of multicore low voltage 0.6/1.1kV, XLPE insulated power and control cables (IEC 60502) shall be supplied, installed, glanded, terminated and have individual cores identified to be used for connection of all equipment supplied under the Contract. The cable routing and core schedules shall also be provided.

9F Earthing and Lightning Protection

9F1 One (1) lot of design, supply and installation of earthing system and lightning protection screen including connections, connectors and clamps for the portion to be extended under this turnkey bid and to suit the substation overall arrangement.

9G Battery, Charger & DC Distribution

9G1 One (1) set NiCad 250Ahr, 110V DC Battery bank and one(1) set of battery charger complete, 75A rating for 110V DC to be supplied, installed, commissioned and coupling with existing DC system.

9G2 One (1) lot of modification of existing DCDB system by necessary MCBs, cable, connectors etc. required for the plant being installed.

9H LVAC Distribution

9H1 One (1) lot of modification of existing LVAC switchboard for substation services including supply of all necessary MCBs, bus material, connection cables, lugs etc. to provide the 415/240V supplies to all equipment being supplied under this turnkey Bid.

9I Land Development, Civil Works, Building and Foundation

9I1 Complete earth filling by imported carried earth free from foreign solid particles and organic materials in addition to the earth recovered from digging of foundation, to make the top of the final ground level of substation 0.5m high from highest flood level and final compaction to be achieved 95% for total volume 2,500 cubic meter. The volume of earth filling may be varied but the payment shall be as per actual measurement of work done.

9I2 One(1) lot of complete design, supply and construction of all civil items required for the outdoor works suitable for switchyard gantry & equipment foundations, internal roads, cable trenches, surfacing, gravel laying, drainage, security fences, etc.

9J Lighting, Small Power

9J1 One(1) lot of complete set of design, supply, installation and commissioning of equipment to provide lighting (flood light LED type) for security, roadway, switchyard and emergency DC lighting at strategic locations for equipment operation and inspection to suit the substation overall arrangement for the plant & equipment to be installed under this turnkey bid.

9K Fibre Optic Multiplexer Equipment for Communication and Protection

9K1 The equipment to be supplied, installed and commissioned shall be as shown on bid drawing. One(1) lot complete set of design, supply, installation and commissioning for extension of existing fibre optic multiplexer & communication equipment(AREVA, France made MSE 5001 type) including necessary works to interface with existing system is to be provided to accommodate new bays:

9K2 Underground optical fibre cables (24cores for 132kV switchyard) from terminal box gantry structure at each 132kV double circuit transmission line termination point to MDF (Main distribution Frame) to be installed in control room. The Contract includes supply and installation of MDF and pigtail cables with adequate length.

9L SCADA system for Telecontrol and Telemetering

9L1 One(1) lot of complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol & telemetering facilities required at the existing National Load Despatch Center (NLDC) at Rampura for integration of complete 132/33kV substation. All required electrical signals shall be transmitted to the NLDC through the Industrial Gateway of the substation automation system. All HV breakers, motorized disconnectors, tap changer, etc. shall be controlled form NLDC through the Gateway of the substation automation system using IEC 60870-

5-104 protocol. All necessary modification works in the software of master station of NLDC are to be carried out.

10) Extension of existing 132/33kV AIS Substation at Chatak

The equipment to be designed, supplied, installed, tested & commissioned as stipulated in bid specification and shown in bid drawings:

Item	Description
10A	**145kV Air Insulated Switchgear (AIS)**
	The 145kV AIS shall comply with the particular requirements as detailed in the Schedule of Technical Requirements included as Appendix A1 to this section and bid drawings; shall comprise the following:-
10A1	One(1) sets of 145kV, 1250A, 31.5kA/1sec, 50Hz, 650kVp BIL, live tank type, single pole operated, SF6 gas circuit breakers with spring-stored energy operating mechanism (for Transmission line bays).
10A2.1	One(1) sets of 145kV, 1250A, 31.5kA/1sec, 50Hz, 650kVp BIL, single centre break, post type, motor operated disconnectors with manual earthing switch.
10A2.2	Two(2) sets of 145kV, 1250A, 31.5kA/1sec, 50Hz, 650kVp BIL, single centre break, post type, motor operated disconnectors without earthing switch.
10A3	Three(3) nos. of single-phase, 4-core, multi ratio, 145kV, 31.5kA/1sec, 50Hz, 650kVp BIL, post type current transformer(for line bays).
10A4	Three (3) nos. of single-phase, 2-core, 145kV, 31.5kA/1sec, 50Hz, 650kVp BIL, Capacitor voltage transformers(CVT).
10A5	Three(3) nos. of 120kV rated voltage, 102kV(rms) continuous operating voltage at 50^0c, 10kA nominal discharge current, 50Hz, Heavy duty station class, gapless metal oxide type, single phase surge arresters.
10A7	One(1) lot of flexible conductors for busbar[ACSR, twin Moose] & jackbus, jumper, equipment connections[ACSR, Single Grosbeak(636MCM)], including all necessary clamps & connectors required for extension of busbar to accommodate two line bays.
10A8	One (1) lot of insulators and fittings including all necessary accessories required to complete 145kV switchyard.
10A9	One(1) lot of steel structures for gantry and equipment supports including nuts & bolts and cable tray including all necessary fitting & fixing accessories required to complete 145kV switchyard.
10D	**Control, Protection & Metering**
	132 kV Circuits

The equipment to be designed, supplied, installed and commissioned is shown in bid drawings are comprising of :-

10D1 Control, Protection & Metering for one(1) sets of overhead line circuits for one new line bay.

10D2 Tariff metering to accommodate programmable & recordable digital 3-phase, 4-wire import and export MWh and MVArh meters (accuracy class 0.2) for one(1) 132kV line. For each feeder minimum two meters (main & check). The scope of works also includes supply of software(s) & connection cords of the above energy meters for future re-configuration.

10E Multicore Cables

10E1 One (1) lot complete set of multicore low voltage 0.6/1.1kV, XLPE insulated power and control cables (IEC 60502) shall be supplied, installed, glanded, terminated and have individual cores identified to be used for connection of all equipment supplied under the Contract. The cable routing and core schedules shall also be provided.

10F Earthing and Lightning Protection

10F1 One (1) lot of design, supply and installation of earthing system and lightning protection screen including connections, connectors and clamps for the portion to be extended under this turnkey bid and to suit the substation overall arrangement.

10G Battery, Charger & DC Distribution

10G1 110V substation NiCad batteries complete with chargers and distribution switchboard to be supplied, installed and commissioned to provide all DC supplies to equipment being supplied. The existing Batteries, Chargers and DC Distribution panels are to be replaced by the new sets and handed over to the store with all recovered materials.

The system shall generally be as shown in bid drawing and shall include:

(a) Two (2) sets of 100% batteries complete, each capacity shall not be less than 250Ah at the 5-hour rate of discharge.
(b) Two (2) sets of battery chargers complete, each charger shall not be less than 75A rating.

10G2 One (1) lot of modification of existing DCDB system by necessary MCBs, cable, connectors etc. required for the plant being installed.

10H LVAC Distribution

10H1 One (1) lot of modification of existing LVAC switchboard for substation services including supply of all necessary MCBs, bus material, connection cables, lugs etc. to provide the 415/240V supplies to all equipment being supplied under this turnkey Bid.

10I Land Development, Civil Works, Building and Foundation

10I1 Complete earth filling by imported carried earth free from foreign solid particles and organic materials in addition to the earth recovered from digging of foundation, to make the top of the final ground level of substation 0.5m high from highest flood level and final compaction to be achieved 95% for total volume 6,500 cubic meter. The volume of earth filling may be varied but the payment shall be as per actual measurement of work done.

10I2 One(1) lot of complete design, supply and construction of all civil items required for the outdoor works suitable for switchyard gantry & equipment foundations, internal roads, cable trenches, surfacing, gravel laying, drainage, security fences, etc.

10J Lighting, Small Power

10J1 One(1) lot of complete set of design, supply, installation and commissioning of equipment to provide lighting (flood light LED type) for security, roadway, switchyard and emergency DC lighting at strategic locations for equipment operation and inspection to suit the substation overall arrangement for the plant & equipment to be installed under this turnkey bid.

10K Fibre Optic Multiplexer Equipment for Communication and Protection

10K1 The equipment to be supplied, installed and commissioned shall be as shown on bid drawing. One(1) lot complete set of design, supply, installation and commissioning for extension of existing fibre optic multiplexer & communication equipment(AREVA, France made MSE 5001 type) including supply of a new digital telephone exchange and necessary works to interface with existing system is to be provided to accommodate new bay.

10K2 Underground optical fibre cables (24cores for 132kV switchyard) from terminal box gantry structure at each 132kV double circuit transmission line termination point to MDF (Main distribution Frame) to be installed in control room. The Contract includes supply and installation of MDF and pigtail cables with adequate length.

10L SCADA system for Telecontrol and Telemetering

10L1 One(1) lot of complete design, supply, delivery, installation, testing & commissioning of hardware and software to provide the telecontrol & telemetering facilities required at the existing National Load Despatch Center (NLDC) at Rampura for integration of complete 132/33kV substation. All required electrical signals shall be transmitted to the NLDC through the Industrial Gateway of the substation automation system. All HV breakers, motorized disconnectors, tap changer, etc. shall be controlled form NLDC through the Gateway of the substation automation system using IEC 60870-5-104 protocol. All necessary modification works in the software of master station of NLDC are to be carried out.

APPENDIX- A1

SCHEDULE OF TECHNICAL REQUIREMENTS OF

132kV and 33kV AIR INSULATED SWITCHGEAR (AIS)

Sl. No.	Description	Unit	132kV	33kV
1.	**Site Condition**			
	Max. Altitude above sea level	meter	not more than 1000	
	Max. Ambient temperature outdoor	ºC	+45	
	Min. Ambient temperature outdoor	ºC	+4	
	Max. Ambient relative humidity	%	100	
	Max. Seismic acceleration at floor level			
	- horizontal	g	0.2	
	- vertical	g	0.2	
2.	**Electrical Data**			
	Nominal system Voltage	kV	132	33
	Rated Voltage	kV	145	36
	Rated Frequency	Hz	50	50
	Insulation Level			
	- lightning impulse withstand	kVp	650	170
	- switching impulse withstand	kVp	—	—
	- 50 Hz withstand 1 minute	kV	275	70
	Rated continuous current at 40°C ambient temperature			
	- main busbar and bus coupler	A	2000	2000
	- transformer bay	A	1250	2000
	- line bay	A	1250	-
	Rated short time withstand			
	- current	kA	31.5	25
	- duration	Sec	1	1
	Rated peak withstand current	kA	80	62.5
3.	**Secondary Circuit**			
	Auxiliary voltage			
	- for control and signal	V dc	110	
	- for remote control	V dc	110	
	- for heating	V ac	415/240	
	- tolerances	%	-15/+10	

4. Circuit Breakers

4.1 145kV Class Circuit Breakers

1	Type	Outdoor, SF_6 insulated, live tank type
2	Standard	IEC 62271-100
3	Rated voltage	145 kV
4	Rated short-duration power frequency withstand voltage (1 min.) - Between line terminal and ground - Between terminals with CB open - Between terminals with isolator open	 275 kV rms 275 kV rms 315 kV rms

5	Rated lightning impulse withstand voltage - Between line terminal and ground - Between terminals with CB open - Between terminals with isolator open	 650 kV peak 650 kV peak 750 kV peak
6	First pole to clear factor	1.3
7	Rated current - Bus coupler - Transformer bay - Line bay	 2000 A 1250 A 1250 A
8	Rated short circuit breaking current	31.5 kA rms
9	Rated short circuit making current	80 kA peak
10	Short time withstand current for 1 sec.	31.5 kA rms
11	Max. radio interference voltage for frequency between 0.5MHz and 2MHz in all positions	500 micro V (at 92 kV rms)
12	Total closing time	Not more than 150 ms
13	Total breaking time	65 ms
14	Operating mechanism	Spring
15	Rated duty cycle	O-0.3S-CO-3min-CO
16	Reclosing	Single phase & Three phase auto-reclosing
17	Creepage distance	25 mm/kV
18	Number of closing coils	1
19	Number of tripping coils	2
20	Number of auxiliary contacts for: - Making - Breaking - Middle position	 Min. 12 Min. 12 0
21	Protection class	IP55

4.2 36kV Class Circuit Breakers

1	Type	Outdoor type VCB and one Indoor type VCB for Nrasindhi
2	Standard	IEC 62271-100
3	Rated voltage	36 kV
4	Rated short-duration power frequency withstand voltage (1 min.)	70 kV rms
5	Rated lightning impulse withstand voltage	170 kV peak
6	First pole to clear factor	1.5
7	Rated current	2000 A
8	Rated short circuit breaking current	25 kA rms
9	Rated short circuit making current	65 kA peak
10	Short time withstand current for 1 sec.	25 kA rms
11	Total closing time	Not more than 150 ms

12	Total breaking time	45 ms
13	Operating mechanism	Motor spring stored energy
14	Rated duty cycle	O-0.3S-CO-3min-CO
15	Number of closing coils	1
16	Number of tripping coils	2
17	Number of auxiliary contacts for: - Making - Breaking - Middle position	 Min. 8 Min. 8 0
18	Protection class	IP55

5. Disconnector Switches/Isolators

5.1 145kV Class Disconnector and Earthing Switch

1	Type	Outdoor, i)Double side break ii)Single Center break ii)Single break Series
2	Standard	IEC 62271-102
3	Rated voltage	145 kV
4	Rated short-duration power frequency withstand voltage (1 min.) - To earth - Across isolating distance	 275 kV rms 315 kV rms
5	Rated lightning impulse withstand voltage - To earth - Across isolating distance	 650 kV peak 750 kV peak
6	Rated normal current - Bus coupler - Transformer bay - Line bay	 2000 A 1250 A 1250 A
7	Rated short circuit current (Ith), 1s	31.5 kA rms
8	Rated short circuit current (Idyn)	80 kA peak
9	Creepage distance of insulator	25 mm/kV
10	Operating mechanism of isolator------ Earthing switch----------	AC motor operated manual operated
11	Number of auxiliary contacts for main switch - Making - Breaking - Middle position	 Min. 6 Min. 6 Min. 1
12	Number of auxiliary contacts for earthing switch - Making - Breaking - Middle position	 Min. 6 Min. 6 Min. 1
13	Radio interference level for 0.5 MHz to 2 MHz	500 micro V (at 92 kV rms)

5.2 36kV Class Isolators

1	Type	Outdoor, Single vertical break

2	Standard	IEC 62271-102
3	Rated voltage	36 kV
4	Rated short-duration power frequency withstand voltage (1 min.)	70 kV rms
5	Rated lightning impulse withstand voltage	170 kV peak
6	Rated normal current	2000 A
7	Rated short circuit current (Ith), 1s	25 kA rms
8	Rated short circuit current (Idyn)	65 kA peak
9	Creepage distance of insulator	25 mm/kV
10	Operating mechanism of isolator	manual operated
11	Number of auxiliary contacts for main switch - Making / Breaking	Min. 6 / 6

6. Instrument Transformers

6.1 Instrument Transformers

		145 kV	36kV	
1	Rated lightning impulse withstand voltage	650 kVp	170 kVp	
2	Rated switching impulse withstand voltage	-		
3	Power frequency withstand voltage (1 min.)	275 kVrms	70 kVrms	
4	Corona extinction voltage	-		
5	Radio interference level for 0.5 MHz to 2 MHz	1000 micro V (at 92 kVrms)	1000 micro V (at 92 kVrms)	
6	Partial discharge level	10 pC	10 pC	
7	Type of insulation	Class A	Class A	

6.2.1 145kV Class Current Transformers (for transformer bay)

1	No. of Cores	Total-4 (Metering-1 plus Protection-3)
2	Ratio	800-400/1/1/1A 2000/1A
3	Class of accuracy	- Protection : 5P20 - Metering : Class 0.2
4	Burden (VA)	30
5	Min. knee point voltage at lowest ratio (Volts)	>1kV@ max ratio for protection core <150V@ max ratio for metering core
6	Max. magnetizing current guaranteed at knee point voltage & the lowest ratio(mA)	M.R.
7	Max. resistance of secondary winding at 75 ^{0}C and at lowest ratio(ohms)	M.R.

6.2.2 36kV Class Current Transformers (for transformer bay)

1	No. of Cores	3
2	Ratio	1200-800/1/1/1[for 25/41MVA] 1600-800/1/1/1[for 50/75MVA]

3	Class of accuracy	- Protection : 5P20 - Metering : Class 0.2
4	Burden (VA)	30
5	Min. knee point voltage at lowest ratio (Volts)	>1kV@ max ratio for protection core <150V@ max ratio for metering core
6	Max. magnetizing current guaranteed at knee point voltage & the lowest ratio (mA)	M.R
7	Max. resistance of secondary winding at 75 ^{0}C and at lowest ratio (ohms)	M.R

6.3 145kV Class Current Transformers (for line bay)

1	No. of Cores	Total-4 (Metering-1 plus Protection-3)
2	Ratio	800-400/1/1/1 2000/1
3	Class of accuracy	- Protection : 5P20 - Metering : Class 0.2
4	Burden (VA)	30
5	Min. knee point voltage at lowest ratio (Volts)	>1kV@ max ratio for protection core <150V@ max ratio for metering core
6	Max. magnetizing current guaranteed at knee point voltage & the lowest ratio (mA)	M.R
7	Max. resistance of secondary winding at 75 ^{0}C and at lowest ratio (ohms)	M.R

6.4 145kV Class Current Transformers (for bus coupler bay)

1	Core No.	I	II
2	Ratio	2000/1	2000/1
3	Purpose	Protection	Measuring
4	Class of accuracy	5P20	0.5
5	Burden(VA)	30	30
6	Min. knee point voltage at lowest ratio(Volts)	>1kV@ max ratio for protection core	<150V@ max ratio for metering core
7	Max. magnetising current guaranteed at knee point voltage & the lowest ratio(mA)	M.R	M.R
8	Max. resistance of secondary winding at 75 ^{0}C and at lowest ratio (ohms)	M.R	M.R

6.5 145kV Class Voltage Transformer

1	Rated voltage levels	145 kV
2	High frequency capacitance for entire carrier frequency range	Within 80% to 150% of rated capacitance
3	Rated Voltage Factor	1.2 continuous; 1.5 for 30 seconds
4	Rated total capacitance(pF)	6600, +10% and -5%

5	Phase angle error (minutes)	20	
6	Acceptable limit of variation of total capacitance over the entire carrier frequency range	+ 50% and -20% of the rated capacitance	
7	Equivalent series resistance over the entire carrier frequency range or temperature range (ohms)	Less than 40	
8	Stray capacitance and stray conductance of low voltage terminal over the entire capacitance.	As per IEC	
9	Core details	Core-I :	Core-II
10	Purpose	Protection	Metering
11	Secondary Voltage	110/√3	110/√3
12	Burden (VA)	100	50
13	Class of accuracy	3P	0.2
14	Rated total thermal burden(VA)	150	150
15	One minute power frequency withstand voltage between LV terminal and earth(kV rms)	4(10 if the low voltage terminal is exposed)	
16	Withstand voltage for secondary winding (kV rms)	2	

6.6 36kV Class Voltage Transformer

1	Rated voltage levels	36 kV		
2	Rated Voltage Factor	1.2 continuous; 1.5 for 30 seconds		
3	Phase angle error (minutes)	20		
4	Core details		Core-I :	Core-II :
5	Purpose		Protection	Metering
6	Secondary Voltage		110/√3	110/√3
7	Burden (VA)		50	25
8	Class of accuracy		3P	0.2
9	One minute power frequency withstand voltage between LV terminal and earth(kV rms)	4(10 if the low voltage terminal is exposed)		
10	Withstand voltage for secondary winding (kV rms)	2		

7 Surge Arresters

1	Max. highest system voltage			145kV	36kV
2	Type	Outdoor type, ZnO, Gapless			
3	Standard	IEC 60099-4			
4	Rated voltage			120kV	30kV
5	Max. continuous operating voltage			102kVrms	
6	Nominal discharge current			10kA	10kA
7	Discharge class			Heavy duty 3	Heavy duty 3

8	Surge counter			Yes	Yes
9	Leakage current detector			Yes	Yes

APPENDIX- A2.1

SCHEDULE OF TECHNICAL REQUIREMENTS OF

132/33 kV POWER TRANSFORMER (25/41 MVA)

Sl. No.	**Description**		
	RATING AND PERFORMANCE		
1	Maximum continuous rating(MCR)	MVA	41
2	Number of Phases		3
3	Number of windings		2
4	Normal ratio of transformation at no load and at principle tap - HV/LV	kV	132/33
5.1	Corresponding highest system voltages	kV	145/36
5.2	Corresponding lowest system frequency	Hz	48
6	Minimum withstand voltages: - Full wave impulse withstand of windings of line terminal bushings - Induced over voltage - Power frequency withstand of neutral	 kVp kVp kV rms kV rms	 650/170 650/170 275/70 38
7	Type of cooling		ONAN/ONAF
8	Minimum continuous rating	MVA	25/41
9	Rating of tertiary windings	MVA	NA
10	Service conditions: - External cooling medium - Altitude not exceeding - Air temperature not exceeding Average air temperature in any one year not exceeding: - In any one day - Average in one year	 - m ^{0}C ^{0}C ^{0}C	 Air 150 45 45 35
11.1	Maximum temperature : - Top oil rise normal - Average ONAN winding rise - Average ONAF winding rise	 ^{0}C ^{0}C ^{0}C	 50 55 55
11.2	Maximum hot spot temperature at maximum continuous rating at yearly average ambient temperature	^{0}C	98
11.3	Winding hot spot temperature on emergency overload not exceeding	^{0}C	140
12	Phase connections: - HV winding - LV winding - TV winding - Vector group - HV/LV/TV		 Delta Star - DYN1
13	Short circuit withstand fault level (one sec) at terminals of: - 132 kV busbars	 kA kA	 31.5 25

	- 33 kV busbars		
14	Impedance voltage at 75ºC and MCR (41 MVA) between windings (% on HV Base) at Nominal tap at maximum tap at minimum tap	 % % %	 10 ~14 10 ~14 10 ~14
15	Not used		
16.1	Total range of variation of on load transformation ratio (on HV side) as sl. no. 4: - Ratio - Size of steps	 % %	 ±10 1.25
16.2	Type of control		On load local, remote and supervisory electrical and hand operation
17	Line drop compensation		Yes
18	Whether automatic control required and referenced voltage		Yes, 110V, 50Hz
19	Whether separate remote control panel required		Yes
20	DC supply: - Nominal - Maximum float voltage	 V V	 110 125
21	Whether provision for supervisory control required, including AVR setting		Yes
22	Whether marshalling kiosk required		Tank side Cubicle
23	Number of transformers for which automatic control is to be suitable		2 (and provision for future 3rd)
24	**TERMINATIONS** Bushing insulators or cable boxes on line and neutral terminals: i) HV line ii) Neutral iii) LV line		 Oil/Air Bushings Oil/Air Bushings Oil/Air Bushing
25	**BCT PARTICULARS** i) HV (132kV) Side Core 1 & 2		 300/1, Cl-5P20, 30VA
	Core 3		Ratio, burden and accuracy class shall be matched with WTI meter
	ii) LV (33 kV) Side (Core 1 & 2):		1200/1, Cl-5P20, 30VA
	Core 3		for WTI meter
	Core 4		for Tapchanger
	iii) Neutral Bushing (core 1 & 2):		1200/1, Cl-5P20, 30VA

26	Pollution category of bushing insulators		25 mm/kV of system rated (highest) voltage
27	**COOLING** i) Number of cooler banks required per transformer ii) Rating of each cooler bank as percentage of total loss at CMR iii) Standby cooling requirement	% 	i)To suit transformer design ii)100% iii)One fan in each group
	GENERAL		
28	Type of oil preservation system		Air Cell
29	Maximum acceptable noise level		78 dBA

APPENDIX- A2.2

SCHEDULE OF TECHNICAL REQUIREMENTS OF

132/33 kV POWER TRANSFORMER (50/75MVA)

Sl. No.	**Description**		
	RATING AND PERFORMANCE		
1	Maximum continuous rating (MCR)	MVA	75
2	Number of Phases		3
3	Number of windings		2
4	Normal ratio of transformation at no load and at principle tap - HV/LV	kV	132/33
5.1	Corresponding highest system voltages	kV	145/36
5.2	Corresponding lowest system frequency	Hz	48
6	Minimum withstand voltages: - Full wave impulse withstand of windings of line terminal bushings - Induced over voltage - Power frequency withstand of neutral	 kVp kVp kV rms kV rms	 650/170 650/170 275/70 38
7	Type of cooling		ONAN/ONAF
8	Minimum continuous rating	MVA	50/75
9	Rating of tertiary windings	MVA	NA
10	Service conditions: - External cooling medium - Altitude not exceeding - Air temperature not exceeding Average air temperature in any one year not exceeding: - In any one day - Average in one year	 - m ^{0}C ^{0}C ^{0}C	 Air 150 45 45 35
11.1	Maximum temperature : - Top oil rise normal - Average ONAN winding rise - Average ONAF winding rise	 ^{0}C ^{0}C ^{0}C	 50 55 55

11.2	Maximum hot spot temperature at maximum continuous rating at yearly average ambient temperature	^{0}C	98
11.3	Winding hot spot temperature on emergency overload not exceeding	^{0}C	140
12	Phase connections: - HV winding - LV winding - TV winding - Vector group - HV/LV/TV		 Delta Star - DYN1
13	Short circuit withstand fault level (one sec.)at terminals of: - 132 kV busbars - 33 kV busbars	 kA kA	 31.5 25
14	Impedance voltage at 75ºC and MCR (75 MVA) between windings (% on HV Base) at Nominal tap at maximum tap at minimum tap	 % % %	 10 ~14 10 ~14 10 ~14
15	Not used		
16.1	Total range of variation of on load transformation ratio (on HV side) as sl. no. 4: - Ratio - Size of steps	 % %	 ±10 1.25
16.2	Type of control		On load local, remote and supervisory electrical and hand operation
17	Line drop compensation		Yes
18	Whether automatic control required and referenced voltage		Yes, 110V, 50Hz
19	Whether separate remote control panel required		Yes
20	DC supply: - Nominal - Maximum float voltage	 V V	 110 125
21	Whether provision for supervisory control required, including AVR setting		Yes
22	Whether marshalling kiosk required		Tank side Cubicle
23	Number of transformers for which automatic control is to be suitable		2 (and provision for future 3rd)
24	**TERMINATIONS** Bushing insulators or cable boxes on line and neutral terminals: i) HV line ii) Neutral iii) LV line		 Oil/Air Bushings Oil/Air Bushings Oil/Air Bushing
25	**BCT PARTICULARS** i) HV (132kV) Side Core 1 & 2		 400/1, Cl-5P20, 30VA

	Core 3		Ratio, burden and accuracy class shall be matched with WTI meter
	ii) LV (33 kV) Side (Core 1 & 2):		1600-800/1, Cl-5P20, 30VA
	Core 3		for WTI meter
	Core 4		for Tapchanger
	iii) Neutral Bushing (core 1 & 2):		1600-800/1, Cl-5P20, 30VA
26	Pollution category of bushing insulators		25 mm/kV of system rated (highest) voltage
27	**COOLING** i) Number of cooler banks required per transformer ii) Rating of each cooler bank as percentage of total loss at CMR iii) Standby cooling requirement	% %	i)To suit transformer design ii)100% iii)One fan in each group
	GENERAL		
28	Type of oil preservation system		Air Cell
29	Maximum acceptable noise level		78 dBA

APPENDIX- A3

SCHEDULE OF TECHNICAL REQUIREMENTS OF 33/0.415 kV AUXILIARY (STATION SERVICE) TRANSFORMER

SL. No.	Description		
	AUXILIARY TRANSFORMER		
1.	Nominal rating	kVA	200
2.	Number of phase		3
3.	Frequency	Hz	50
4.	No-load voltage ratio	kV	33/0.415
5.	Corresponding highest system voltage	kV	36/1.1
6.	Type of cooling		ONAN
7.	Coolant		Mineral Oil
8.	Type		Core, Conservator Type
9.	Installation		Outdoor, Tropical and high rainfall and humidity
10.	Earthing		Neutral solidly earthed in interconnected star winding Neutral earthed in LT 3 phase, 4 wire system
11.	Windings		Double wound of high conductivity copper
12.	Test voltage		
	Impulse test voltage (1.2/50 μs)	kV	170/10 (HT/LT)
	Power frequency withstand voltage for 1 min	kV	70/2.5 (HT/LT)
13.	Vector group		dyn11
14.	Neutral to be brought out		HT: no, LT: Yes
15.	Neutral insulation		Full insulation and 100% loading capacity
16.	LT bushing		4 nos.

17.	Impedance voltage	%	4-5
18.	Tapping range		Off load tap changer ±5% in the step of 2.5
19.	Tap changer control		Manual

APPENDIX- A4

SCHEDULE OF TECHNICAL REQUIREMENTS OF

APPENDIX A4

NI-CAD BATTERY

SL. No.	**Description**	
1.	Installation	: Indoor
2.	Cell type	: Ni-cd
3.	Voltage (Normal)	: 1.2 volts per cell
4.	Float voltage	: 1.40-1.42 volt/cell
5.	Equalizing voltage	: 1.55 - 1.65 volt/cell
6.	Capacity in AH at 20°C	: 250 AH @ 5 Hr (for 110 V DC) : 150 AH @ 5 Hr (for 48 V DC)
7.	Ambient temperature	: 45°C
8.	Positive plate	: Tubular
9.	Negative plate	: Pasted
10.	Type of container	: Plastic polymer
11.	Discharge voltage	: 1.0 V/Cell
12.	Sp. gravity of electrolyte	: 1.19 ± 1%
13.	Sp. gravity of electrolyte (Charged)	: 1.23 ± .010 at 20°C
14.	Vent plug	: Anti-corrosive & fire proof
15.	Cell condition	: Pre-charged.
16.	Battery stand	: Steel frame of step type
17.	Standard	: IEC or equivalent

APPENDIX- A5

SCHEDULE OF TECHNICAL REQUIREMENTS OF

110 V BATERY CHARGER

SL. No.	**Description**	
	A) GENERAL	
1.	Installation	: Indoor
2.	Rectifier type	: Thyristor controlled.
3.	Rated D.C. voltage	: 110V ±5%
4.	Rated output current	: 75 Amps
5.	Charging mode	: Both constant current & constant voltage
6.	High Voltage Insulation	: 1000 V AC for 1 minute between input to output and input to ground
7.	Insulation resistance	: 10 MΩ with 500 V DC for 1 minute
8.	Cooling system	: Self & natural air cooled.

9.	Relative humidity	: Up to 98%
10.	Ambient temperature	: 45°C (max.)
11.	Noise level	: 65 dB (max)
12.	Altitude	: 1000 m
13.	Applicable Standard	: IEC or equivalent.

B) TECHNICAL DATA

A.C. INPUT

1.	Voltage	: 415 Volts
2.	Phase	: 3 Phase
3.	Frequency	: 50 ± 5% Hz
4.	Input AC voltage variation	: ± 5%
5.	Power factor (Full range)	: 0.8
6.	Efficiency (Full load)	: 85%
7.	Charge Characteristics (During float charge)	: Constant current /Constant voltage
8.	Current limitation	: 110%

D.C. OUTPUT

1.	Voltage	: 110 ± 5% volt
2.	Ripple Voltage (Full load)	: ± 3%
3.	Charge modes (3 level)	: Charge, Float charge & Boost charge
4.	Float Voltage (adjustable)	: 1.42 volt/cell
5.	Boost Voltage (adjustable)	: 1.53 volt/cell

APPENDIX- A6

SCHEDULE OF TECHNICAL REQUIREMENTS OF

48 V BATERY CHARGERS

SL. No.	**Description**	

A) GENERAL

1.	Installation	: Indoor
2.	Rectifier type	: Thyristor controlled.
3.	Rated D.C. voltage	: 48 V ± 5%
4.	Rated output current	: 50 Amps
5.	Charging mode	: Both constant current & constant voltage
6.	High Voltage Insulation	: 1000 V AC for 1 minute between input to output and input to ground
7.	Insulation resistance	: 10 MΩ with 500V DC for 1 minute
8.	Cooling system	: Self & natural air cooled.
9.	Relative humidity	: Up to 98%
10.	Ambient temperature	: 45°C (max.)
11.	Noise level	: 65 dB (max)
12.	Altitude	: 1000 m
13.	Applicable Standard	: IEC or equivalent.

B) TECHNICAL DATA

A.C. INPUT

1.	Voltage	: 415 Volts
2.	Phase	: 3 Phase
3.	Frequency	: 50 ± 5% Hz
4.	Input AC voltage variation	: ± 5%
5.	Power factor (Full range)	: 0.8
6.	Efficiency (Full load)	: 85%
7.	Charge Characteristics (During float charge)	: Constant current /Constant voltage
8.	Current limitation	: 110%

D.C. OUTPUT

1.	Voltage	: 48 ± 5% volt
2.	Ripple Voltage (Full load)	: ± 3%
3.	Charge modes (3 level)	: Charge, Float charge & Boost charge.
4.	Float Voltage (adjustable)	: 1.42 volt/cell
5.	Boost Voltage (adjustable)	: 1.53 volt/cell

APPENDIX- A7

SCHEDULE OF TECHNICAL REQUIREMENTS OF

SUBSTATION AUTOMATION SYSTEM

1. General Requirement:		
	Standards to be complied with Substation Automation system	
	Test Ca. Damp heat steady state	IEC 60068-2-3
	Test Db and guidance; Damp heat cyclic	IEC 60068-2-30
	Digital I/O, Analogue I/O dielectric Tests	IEC 60870-3 class 2
	Digital I/O, Surge withstand test	IEC 60801-5/Class 2
	Radio interference test	IEC 60870-3/Calss 2
	Transient fast burst test	IEC 60801-4/4
	Static Discharge	IEC 60801-2/4
	Electromagnetic fields	IEC 60801-3-3
	Temperature range (min/max)	℃ 0/50
	Relative humidity	% 93
	Intelligent Electronic Devices (IED's)	
	- serial communication interface included?	Yes
	- Protection & Control IED's connected same bus?	Yes
	- self monitoring	Yes
	- display of measured values	Yes
	- remote parameterization	Yes
	- disturbance record upload and analysis	Yes
	Availability Calculation shall be furnished for each equipments as well as for the entire system	Yes
	The main part of the system, HMI, Gateway,IED shall be furnished with dual communication port against any failure.	Yes

	SNTP server shall provide GPS time-sync information to all communication (HMI, Gateway, IED) and the system shall be synchronized.	Yes
	Ethernet switch shall have dual system topology not to lose entire system with single swithing system failure.	Yes
2. Detailed Requirements:		
	Number of years of proven field experience of offered system. (Note: proof of experience should be furnished. The components used in the offered system and those with field experience should be the same) Design life of substation Automation System Manufacturers quality assurance system Dimensions of cubicle - Width - Depth - Height - Floor load	5 Yrs. 20 Yrs ISO 9001/9002 or equivalent mm mm mm N/m2 max.600
3. Station Level Equipment:		
	Station Controller MTBF (Mean time between Failures) MTTR (Mean time to repair)	Industrial PC Hrs Hrs
	Station computer shall have dual connection to Ethernet switch as redundant (hot, standby) Hot standby take over time Dual Wide Monitor each HMI (over 25") Single wide screen Annunciator for Station PC system software Number of years of proven field experience of offered software	Yes Seconds Yes Yes 16 Windows 5 Yrs
	Operating System All standard picture as per spec included in HMI Process Status Display & Command Procedures Event processing as per spec Alarm processing as per spec Reports as per spec Trend Display as per spec Graphical fault information receiving function Disturbance & Fault recording and analysis with graphical format User Authority levels as per spec System supervision & monitoring as per spec Automatic sequence control as per spec	Windows Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes
4. Gateway to National Load dispatch Center		
	Number of years of proven filed experience of offered unit	5Yrs

	Insulation tests	IEC 60255-5
	Fast disturbance tests	IEC 61000-4-4,Calss 4
	Industrial environment	EN 50081-2 Class A
	Industrial grade hardware with no moving parts (PC based gateway is not accepted)	Yes
	Design life of offered equipment	20 Yrs
	Redundant communication channel	Yes
	Redundant CPU	Yes
	Redundant DC/DC Supply	Yes
	MTBF (Mean time between Failures)	Hrs
	MTTR (Mean time to repair)	Hrs
	Gateway shall have dual connection to ethernet switch(hot and standby)	Yes
5. Station Bus:		
	Physical Meduim	Glass fibre optic
	Each communication devices shall have dual connection, hot and standby.	Yes
6. Interbay Bus		
	Physical Meduim	Glass fibre optic
7. Printer server		
	MTBF	Hrs
8. Event Printer		
	MTBF	Hrs
9. Hard Copy colour Printer		
	MTBF	Hrs
10. Master Clock – GPS (Global Positioning System) Receiver:		
	MTBF	Hrs
11. Bay control Unit		
	Number of years of proven field experience of offered unit	5 Yrs
	Separate Bay controller unit provided for each bay & feeder	Yes
	Type of bay controller offered HV/MV	HV
	Select Before Operate with Open Execute & Close Execute	Yes
	Single bit dependence	No
	Interlocking, bay & Station wide	Yes
	Synchrocheck function	
	- Maximum Voltage difference	Specify range
	- Maximum Frequency difference	Specify range
	- Maximum Phase difference	Specify range
	Double command blocking	Yes
	Independent settable parameter groups	4
	Local Display Unit	Yes
	Sequence of event recorder	
	- Events	256
	- Time resolution	1 ms
	Disturbance recording file transfer function	Yes

	Comtrade file generation function of Distrubance Recorder	Yes
	IED shall have dual connection to Ethernet switch (hot & standby)	Yes
	Comprehensive self-supervision	Yes
	Battery free backup of events and disturbance records	Yes
	Insulation tests	IEC 60255-5
	Fast disturbance tests	IEC 61000-4-4, Class 4
	MTBF	Hrs
	MTTR	Hrs
	Temperature range: IED's	
	- Operation	℃ -10 to +50
	- Transport and storage	℃ -10 to +50
	Relative humidity:	
	- Operating max./min	% 93
	- Transport and storage	% 93
12. Back up control mimic		
	Control functionality:	
	Control of breaker as well as all isolators/earthing switch	
	(Control functionality should not be affected if bay controller fails)	Yes
	Key-Locked	Yes
	Interlock override function	Yes
	Separate backup control mimic provided for each bay & feeder	Yes
13. System Performance:		
	Exchange of display (First reaction)	< 1 S
	Presentation of a binary change in the process display	< 0.5 S
	Presentation of an analogue change in the process display	< 1 S
	From order to process output	< 0.5 S
	From order to updated of display	< 1.5 S

APPENDIX- A8

SCHEDULE OF TECHNICAL REQUIREMENTS OF

FIBRE OPTIC MULTIPLEXER EQUIPMENT

SL.No.	DESCRIPTION	UNIT	REQUIRED
1.0	**GENERAL:**		
1.1	Type of multiplexer		SDH: ADM
1.2	Complying to ITU-T rec.		Yes
1.3	Transmission Capacity	Mbit/s	STM-1: 155
1.4	Access capacity on 64 kbit/s	channels	Minimum 200
1.5	Access capacity on 2 Mbit/s	channels	Minimum 40

1.6	Redundant central processor		Shall be available
1.7	Digital cross connect function		Fully non-blocking
2.0	**Available AGGREGATES:**		
2.1	Optical aggregates (ITU-T G.957)		L-1.1, L-1.2
3.0	**Available TRUNK INTERFACES:**		
3.1	HDB3, 2 Mbit/s interfaces per module	No.	Minimum 8
3.2	Complying to ITU-T rec.		G.703, transparent G.704, selectable
3.3	HDSL, 2Mbit/s interface: no of copper wires Capacity on 2Mbit/s or on 1Mbit/s Capacity selectable	No. ch ch / pair of wire	4 or 2 30 or 15 30 / 2 pairs 30 / 1 pair 15 / 1 pair
4.0	**Available USER INTERFACES**		
4.1	**Voice interfaces for trunk lines:**		
4.1.1	1 + 1 com path protection, available for all		yes
4.1.2	Analogue, 4wire with E&M: Input level Output level	dBr	+7.5 .. –16 +7.0 .. –16.5
4.1.3	Analogue, 2wire with E&M: Input level Output level	dBr	+6.5 .. –12.5 –1.0 .. -20
4.1.4	Digital, 2Mbit/s CAS or PRI		yes
4.2	**Voice interfaces for remote subscriber:**		
4.2.1	2wire, subscriber side	dBr	-5 .. +4 / -7.5 .. -1
4.2.2	2wire, PABX side	dBr	-5 .. +4 / -7.5 .. -3
4.3	**Integrated teleprotection**		
4.3.1	**Interface for Commands:**		
4.3.1.1	Number of independent commands	No.	4
4.3.1.2	Transmission time max.	ms	6
4.3.1.3	Signal voltage	Vpeak	250
4.3.1.4	1 + 1 com path protection		yes
4.3.2	**Interface(s) for Differential Protection:**		
4.3.2.1	Electrical interface: G.703	kbit/s	64
4.3.2.2	Optical Interface	kbit/s	Minimum 64
4.4	**Data: channels per module**		
4.4.1	1 + 1 com path protection, available for all		yes
4.4.2	V.24/V.28 (RS-232): up to 38.4kbit/s	No.	4
4.4.3	V.11/X.24 (RS-422): 64kbit/s	No.	4
4.4.4	V.35: 64kbit/s	No.	4
4.4.5	V.36 (RS-449): 64kbit/s	No.	2
4.4.6	G.703: 64kbit/s	No.	8
4.4.7	Ethernet: 10/100 BaseT WAN capacity Protocols	No. Mbit/s	1 Min: 2x 2Mbit/s Min.: IP
4.5	**Integrated alarm gathering module:**		
4.5.1	Number of external alarms per module	No.	Min. 20
4.5.2	Auxiliary power supply for ext. contacts		Yes
4.6	**Network Management System**		
4.6.1	Type/Name of configuration tool		
4.6.2	For fault / configuration management		Yes / yes
4.6.3	For local / remote operation		Yes / yes
4.6.4	Data communication network (DCN)		Ethernet / IP or Ethernit / OSI
4.7	**Ambient Conditions:**		
4.7.1	Storage: ETS 300 019-1-1, class 1.2	°C / % hum	-25 .. + 55 / class 1.2
4.7.2	Transport: ETS 300 019-1-2, class 2.2	°C / % hum	-25 .. + 70 / class 2.2

4.7.3	Operation: ETS 300 019-1-3, class 3.1E	°C / % hum	-5 .. +45 / class 3.1E
4.8	**Power Supply**		
4.8.1	Operation	VDC	48 / 60 (-15/+20%)
4.8.2	Fully redundant power supply		yes

APPENDIX- A9

SCHEDULE OF TECHNICAL REQUIREMENTS OF

OPERATIONAL TELEPHONE SYSTEM (PABX)

SL.No.	DESCRIPTION	UNIT	REQUIRED
1.0	**GENERAL:**		
1.1	Type		IP PABX
1.2	Complying to ITU-T rec.		Yes
1.3	Analogue Trunk Connectivity		Yes
1.4	Digital Trunk Connectivity(E1/T1)		Yes
1.5	10/100 BaseT Ethernet Connection		Yes
1.6	No of Subscribers	No.	Up to 32
2.0	**Trunk Connectivity**		
2.1	Analogue Trunk		
2.1.1	- Loop Start/Ground Start(Via peripheral)		Yes
2.1.2	- E&M		Yes
2.1.3	- DID(Direct Inward Dial)		Yes
2.2	Digital Trunk		
2.2.1	- T1		Yes
2.2.2	- E1		Yes
2.2.3	- ISDN Connectivity using BRI/PRI		Yes
2.3	IP Trunk		
2.3.1	- 10/100 Mbps Ethernet(IEEE 802.3)		Yes
2.3.2	- TCP/IP, H.323, T.38(Switching)		Yes
2.3.3	- Voice Compressor : G.711, G729		Yes
2.3.4	- QoS(Quality of Signal) : 802.1		Yes
2.3.5	- SIP(Session Initiation Protocol): RFC 3261		Yes
3.0	**Main Features**		
3.1	- Ring Back		Yes
3.2	- Call Forwarding, park, waiting, pick-up		Yes
3.3	- Call/Message waiting lamp		Yes
3.4	- Hands Free operation		Yes
3.5	- Speed Calling, Stored number redial		Yes
3.6	- Account Code		Yes
3.7	- Automatic Attendant, Auto Answer		Yes
3.8	- Automatic Route Selection		Yes
3.9	- Call-by-call Service, Call Duration Display		Yes
3.10	- Call Transfer, Direct Outward Dialing		Yes
3.11	- Hunt Group, Music on Hold		Yes
3.12	- Night Service, Off-hook Alarm, Redial		Yes
4.0	**Network Management System**		
4.1	Type/Name of configuration tool		
4.2	For fault / configuration management		Yes / yes
4.3	For local / remote operation		Yes / yes
4.4	Data communication network (DCN)		Ethernet / IP or Ethernet / OSI
5.0	**Ambient Conditions:**		

5.1	Storage: ETS 300 019-1-1, class 1.2	°C / % hum	-25 .. + 55 / class 1.2
5.2	Transport: ETS 300 019-1-2, class 2.2	°C / % hum	-25 .. + 70 / class 2.2
5.3	Operation: ETS 300 019-1-3, class 3.1E	°C / % hum	-5 .. +45 / class 3.1E

APPENDIX- A10.1

SCHEDULE OF TECHNICAL REQUIREMENTS OF

INSULATOR

1	Rated Voltage	145kV	36kV
2	Lightning impulse withstand positive and negative (kVp) (Dry and wet)	650	170
3	Switching impulse withstand voltage (kVp)	-	-
4	One min. power freq. withstand voltage (kVrms) (Wet and Dry)	275	70
5	Total creepage distance (mm) pedestal	3625	
6	Total min. cantilever strength (kg)	800	
7	Corona extinction voltage (kVrms)		
8	Total min. height of insulator (mm)	2500	

APPENDIX- A 10.2

SCHEDULE OF TECHNICAL REQUIREMENTS OF

INSULATOR STRING

1	Rated voltage	145kV
2	Type	Anti FOG
3	Size of insulators units (mm)	255 x 145
4	Creepage distance of individual insulator unit (Minimum or as required to obtain total creepage distance, mm)	430
5	Electromechanical strength (kN)	120
6	Power frequency withstand voltage of the complete string (kVrms)	275
7	Lightning impulse withstand voltage of the complete string with C.C. ring (Dry and wet, kVp)	650
8	Switching surge withstand voltage of the complete string with C.C. rings(Dry & wet, kVp)	-
9	Power frequency puncture withstand voltage for a string insulator unit	1.3 times the actual wet flashover voltage of the unit.
10	Minimum corona extinction voltage level of the complete string with C.C. ring (Dry, kVrms)	
11	R.I.V. Level of the complete string with C.C. ring. (micro V)	500
12	Total creepage distance of complete insulator string (mm)	3625

APPENDIX- A 11

SCHEDULE OF TECHNICAL REQUIREMENTS OF

33kV XLPE POWER CABLE

1	Rated voltage	36kV
2	Nominal system voltage	33kV
3	Rated frequency	50Hz
4	No. of core per cable	1
5	Conductor	Copper 99.9% (stranded; compact round)
6	Conductor Cross sectional area	i) 500 mm^2 ii)185 mm^2
7	Power frequency withstand voltage (kVrms)	70
8	Lightning impulse withstand voltage (kVp)	170
9	Insulation	XLPE
10	Min. bending radius	15D
11	DC resistance at 20 ^oC	0.0366 ohm/km
12	Short circuit rating for 1 sec	25kA
13	Three phase symmetrical fault	70 kA