

CEYLON ELECTRICITY BOARD SRI LANKA

MANNAR NADUKUDA EMBILIPITIYA GRID SUBSTATIONS **AUGMENTATION PROJECT**

(Funds: Savings from ADB Loan Nos.3585-SRI and 3147-SRI)

GRID SUBSTATIONS

Procurement of Plant

Design, Supply, and Installation

Single-Stage: Two-Envelope Bidding Procedure

> **BIDDING DOCUMENT** FOR

> > -,C

Augmentation of:

Mannar 220/33 kV Grid Substation Nadukuda 220/33 kV Grid Substation

Embilipitiya 132/33 kV Grid Substation

VOLUME 4 of 8

Part II- REQUIREMENTS

Section 6 - Employer's Requirements: Part A-Scope of Works

Issued on: 02 Sep 2021 Invitation for Bids No.: CEB/AGM/PRO/2021/IFB/MNEGSAP OCB No.: CEB/AGM/PRO/2021/OCB/MNEGSAP **Employer: Ceylon Electricity Board** Country: Sri Lanka

Projects Division Ceylon Electricity Board, P.O. Box 540, Colombo 02 Sri Lanka **Document – Revision 1**

© Transmission Design & Environment Branch, CEB

6A-2

whormation copy Not for Bidding

Preface

This Bidding Document for Procurement of Plant – Design, Supply, and Installation, has been prepared by Ceylon Electricity Board and is based on the Standard Bidding Document for Procurement of Plant – Design, Supply, and Installation (SBD Plant) issued by the Asian Development Bank dated June 2018.

ADB's SBD Plant has the structure and the provisions of the Master Procurement Document entitled "Procurement of Plant – Design, Supply, and Installation", prepared by multilateral development banks and other public international financial institutions except where ADB-specific considerations have required a change.

Savings of ADB Loan No. 3585-SRI is used for the Augmentation of Mannar Grid Substation and Nadukuda Grid Substation. Savings of ADB Loan No. 3147-SRI is used for the Augmentation of the Embilipitiya Grid Substation. In order to make the payment for the augmentation of Mannar Grid Substation and Nadukuda Grid Substation by ADB Loan No. 3585-SRI and augmentation of Embilipitiya Grid Substation by ADB Loan No. 3147-SRI, this procurement is separated into two lots as follows.

- Lot A Augmentation of Mannar 220/33kV Grid Substation and Nadukuda 220/33kV Grid Substation
- Lot B Augmentation of Embilipitiya 132/33KV Grid Substation

Separation of this procurement into two lots is only for the above mentioned purpose. It is mandatory for all Bidders to bid for both lots (Lot A and Lot B). Preparation of Bidding Document, evaluation, awarding etc. is carried out accordingly and a single contract that includes both lots will be signed with the successful Bidder.

Single-Stage: Two-Envelope

6A-4

whormation copy Not for Bidding

Table of Contents - Summary Description

VOLUME 1 OF 8

PART I BIDDING PROCEDURES

Section 1 - Instructions to Bidders (ITB) ------.---- 1-1 This Section specifies the procedures to be followed by Bidders in the preparation and submission of their Bids. Information is also provided on the submission, opening, and evaluation of bids and on the award of contract. Section 2 - Bid Data Sheet (BDS) ----------- 2-1 This Section consists of provisions that are specific to each procurement and supplement the information or requirements included in Section 1 - Instructions to Bidders. Section 3 - Evaluation and Qualification Criteria (EQC) --------- 3-1 This Section contains the bid evaluation criteria to determine the lowest evaluated bid and lists the necessary qualifications of Bidders. VOLUME 2 OF 8 * for **BIDDING PROCEDURES** PARTI Section 4 - Bidding Forms (BDF) --4A-1 Part A-Price Bid This Section contains the forms which are to be completed by the Bidder and submitted as part of its Bid. **VOLUME 3 OF 8 PARTI** BIDDING PROCEDURI

	Section 4 - Bidding Forms (BDF)	4B-	1
	Part B-Technical Bid		
	This Section contains the forms which are to be completed by the Bidder and submitted as part of its		
	Bid.		
	Section 5 - Eligible Countries (ELC)	5-	1
	This Section contains the list of eligible countries.	-	
_			

VOLUME 4 OF 8

PART II REQUIREMENTS

Section 6 - Employer's Requirements (ERQ) ------ 6A-1 Part A-Scope of Works

VOLUME 5 OF 8

PART II REQUIREMENTS

Section 6 - Employer's Requirements (ERQ) ------ 6B-1 Part B-Technical Specification

VOLUME 6 OF 8

PART II REQUIREMENTS

Section 6 - Employer's Requirements (ERQ) ------ 6C-1 Part C-Drawings

VOLUME 7 OF 8

PART II REQUIREMENTS

 Section 6 - Employer's Requirements (ERQ)
 6D-1

 Part D-Supplementary Information
 6D-1

 Section 6 - Employer's Requirements (ERQ)
 6D-1

 Part E-Bank Guarantees and Certificates, Change Orders
 6D-1

VOLUME 8 OF 8

PART III CONDITIONS OF CONTRACT AND CONTRACT FORMS

Section 7 - General Conditions of Contract (GCC) ------ 7-1 This Section contains the general clauses to be applied in all contracts. These Conditions are subject to the variations and additions set out in Section 8 (Special Conditions of Contract).

Section 8 - Special Conditions of Contract (SCC) ------ **8-1** This Section contains provisions that are specific to each contract and that modify or supplement the GCC. Whenever there is a conflict, the provisions herein shall prevail over those in the GCC. The clause number of the SCC is the corresponding clause number of the GCC.

Section 9 - Contract Forms (COF) ------- **9-1** This Section contains forms, which, once completed, will form part of the Contract. The forms for Performance Security and Advance Payment Security, when required, shall only be completed by the successful Bidder after contract award.

Information

Hornation copy. Not for Bidding

Section 6 - Employer's Requirements Part A - Scope of Works

Single-Stage: Two-Envelope

Mornation Copy Not for Bidding

TABLE OF CONTENTS

Prefac	е		. 6A-3
LOT A			6A-12
1 SC	COPE	OF WORKS	6A-12
1.1	GEN	NERAL DESCRIPTION OF THE PROJECT	6A-12
1.1	1.1	AUGMENTATION OF MANNAR GRID SUBSTATION	6A-12
1.1	1.2	AUGMENTATION OF NADUKUDA GRID SUBSTATION	6A-13
1.1	1.3	SCOPE OF WORKS RELATED TO FEEDING END GRID SUBSTATIONS	.6A-13
1.1	1.4	TERMINAL POINTS	6A-14
1.1	1.5	SITE ENVIRONMENTAL CONDITIONS	.6A-16
1.1	1.6	ELECTRICITY, WATER, GAS AND OTHER SERVICES	6A-16
1.1	1.7	ADHERENCE TO THE ENVIRONMENTAL MITIGATION MEASURES	6A-16
1.2	PLA	ANT & EQUIPMENT INCLUDING MANDATORY SPARE PARTS(6A-17
1.2	2.1	MANNAR GRID SUBSTATION	6A-17
1.2	2.2	NADUKUDA GRID SUBSTATION	6A-31
1.3	CIVI	L WORKS, INSTALLATION, OTHER SERVICES AND TRAINING	6A-37
1.3	3.1	CIVIL WORKS	6A-37
1.3	3.2	INSTALLATION	6A-41
1.3	3.3	OTHER SERVICES	6A-41
1.3	3.4	TRAINING	6A-41
LOT B	3		6A-43
2. SC	COPE	OF WORKS	6A-43
2.1	GEN	NERAL DESCRIPTION OF THE PROJECT	6A-43
2.1	1.1	EMBILIPITIYA GRID SUBSTATION	.6A-43
2.1	1.2	SCOPE OF WORKS RELATED TO FEEDING END GRID SUBSTATIONS	.6A-44
2.1	1.3	TERMINAL POINTS	6A-45
2.1	1.4	SITE ENVIRONMENTAL CONDITIONS	.6A-46
2.1	1.5	ELECTRICITY, WATER, GAS AND OTHER SERVICES	6A-46
2.1	1.6	ADHERENCE TO THE ENVIRONMENTAL MITIGATION MEASURES	6A-46
2.2	PLA	NT & EQUIPMENT INCLUDING MANDATORY SPARE PARTS	6A-47
2.2	2.1	EMBILIPITIYA GRID SUBSTATION	.6A-47
2.3	CIVI	L WORKS, INSTALLATION, OTHER SERVICES AND TRAINING	6A-60
2.3	3.1	CIVIL WORKS	.6A-60
2.3	3.2	INSTALLATION	6A-63

2.3.3	OTHER SERVICES	6A-63
2.3.4	TRAINING	6A-63
Annex A		
Annex B		
Annex C		

Annex D

Annex E

thormation copy not for Bidding

LOT A

AUGMENTATION OF MANNAR 220/33 kV GRID SUBSTATION AUGMENTATION OF NADUKUDA 220/33 kV GRID SUBSTATION

Hornation copy Not for Bidding

LOT A

1 SCOPE OF WORKS

1.1 GENERAL DESCRIPTION OF THE PROJECT

1.1.1 AUGMENTATION OF MANNAR GRID SUBSTATION

Augmentation of Mannar Grid Substation shall consist of following main features.

- 1. 245kV outdoor air insulated switchgear with extension to the existing double busbar arrangement comprising of 02 Nos. 245kV Transformer bays.
- 2. 02 Nos. 220/33 kV, 63MVA Power Transformers.
- 3. 02 Nos. 33kV, 800A Earthing Transformers.
- 4. 01 No. 33/0.4kV, 160kVA Auxiliary Transformers.
- 5. Extension to the 36kV indoor SF6 gas insulated switchgear with single busbar arrangement comprising of
 - 02 Nos. 36kV Transformer bays
 - 12 Nos. 36kV Generator feeder bays
 - 01 No. 36kV Bus Section bay
 - 01 No. 36kV Bus Section bay/ interfacing panel
- 6. 12 Nos. of 36kV Outdoor line gantries including 36kV cable terminations.
- 7. Additions / modifications on Control, Metering, Monitoring and Protection equipment.
- 8. Additions / modifications on Batteries and DC equipment, LVAC, Chargers and Inverter equipment etc.
- 9. Additions / modifications on SCADA & Communication equipment
- 10. Additions (Modification of Substation Automation System.
- 11. Additions / modifications of Energy Metering System.
- 12. Modifications to the Digital Disturbance Recorder.
- 13. Power and Control cables including terminations.
- 14. Additions / modifications on Substation grounding system and shield earth wire system.
- 15. Electrical, Civil and Mechanical works required for substation and control building.
- 16. Spare parts.

1.1.2 AUGMENTATION OF NADUKUDA GRID SUBSTATION

The augmentation of Nadukuda Grid Substation shall consist of following main features.

- 1. 01 No. 220/33 kV, 63MVA Power Transformer.
- 2. 01 No. 33kV, 800A, 30s Earthing Transformer
- 3. Additions / modifications to Control, Metering, Monitoring and Protection equipment.
- 4. Additions / modifications on LVAC and DC distribution boards etc.
- 5. Additions / modifications on SCADA & Communication equipment.
- 6. Additions / Modification of Substation Automation System.
- 7. Power and Control cables including joints and terminations.
- Extension and modifications on substation grounding system and shield earth 8. wire system.
- for substation and control Electrical, Civil and Mechanical works required 9. building.
- 10. Spare parts.

1.1.3 SCOPE OF WORKS RELATED TO FEEDING END GRID SUBSTATIONS ration cop

Not Applicable

A. Mannar 220/33kV Grid Substation

The following shall be the contract terminal points:-

(a) 245kV Outdoor Busbar interface

The existing 245kV busbar shall be extended to connect the new transformer bays. This contract includes the connections and connectors from the existing 245kV busbar to new 245kV busbar.

(b) 36kV Overhead Line/ Switchgear interfaces

36kV overhead distribution lines terminate at the line bay gantries erect under this contract. This includes the connections and connectors from 36kV outdoor terminations to the 36kV line down droppers, which terminate at the line bay gantries.

(c) 36kV Indoor Switchgear

The existing 36kV indoor gas insulated switchgear shall be extended to connect the new 36kV transformer bays and 36kV generator bays including bus section bay/interfacing panel between the existing and new indoor switchgear panels. 36kV cables and terminations shall be provided under this contract.

(d) Control and Protection interface

This contract includes the modifications to the existing control and protection system with the addition of 220kV bus extension and two nos. of 220/33 kV power transformers including extension to the existing busbar protection scheme.

(e) Substation Automation System (SAS) interface

Proposed 220kV and 33kV system protection and control IEDs shall be covered under this project. Connecting IEDs to network and field signal testing associated with commissioning shall be carried out by the contractor. Integration of new IEDs into existing Substation Automation System will be carried out by SAS unit of CEB.

(f) Communication interface

This Contract includes the modifications to the existing communication system up to the interface panel or RTU as per detailed scope of work to include the new bays.

B. Nadukuda 220/33kV Grid Substation

The following shall be the contract terminal points:-

(a) 245kV switchgear Interface

245kV GIS feeder bay is available to connect the fourth transformer. Connection of new 220/33 kV power transformer to the existing 245 kV GIS

with 245 kV underground power cable with terminations are included to this contract.

(b) 36kV switchgear interface

36kV GIS feeder bay is available to connect the fourth transformer. Connection of new 220/33 kV power transformer to the existing 36 kV GIS with 36 kV underground power cable with terminations are included to this contract.

(c) Control and Protection interface

Bay protection for transformer 245kV and 36kV is available with the 245kV and 36kV GIS. Transformer Voltage Regulation controls shall be provide under this contract. Commissioning of the existing protection schemes of the transformer bay is also included in this contract.

(d) Transformer AVR interface

This contract includes the supply, installation and commissioning of a new AVR for new transformer with both minimum circulating current method and master follower method for parallel operation with existing 220/33 kV transformers. AVR shall be capable for correct operation of the voltage regulation described in the Chapter 10 of the specification.

(e) Substation Automation System (SAS) interface

Proposed 220kV and 33kV system protection and control IEDs shall be covered under this project. Connecting IEDs to network and field signal testing associated with commissioning shall be carried out by the contractor. Integration of new IEDs into existing Substation Automation System will be carried out by SAS unit of CEB.

mormation

1.1.5 SITE ENVIRONMENTAL CONDITIONS

Mannar and Nadukuda

Altitude of site above sea level not exceeding	m	100
Maximum ambient air temperature	D_0	38.5
Minimum ambient air temperature	O	15.5
Average yearly temperature	D_0	30
Relative humidity (24 hours)	%	81
Average annual rainfall	mm	963
Winds	Maximum 1 to 3 second 145 km per hour. Mean sp per hour over 24 hours.	l gusts at beed 6 km
Storms	Frequency of thunderstor	ms high
Average isokeraunic level	60 days per annum	
Pollution Condition	Very heavy saline pollution	on
Pollution level for insulators and bushings (USCD)	53.7mm/kV	
Atmospheric Corrosivity Category	C5M	
(ISO12944-2)		

1.1.6 ELECTRICITY, WATER, GAS AND OTHER SERVICES

The Contractor shall at his expense, provide all electricity, water, gas and other services necessary to execute and complete the Works on site. Prevailing tariff and service connection procedure shall be applicable.

1.1.7 ADHERENCE TOTHE ENVIRONMENTAL MITIGATION MEASURES

Bidders are requested to comply with the requirements stated in the Chapter 1, Clause 1.7 of Section 6 Part B-Technical Specifications.

1.2 PLANT & EQUIPMENT INCLUDING MANDATORY SPARE PARTS

1.2.1 MANNAR GRID SUBSTATION

1.2.1.1 OUTDOOR SWITCHGEAR

Insulators of all outdoor 245kV switchgears and insulator strings shall be RTV silicone coated.

1.2.1.1.1 Extension to the existing 245kV double busbar system comprising:-

1 Set - 3000A, 245kV, 40kA three phase tubular double busbar with post insulators.

(The existing double busbar system shall be extended as per the drawing no.

TD/CE/1/201/D/00/01-A and TD/CE/1/201/D/01/01-A)

1.2.1.1.2 02 Nos. of 245kV Transformer bays each comprising:-

- 2 Nos. 1250A, 245kV, 40kA three phase busbar disconnector with hand and motor operating mechanism.
- 1 No. 1250A, 245kV, 40kA three phase circuit breaker complete with operating mechanism etc.
- 3 Nos. 245kV, 40kA Current Transformers with cores as follows:-Class 5P20, ratio 400/200/1A for Main 1 protection and control IED Class 5P20, ratio 400/200/1A for Main 2 protection and control IED Class 0.2, ratio 400/200/1A

Class 5P20, ratio 3000/1A for bus bar and breaker failure protection.

- 3 Nos. 192ky 10kA Class 2 Surge arrestors with leakage current indicators and counters.
- 1No. CNeutral Current Transformer with core as follows:-

Class 5P20 ratio 400/1A for Main 1 protection and control IED

Class 5P20 ratio 400/1A for Main 2 protection and control IED

1 Lot - Set of connections, connectors, clamps, access ladders etc. including connections to transformer 220kV and neutral bushings.

1.2.1.1.3 02 Nos. of 36kV Transformer bays each comprising:-

- 3 Nos. 36kV, 10kA, Class 2 Pluggable Surge arresters with counters
- No. Neutral Current Transformer with cores as follows:-Class 5P20, ratio 800/1A for HV Main 1 protection and control IED, Class 5P20, ratio 800/1A for HV Main 2 protection and control IED and DDR.

1 Lot - Set of cable connection between indoor switchgear and power transformer including set of connections, connectors, clamps, structures, access ladders, cable sealing end or terminal arrangement suitable for incoming 36kV cables etc. to terminate the 36kV cable and connect to the transformer.

1.2.1.1.4 01 No. of 36kV Auxiliary transformer bay each comprising:-

- 1 Lot Set of cable connections between Power transformer and Auxiliary transformer including set of connections, connectors, clamps, structures, access ladders, cable sealing end or terminal arrangement suitable for incoming 36kV cables etc. to terminate the 36kV cable and connect to the transformer.
- 1 Lot Connections, connectors, clamps and access ladders etc. including connections to auxiliary transformer 36kV bushings
- 1 Lot Set of cable connection between indoor LVAC switchgear and LV cable box including set of connections, connectors, clamps, structures.

1.2.1.1.5 02 Nos. of 36kV Earthing transformer bays each comprising:-

- 1 Lot Set of cable connections between Power transformer and Earthing transformer including set of connections, connectors, clamps, structures, access ladders, cable sealing end or terminal arrangement suitable for incoming 36kV cables etc. to terminate the 36kV cable and connect to the transformer.
- 1 Lot Connections, connectors, clamps, and access ladders etc. including connections to earthing transformer 36kV bushings.
- 1 Lot Outdoor equipment including set of connections, connectors, clamps, structures, access ladders etc. to connect neutral current transformers.

1.2.1.1.6 12 Nos. of 36kV Generator Feeder bays each comprising:-

- 3 Nos. 36kV, 10kA, Class 2 Surge arresters with counters.
- 1 Lot Set of bay connections, connectors, and clamps, etc.
- 1 Lot Set of cable connection between indoor switchgear and outdoor equipment including set of connections, connectors, clamps, structures, access ladders, cable terminating structure, sealing end or terminal arrangement suitable for incoming 36kV cables etc. to terminate the 36kV cable and connected to the 36kV take-off structure.

Note: The current rating of generator feeders is 800A, and hence all connections, connectors and clamps shall be selected accordingly.

1.2.1.2 SF6 INSULATED INDOOR SWITCHGEAR

Panel design which allows removal of panel with lowest disturbance to adjacent panels is preferred.

1.2.1.2.1 02 Nos. 36kV Transformer bays each comprising:-

- 1 Set 2500A, 36kV, 25kA three phase busbars.
- 1 No 2500A, 36kV, 25kA, three phase busbar disconnector with earth switch and motor operating mechanism.
- 1 No 2500A, 36kV, 25kA, three phase circuit breaker complete with operating mechanism.
- 3 Nos. 36kV current transformers with cores as follows:

Class 5P20, ratio 2000/1A for HV Main 1 protection and control IED

Class 5P20, ratio 2000/1A for HV Main 2 protection and control IED, DDR, AVR and LV protection and control IED.

Class 0.2 ratio 2000/1 for metering.

3 Nos. - Single phase voltage transformers with cores:
 Class 3P ratio 33,000/√3V:110/√3V for HV Main 1 protection and control IED.

Class 3P ratio $33,000/3V:110/\sqrt{3V}$ for HV Main 2 protection and control IED, AVR, DDR and LV protection and control IED.

Class 0.2 ratio $33,000/\sqrt{3}$ V:110/ $\sqrt{3}$ V for Energy metering system.

- 1 Lot Cable terminating chamber, complete with cable box, sealing end or terminal arrangement including cable termination suitable for incoming 36kV cables.
- 1 Lot Complete set of miscellaneous items required for the safe and efficient operation of the switch gear, including cables, independently lockable shutters over busbar, cable and voltage transformer spouts (as appropriate), facility to enable busbar or cable to be earthed through circuit breakers, terminal boxes for multi-core cables, busbar end covers or link to adjacent switch panel as appropriate etc.

1.2.1.2.2 12 Nos. of 36kV Feeder bays for incoming generations each comprising:-

- 1 Set 36kV, 2500A, 25kA three phase busbars.
- 1 No. 1250A, 36kV, 25kA three phase busbar disconnector with earth switch and motor operating mechanism.

- 1 No. 1250A, 36kV, 25kA three phase circuit breaker complete with operating mechanism.
- 3 Nos. 36kV current transformers with cores as follows:

Class 5P20, 800/400/1A for directional over current, directional earth fault, over current and earth fault protection. Class 0.2, 800/400/1A for Energy metering system.

3 Nos. - Single phase voltage transformers, ratio 33,000/√3V:110/√3V:110/√3V Class 0.2 for energy metering of incoming generation and Class 3P for protection.

Note: These 36kV generator feeder bays require live-bus/dead-line detecting system.

- 1 Lot Cable terminating chamber, complete with cable box, sealing end or terminal arrangement including cable termination suitable for incoming 36kV cables.
- 1 Lot Complete set of miscellaneous items required for the safe and efficient operation of the switch gear, including cables, independently lockable shutters over busbar, cable and voltage transformer spouts (as appropriate), facility to enable busbar or cable to be earthed through circuit breakers, terminal boxes for multi-core cables, busbar end covers or link to adjacent switch panel as appropriate etc.

1.2.1.2.3 01 No. of 36kV Bus Section bay comprising:-

- 1 Set 36kV, 2500A, 25kA three phase busbars.
- 2 Nos. 2500A, 36kV, 25kA three phase disconnector with earth switch and motor operating mechanism.
- 1 No 2500A, 36kV, 25kA, three phase circuit breaker complete with operating mechanism.

3 Nos. 🔁 36

36kV Current transformers with core as follows:

Class 5P20, ratio 2500/1A for over current and earth fault protection and for metering with interposing current transformer.

6 Nos. - Single phase voltage transformers with cores as follows:

Class 3P ratio 33,000/ $\sqrt{3}$ V:110/ $\sqrt{3}$ V for for Protection and control IED Class 0.2 ratio 33,000/ $\sqrt{3}$ V:110/ $\sqrt{3}$ V for Energy metering system

1 Lot - Complete set of miscellaneous items required for the safe and efficient operation of the switch gear, including cables, independently lockable shutters over busbar, cable and voltage transformer spouts (as appropriate), facility to enable busbar or cable to be earthed through circuit breakers, terminal boxes for multi-core cables, busbar end covers or link to adjacent switch panel as appropriate etc.

1.2.1.2.4 Interconnection Arrangement and Bus Section bay between existing 36kV SF₆ insulated indoor switchgear and new 36kV SF₆ insulated indoor switchgear:-

The make of existing 36 kV GIS of Mannar 220/33 kV Grid Substation is LSIS South Korea and it is fed by existing 45 MVA transformer. In an event of a failure of the 45MVA transformer, the existing 36kV GIS needs to be fed from new 63 MVA transformers to be installed in Mannar GSS under this contract. Therefore the new 36 kV GIS procured under this contract shall be connected to existing 36 kV GIS by suitable interconnection arrangement with 36kV Bus section comprising with:-

- 1 Set 36kV, 2500A, 25kA three phase busbars.
- 2 Nos. 2500A, 36kV, 25kA three phase disconnector with earth switch and motor operating mechanism.
- 1 No 2500A, 36kV, 25kA, three phase circuit breaker complete with operating mechanism.
- 3 Nos. 36kV Current transformers with core as follows:

Class 5P20, ratio 2500/1A for over current and earth fault protection and for metering with interposing current transformer.

- 1 Lot Accessories required for interconnection arrangement between existing 36kV GIS and new 36kV GIS.
- 1 Lot Complete set of miscellaneous items required for the safe and efficient operation of the switch gear, including cables, independently lockable shutters over busbar, cable and voltage transformer spouts (as appropriate), facility to enable busbar or cable to be earthed through circuit breakers, terminal boxes for multi-core cables, busbar end covers or link to adjacent switch panel as appropriate etc.

Please refer the drawing no. TD/CE/1/201/D/00/01-A, TD/CE/1/201/D/00/01-C and TD/CE/1/201/D/60/01-B. The bidder shall submit the details of interconnection arrangement with the bid.

1.2.1.3 ADDITIONS / MODIFICATIONS TO THE EXISTING LVAC SWITCH BOARDS

The existing 400V switchboards shall be modified to add new auxiliary transformer and change over operation.

1.2.1.3.1 Additions / modifications to the existing 400V Distribution panel comprising:-

MCB for following distribution Circuits (Number of Phases and rating shall be according to the load required.)

Essential loads

Main transformer No. 2 OLTC & cooling fans

Main transformer No. 3 OLTC & cooling fans

Others as necessary

Panel No.1

Ry. Not for Bidding 245kV Switchgear Auxiliary Power

36kV Switchgear Auxiliary Power

Cubicle lighting & space heater

Others as necessary

Panel No.2

245kV Switchgear Auxiliary Power

36kV Switchgear Auxiliary Power

Others as necessary

1.2.1.4 ADDITIONS MODIFICATIONS TO THE DC DISTRIBUTION BOARDS

Addition of new DC distribution panel to the existing 220V DC system to accommodate the load of proposed augmentation works including modifications to the existing DC distribution board.

1.2.1.5 PROTECTION, METERING AND CONTROL

1.2.1.5.1 Additions / Modifications to the Substation Automation System:-

Following items shall be supplied as per the Clause: 5.24 of Chapter 5, Technical Specification - Grid Substation of bidding document and architecture drawing for SAS in Annexure 7.

Engineering Workstation (EWS) with two 27' Monitors 1 No. -

- 1 No Next Generation Firewall
- 4 Nos. Industrial type layer 2 Manageable Ethernet Switch and connections for two power transformer bays and two 33 kV bus sections.

CEB will carry out integration work of new control & protection IEDs to existing Substation Automation Systems at Mannar Grid Substation.

The connecting IEDs to network and field signal testing associated with commissioning shall be carried out by the contractor as per the Site Acceptance Tests and Commissioning section of Clause: 5.24 of Chapter 5, Technical Specification - Grid Substation of bidding document.

1.2.1.5.2 Additions / Modification to the existing Digital Disturbance Recorder System:-

1 Lot - Existing Digital Disturbance Recorder (DDR) shall be expanded to include the new bays with 40 Analog Channels and 40 Digital Channels as per clause 5.21 of Technical Specifications.

1.2.1.5.3 245 kV Protection & Control facilities:-

All the control metering and protection panels shall be complied with requirements of Chapter 5 of the Technical Specifications.

The trip circuit supervision scheme shall provide continuous supervision of all the trip coils and trip circuits with the circuit breaker in either the open or closed position for each 245kV bay as per clause 5.19.

1.2.1.5.3.1 For 02 Nos. of 245kV Transformer comprising with:-

Protection and control panel and Mechanical protection and control panel shall be provided as per clause 5.12 of Technical Specifications.

a) Protection and Control panel with IEDs

Protection and control panel with HV main 1 and main 2 IEDs with functions listed in 5.12.1 of Technical Specifications and other required accessories as per Chapter 5 of Technical Specifications shall be provided.

b) Mechanical Protection and Control Panel

Mechanical protection and control panel with relays, AVRs and accessories as per clause 5.12 of technical specifications shall be provided.

1.2.1.5.3.2 Extension to the 245kV Busbar protection and Bus Coupler bay protections and Control system comprising with:-

The 245kV new Transformer bays shall be integrated to the existing busbar and breaker failure protection scheme by providing all necessary relays, central unit interfacing modules, bay protection modules and software/ firmware upgrades if required. Protection/control and monitoring functions listed under clause 5.14 of Technical Specifications shall be included in respective IEDs.

1.2.1.5.4 36kV Protection & Control facilities:-

(Relays may be installed in 36kV switchgear compartment).

1.2.1.5.4.1 For 02 Nos. of 36kV Transformer bays each comprising with

IEDs shall be provided as per the requirements given in Chapter 5 of Technical Specification -Grid Substation for following functions.

Clause 5.12.2		 Directional and Non-directional Over current protection for LV side
		- Directional and Non-directional Residual
		Earth fault protection for LV side
		 BCU function for LV side
	-09×	 Synchronism Check function for the LV side
	\mathbf{O}	 Monitoring of Lockout relay
Clause 5.19	\sim	- Trip circuit supervision
Clause 5.9.5.2		- Synchrocheck & Synchronizing
Clause 5.8.1	nd clause 5.8.2	- Control IED'S on 36kV level
Operation cou	nter auto-trip for cir	cuit breaker.
Operation cou	nter hand-trip for ci	rcuit breaker.
1.2.1.5.4.2 For 02 No. of 36k	/ Bus Section bays	each comprising with:-
IEDs shall be Specification -	provided as per the Grid Substation for	requirements given in Chapter 5 of Technical following functions

Clause 5.16	- Bus Section Bay General requirements				
Clause 5.16.4	- General Requirements for 33kV Bus Section Protection including directional Over current & Earth fault.				
Clause 5.19	- Trip Circuit Supervision.				

Clause 5.8.1 and clause 5.8.2 - Control IED'S on 36kV level

Operation counter auto-trip for circuit breaker.

Operation counter hand-trip for circuit breaker.

1.2.1.5.4.3 For 12 Nos. of 36kV Generator feeder bays each comprising with:-

IEDs shall be provided as per the requirements given in Chapter 5 of Technical Specification -Grid Substation for following functions.

Clause 5.11.1	- General Requirements				
Clause 5.11.4	- Protection/Control Functions Required in 11kV/33kV Feeder Protection (All the clauses under this shall be complied for TCS BF protection etc.)				
Clause 5.11.5	- Trip Matrix				
Clause 5.11.6	- Interlocking				
Clause 5.19	- Trip Circuit Supervision.				
Clause 5.8.1 and clause 5.8.2 - Control IED'S on 36kV level					
Clause 5.8.5 - Synchro-check & Synchronizing					
Operation counter auto-trip for circuit-breaker.					

Operation counter hand-trip for circuit breaker.

1.2.1.5.4.4 Gas Pressure Monitoring System

Gas Pressure Monitoring System shall be provided.

Clause 2.2.1.8.(e) - Gas Monitoring Device

1.2.1.5.4.5 Station Alarm and Annunciation

Modification of existing input modules and annunciator shall be provided as per Clause 5.20 of the Technical Specification - Grid Substation.

1.2.1.5.5 Energy Metering panels comprising with:-

The existing energy metering system shall be modified to incorporate new energy metering panels as per the chapter 9 of the Technical Specification-Grid Substation. Two separate sets of 36kV energy meter panels named as Transco and Disco are required where each set includes Energy meters for Transformers and feeders.

Transco Energy Metering panel set:

Energy meters with modems as specified in chapter 9 of the Technical Specification-Grid Substation for Transformers and 36kV feeders.

Disco Energy Metering panel set:

Energy meters with modems as specified in chapter 9 of the Technical Specification-Grid Substation for Transformers and 36kV feeders.

Ethernet Network Switch:

Ethernet switches for each set of Transco and Disco panels as specified in chapter 9 of the Technical Specification-Grid Substation.

1.2.1.6 ADDITIONS / MODIFICATIONS TO THE EXISTING COMMUNICATION EQUIPMENT AND SCADA GATEWAYS/RTUS

1.2.1.6.1 Fiber Optic Multiplexer at Mannar Grid Substation

The existing Fiber Optic Multiplexer (FO615 by ABB) shall be extended with following interfaces.

- 1 No. Optical interface module of type SAMO5 with SFPs and patch cables for Nadukuda and New Anurafdhapura directions
- 2 Nos. Optical patch cables
- 2 Nos. Small Form-factor Pluggable (SFR) optical transceiver modules (with DDM support) of 1.25Gbit/s

The required extension modules shall be supplied as loose materials. The installation and commissioning work of the existing fibre optic multiplexer at Mannar GSS shall be carried out by CEB.

1.2.1.6.2 Required SCADA for Mannar Grid Substation

SCADA Gateway

The integration work of new control and protection IEDs to existing Gateway at Mannar Grid Substation will be undertaken by CEB.

Bidder shall provide high quality ICD and CID files of new control & protection IEDs and the relevant IED software with license and the required licenses for upgrading the gateway to CEB in order to carry out Gateway modification work.

The integrated SCADA signals shall be tested up to the NSCC by the contractor together with the CEB.

The SCADA signals shall be integrated as given in "Annex A1". Gateway communication path configuration parameters are given in "Annex B".

Configuration of NSCC SCADA Master Station for integration of the signals shall be done by the CEB. All the integrated signals shall be tested up to the NSCC by the contractor.

Required SCADA Signals and Commissioning of Mannar GS to proposed DCC

The integration work of all the signals relevant to the Mannar Grid Substation mentioned in the "Signal List for Mannar Substation- Annex A1" to existing Gateway at

Mannar Grid Substation will be undertaken by CEB to the Distribution Control Center (DCC) SCADA System through the gateways.

Bidder shall provide the required licenses for upgrading the gateway to CEB in order to carry out Gateway modification work

Configuration of DCC SCADA Master Station for integration of the signals shall be done by the CEB. The integrated signals shall be tested up to the DCC by the contractor.

All the signals related to augmented bays of Mannar GSS as per Signal List given in "Annex A1-Mannar GS" shall be configured in the existing Gateway at Mannar GS as per the IEC 60870 – 5 – 104 protocol. Gateway configuration parameters are given in "Annex B". Finalized Signal List shall be submitted at least 02 weeks prior to the commissioning as per the format given in Annex D. Configuration of National System Control Center (NSCC) SCADA Master Station for integration of the signals shall be done by the CEB. The integrated signals shall be tested up to the NSCC by the contractor. Required license upgrading, software and hardware modifications shall be done by the contractor. The existing separate remote controllevel for NSCC operations and interlocking operations shall be activated for the new bays as well for the NSCC operations. Existing signals before the modification of the Gateway shall be available after the modification and all the control signals shall be tested and verified with the NSCC. Final configuration of Database and Project file (Gateway backup files) shall be provided. (As CD/DVD or Portable external hard disk). If any Software upgradation is required for the modification work, that software version shall be provided with the license. (As CD/DVD or Portable external hard disk)

1.2.1.6.3 Modifications required at New Anuradhapura Grid Substation

The existing Fiber Optic Multiplexer (FO615 by ABB) shall be extended with following interfaces.

1 No. Optical interface module of type SAMO5

- 3 Nos. Teleprotection interface modules of type TEPI1 (for the direction of Mannar GSS)
- 1 No. Teleprotection interface modules of type OPIC1 (for the direction of Mannar GSS)
- 2 Nos. Small Form-factor Pluggable (SFP) optical transceiver modules (U 1.2) and 02 nos. of patch cable 10m LC/PC-FC/PC
- 2 Nos. Small Form-factor Pluggable (SFP) optical transceiver modules (with DDM support) of 1.25Gbit/s and 02 nos. Optical patch cables

The required extension modules shall be supplied as loose materials. The installation and commissioning work of the existing fibre optic multiplexer at New Anuradhapura GS shall be carried out by CEB.

1.2.1.7 ADDITIONS / MODIFICATIONS TO THE EXISTING SUBSTATION EARTHING SYSTEM:-

The existing substation earthing system shall be modified and extended to accommodate the augmentation works as per the requirements stated in Chapter 7 of the Technical Specification – Grid Substation. This shall include excavation, backfilling and reinstatement of the ground, driving the earth rods and making of the connections. This shall include additional earth materials to reach the specified value of earth resistance.

An earthing conductor of 95 mm² shall be installed into each borehole in order to connect with the substation earthing system later. This conductor shall be reached to the bottom most level of the borehole. The material of this earthing conductor shall be Copper commercial hard drawn and the surrounding space of this conductor shall be filled with electrically conductive aggregate material/earthing enhancement compound conforming to IEC 62561-7:2011 with the approval of the employer's representative. Locations of the boreholes are indicated in the substation layout drawing no. TD/CE/1/201/D/01/01-A. Advancing of boreholes shall be according to the clause 13 of the technical specification.

1.2.1.8 ADDITIONS / MODIFICATION TO THE EXISTING LIGHTNING PROTECTION SYSTEM COMPRISING:-

Additions and Modification of existing lightning protection system shall include design and erection of lightning protection system with shield earth wires to accommodate the augmentation works. The earth wire to ground the lightning rods shall be provided with suitable insulation level from building and installed not to be touched by a person easily.

1.2.1.9 ADDITIONS / MODIFICATION TO THE EXISTING GROUNDING SYSTEM COMPRISING:-

The existing grounding system shall be extended to accommodate the augmentation work including connections of all steel structures and electrical apparatus to earth mesh and grounding electrodes.

1.2.1.10 POWER AND CONTROL CABLES

The Contractor shall be responsible for the supply, installation, termination and testing of all cables for the execution of this augmentation works.

The Contractor is on a turnkey basis and the prices for Definite Works entered by the Bidder in Schedule of Rates & Prices shall only be varied if the Contract requirements are altered, up or down. For the purpose of such variations, the rates shall be those in Schedule of Prices & Rates.

The rates for supply and installation shall be those appropriate to order of drum lengths as appropriate to each type and rating of cable.

The cable installation rates shall include excavation, backfilling and reinstatement of the ground, installation in concrete trenches and ducts and fixing to cable tracks and supports as necessary.

Control and power cables shall be armoured and they shall be laid in concrete trenches, in the switchyard and within the buildings, they shall be cleated to cable trays. However, any direct buried cables are not permitted in the substation. Cable trays and supports shall be supplied and installed in accordance with the Specification and included in the prices for Definite Work in Schedule of Prices & Rates.

1.2.1.10.1 36kV Power Cables and Terminations

- 02 Lots 36kV, XLPE insulated, Cu wire or Tape screen, PVC sheathed, Armoured single core cables for connections between Power transformers and 36kV indoor switchgear.
- 01 Lot 36kV, XLPE insulated, Cu wire or Tape, screen, PVC sheathed, Armoured single core cables for connections between Power transformer and Auxiliary Transformer.
- 02 Lots 36kV, XLPE insulated, Cu wire or Tape screen, PVC sheathed, Armoured single core cables for connections between Power transformer and Earthing Transformers.
- 12 Lots 36kV, XLPE insulated, Cu wire or Tape screen, PVC sheathed, Armoured single core caples for connections from switchgear panels to outdoor gantries for generator feeders.
- 1.2.1.10.2 All low voltage AC power cables and terminations
- 1.2.1.10.3 All DC power and control cables and terminations
- 1.2.1.10.4 All cables required for Protection, Control, Instrumentation, Communication, SCADA and termination
- 1.2.1.10.5 All cables required for station lighting, small power, fire protection, ventilation equipment

1.2.1.11 TRANSFORMERS

Following transformers as specified in Chapter 10 of Technical Specification -Grid Substation.

lt	tem	Description	Qty	Voltage	Rating	Cooling
	1.	Three phase power transformer with ON-Load Tap Changers	2	220/33kV	63MVA	ONAN/ONAF
	2.	Earthing T/F	2	33 kV	800A, 30s	ONAN
	3.	Auxiliary T/F	1	33/0.4 kV	160kVA	ONAN

Note: 245kV, 36kV and neutral terminals of Power transformers and 36kV and 400V terminals of Auxiliary transformers shall be supplied with bushings as per the Technical Particulars and Guarantees in the Volume 7 of 8 of the bidding document. 36kV bushings of Earthing transformers shall be supplied with plug-in type bushings. These power transformers are used for the connection of wind power generation to 220kV network. Estimated harmonic levels shall be considered during the designing of power transformer. 245kV outdoor bushings shall be RTV silicone coated.

1.2.1.12 WATER SPRAY SYSTEM FOR TRANSFORMERS

The water spray system shall cover the existing 45MVA transformer, Variable Shunt Reactor along with the two nos. of 63MVA transformers which is mentioned in Clause No. 1.2.1.11 above and shall comply with the Technical Specification – Grid Substation.

1.2.1.13 SUPPORTING STRUCTURES INCLUDING GANTRIES

All support structures necessary for the works and all terminating lines specified under the Employer's Requirements shall be provided by the Contractor. Materials used for the structures shall comply with the Technical Specification – Grid Substation.

1.2.1.14 MARSHALLING KIOSKS

Marshalling kiosks shall be provided and wired where necessary.

1.2.1.15 MISCELLANEOUS WORKS

Any work other than listed above.

1.2.1.16 SPARE PARTS

All necessary Spare parts.

1.2.1.17 TOOLS AND INSTRUMENTS

As per the price schedule all the tools and equipment shall be provided. For the technical specification of the tools please refer Annex E of the volume 4 of 8 of the bidding document.

1.2.2 NADUKUDA GRID SUBSTATION

1.2.2.1 OUTDOOR SWITCHGEAR

Insulators of all outdoor 245kV switchgears and insulator strings shall be RTV silicone coated.

1.2.2.1.1 01 No. 245kV Transformer bay comprising:-

- 1 No. Neutral current transformer with core as follows: -Class 5P20 ratio 200/1A for Main 1 protection and control IED Class 5P20 ratio 200/1A for Main 2 protection and control IED
- 1 Lot Connections to the 245kV and neutral terminals of the power transformer including required connectors, clamps, termination accessories and access ladders etc.

1.2.2.1.2 01 No. 36kV Transformer bay comprising:-

- 3 Nos. 36kV, 10kA, Class 2 Pluggable Surge Arresters with counters.
- 1 No. Neutral Current Transformer with cores as follows:
 Class 5P20, ratio 800/1A for HV Main 1 protection and control IED
 Class 5P20, ratio 800/1A for HV Main 2 protection and control IED
- 1 Lot Set of cable connections between Power Transformer and Earthing Transformer including set of connections, connectors, clamps, structures, access ladders, cable sealing end or terminal arrangement suitable for incoming 36kV cables etc. to terminate the 36kV cable and connect to the Power Transformer.
- 1 Lot Set of cable connection between Indoor switchgear and Power Transformer including set of connections, connectors, clamps, structures, access ladders, cable sealing end or terminal arrangement suitable for incoming 36kV cables etc. to terminate the 36kV cable and connect to the Power Transformer.
- 1 Lot Connections, connectors, clamps, and access ladders etc. including connections to Earthing Transformer 36kV bushings.
- 1 Lot Set of connections, connectors, clamps, structures, access ladders etc. to connect 36kV Earthing Transformer and Neutral Current Transformer.

1.2.2.2 MODIFICATION OF LVAC SWITCH BOARDS

Existing 400V AC Main switchboard and distribution panel shall be modified to accommodate the scope of works of this contract.

1.2.2.3 MODIFICATION OF DC DISTRIBUTION BOARDS

Existing 220V DC Main switchboard shall be modified to accommodate the scope of works of this contract.

1.2.2.4 PROTECTION, METERING, MONITORING AND CONTROL

1.2.2.4.1 Additions / Modification of Existing Substation Automation System:-

Following items shall be supplied as per the Clause: 5.24 of Chapter 5, Technical Specification - Grid Substation of bidding document and architecture drawing for SAS in Annexure 7.

- Industrial type layer 2 Manageable Gigabit Ethernet Switch and Ethernet connections. Operator Workstation 1 (HMI-1), Operator Workstation 2 (HMI-2), Engineering Workstation (EWS), Gateway 1, Gateway 2 and Firewall shall be connected to the switch.
- 1 No. Next Generation Firewall
- 1 No. Industrial type layer 2 Manageable Ethernet Switch and connections for power transformer bay.

CEB will carry out integration work of new control & protection IEDs to existing Substation Automation Systems at Nadukuda Grid Substation.

The connecting IEDs to network and field signal testing associated with commissioning shall be carried out by the contractor as per the Site Acceptance Tests and Commissioning section of Clause: 5.24 of Chapter 5, Technical Specification - Grid Substation of bidding document.

1.2.2.4.2 Protection & Control facilities:-

1.2.2.4.2.1 For 01 No. Transformer bay comprising with:-

(a) AVR Panel

AVR shall be mounted on separate panel in the control building.

(b) Protection and Control panel with IEDs

Control and Protection panels related to the scope of this project are available in the Nadukuda GSS. Required modification of wiring, testing and commissioning of existing Protection and control IEDs of **HV and MV** sides including primary injection and transformer stability testing shall be carried out by this contract.

1.2.2.5 COMMUNICATION EQUIPMENT AND SCADA GATEWAYS/RTUS

1.2.2.5.1 Fiber Optic Multiplexer at Nadukuda Grid Substation

The existing Fiber Optic Multiplexer (FO615 by ABB) shall be extended with following interfaces.

- 1 No. Optical interface module of type SAMO5 with SFP and patch cable for Mannar GSS direction
- 1 No. Ethernet Interface module with minimum 04 numbers of Ethernet ports with L2- switching, also configurable for VLAN and L3- routing facility (10/100 Mbps) of type EPSI1
- 1 No. FXS interface module of type LESU1
- 2 Nos. Small Form-factor Pluggable (SFP) optical transceiver modules (with DDM support) of 1.25Gbit/s and 02 nos. Optical patch cables

The required extension modules shall be supplied as loose materials. The installation and commissioning work of the existing fibre optic multiplexer at Nadukuda GS shall be carried out by CEB.

1.2.2.5.2 Required SCADA for Nadukuda Grid Substation

SCADA Gateway

The integration work of new control and protection IEDs to existing Gateway at Nadukuda Grid Substation will be undertaken by CEB.

Bidder shall provide high quality CD and CID files of new control & protection IEDs and the relevant IED software with license and the required licenses for upgrading the gateway to CEB in order to carry out Gateway modification work.

The integrated SCADA signals shall be tested up to the NSCC by the contractor together with the CEB.

The SCADA signals shall be integrated as given in "Annex A2". Gateway communication path configuration parameters are given in "Annex B".

Configuration of NSCC SCADA Master Station for integration of the signals shall be done by the CEB. All the integrated signals shall be tested up to the NSCC by the contractor.

Required SCADA Signals and Commissioning of Nadukuda GS to proposed DCC

The integration work of all the signals relevant to the Nadukuda Substation mentioned in the "Signal List for Nadukuda Substation- Annex A2" to existing Gateway at Nadukuda Grid Substation will be undertaken by CEB to the Distribution Control Center (DCC) SCADA System through the gateways.

Bidder shall provide the required licenses for upgrading the gateway to CEB in order to carry out Gateway modification work

Configuration of DCC SCADA Master Station for integration of the signals shall be done by the CEB. The integrated signals shall be tested up to the DCC by the contractor.

All the signals related to augmented transformer bay of Nadukuda GS as per Signal List given in "Annex A2-Nadukuda GS" shall be configured in the existing Gateway at Nadukuda GS as per the IEC 60870 – 5 – 104 protocol. Gateway configuration parameters are given in "Annex B". Finalized Signal List shall be submitted at least 02 weeks prior to the commissioning as per the format given in Annex D. Configuration of NSCC SCADA Master Station for integration of the signals shall be done by the CEB.

The integrated signals shall be tested up to the NSCC by the contractor. Required license upgrading, software and hardware modifications shall be done by the contractor. The existing separate remote control level for NSCC operations and interlocking operations shall be activated for the new bays as well for the NSCC operations.

Existing signals before the modification of the Gateway shall be available after the modification and all the control signals shall be tested and verified with the NSCC. Final configuration of Database and Project file (Gateway backup files) shall be provided. (As CD/DVD or Portable external hard disk). If any Software upgradation is required for the modification work, that software version shall be provided with the license. (As CD/DVD or Portable external hard disk)

1.2.2.6 SUBSTATION EARTHING SYSTEM COMPRISING:-

The existing substation earthing system shall be modified to accommodate the scope of works as per the requirements stated in Chapter 7 of the Technical Specification – Grid Substation

1.2.2.7 LIGHTNING PROTECTION SYSTEM COMPRISING: -

Additions and Modification of existing lightning protection system shall include design and erection of lightning protection system with shield earth wires to accommodate the augmentation works. The earth wire to ground the lightning rods shall be provided with suitable insulation level from building and installed not to be touched by a person easily.

1.2.2.8 GROUNDING SYSTEM COMPRISING:-

The existing grounding system shall be extended to accommodate the augmentation work including connections of all steel structures and electrical apparatus to earth mesh and grounding electrodes.

1.2.2.9 POWER AND CONTROL CABLES

The Contractor shall be responsible for the supply, installation, termination and testing of all cables for the execution of the works.

The Contractor is on a turnkey basis and the prices for Definite Works entered by the Bidder in Schedule of Rates & Prices shall only be varied if the Contract requirements are altered, up or down. For the purpose of such variations, the rates shall be those in Schedule of Prices & Rates.

The rates for supply and installation shall be those appropriate to order of drum lengths as appropriate to each type and rating of cable.

The cable installation rates shall include excavation, backfilling and reinstatement of the ground, installation in concrete trenches and ducts and fixing to cable tracks and supports as necessary.

Control and power cables shall be armoured and they shall be laid in concrete trenches, in the switchyard and within the buildings, they shall be cleated to cable trays. However, any direct buried cables are not permitted in the substation. Cable trays and supports shall be supplied and installed in accordance with the Specification and included in the prices for Definite Work in Schedule of Prices & Rates.

1.2.2.9.1 245kV Power Cables and Terminations

- 1 Lot 245kV, single core cables with Cu conductor, XLPE insulated, Cu wire screened, Lead alloy sheath, HDPE sheathed single core cables as necessary for connections between Power transformer and 245kV indoor switchgear.
- 1 Lot Cable terminations/ sealing ends for above mentioned cable circuits to be supplied and terminated at power transformer and 245kV GIS bays.

1.2.2.9.2 36kV Power Cables and Terminations

- 1 Lot 36kV, XLRE insulated, Cu wire or Tape screen, PVC sheathed, Armoured single core cables for connections between Power transformer and 36kV indoor switchgear including cable termination/sealing end and required accessories.
- 1 Lot 36kV, XLPE insulated, Cu wire or Tape screen, PVC sheathed, Armoured single core cables for connections between Power transformer and Earthing transformer including cable termination/sealing end and required accessories.

1.2.2.9.3 All low voltage AC power cables and terminations

1.2.2.9.4 All DC power and control cables and terminations

1.2.2.9.5 All cables required for Protection, Control, Instrumentation,

1.2.2.9.6 Communication, SCADA and termination.

1.2.2.9.7 All cables required for station lighting, small power, fire protection, ventilation equipment.

1.2.2.10 TRANSFORMERS

Following transformers as specified in Chapter 10 of Technical Specification -Grid Substation.

Item	Description	Qty	Voltage	Rating	Cooling
1.	Three phase power transformer with ON-Load Tap Changers	1	220/33 kV	63MVA	ONAN/ONAF
2	Earthing Transformer	1	33kV	800A, 30s	ONAN

Note: 245kV, 36kV and neutral terminals of Power transformers shall be supplied with bushings as per the Technical Particulars and Guarantees in the Volume 7 of 8 of the bidding document and as per the drawing no. TD/CE/1/201/D/03/02. 36kV terminal of Earthing transformers shall be supplied with plug-in type bushings. These power transformers are used for the connection of wind power generation to 220kV network. Estimated harmonic levels shall be considered during the designing of power transformer. The power transformers shall be capable of parallel operation with the existing power transformers.

1.2.2.11 WATER SPRAY SYSTEM FOR TRANSFORMERS

The water spray system shall cover two nos of existing 63MVA transformers, one no. of 63MVA transformer proposed under a different contract, one no. of 63MVA transformer which is mentioned in Clause No. 1.2.2.10 above and shall comply with the Technical Specification – Grid Substation.

1.2.2.12 SUPPORTING STRUCTURES

All support structures necessary for the works specified under the Employer's Requirements shall be provided by the Contractor. Materials used for the structures shall comply with the Technical Specification – Grid Substation.

1.2.2.13 MISCELLANEOUS WORKS

Any work other than listed above.

1.2.2.14 SPARE PARTS

All necessary Spare parts as per the price schedule.

1.2.2.15 TOOLS AND INSTRUMENTS

As per the price schedule.
OTHER SERVICES 1.3 CIVIL WORKS, INSTALLATION, AND TRAINING

1.3.1 CIVIL WORKS

1.3.1.1 MANNAR GRID SUBSTATION

1.3.1.1.1 **Preliminary Works**

- Site Survey a)
 - As per chapter 13 of Technical Specification Grid Substation.
- b) Sub Soil Investigations

- As per chapter 13 of Technical Specification - Grid Substation. Bid

1.3.1.1.2 Site Clearing

- Cutting and removing trees & shrubs. a)
 - Big trees, shrubs and boulders.
- Demolishing existing constructions as required. b)

1.3.1.1.3 Site formation and up keeping

- Cutting and filling earth. a)
 - Formation level shall be same as the formation level of the existing Mannar Grid Substation

b) Rock excavation

- If rock excavation is required during earth works, payment shall be made for actual quantities of rock volume based on the volume ranges mentioned in the price schedule 4 of Volume 2.
- Earth retaining structures c)
 - Earth retaining walls
 - All the embankments shall be protected as per specifications and drawings.
 - Rubble pitching work
- d) Landscaping
 - As required for the layout.
- Surface Chipping e)
 - Area covered by the earth mat.

dding

1.3.1.1.4 Cable Trenches & Ducts

- As per chapter 13 of Technical Specification Grid Substation.
- Extensions to cable trenches and ducts as required
- Provision shall be made for all future cables.

1.3.1.1.5 Foundations

- a) For take-off structures & switchgear
 - As required for all the equipment support structures.
- b) For Main transformers
 - 2 Nos. of Main power transformers with concrete firewalls.
- c) Auxiliary & Earthing transformers
 - 1 Nos. Auxiliary transformers
 - 2 Nos. Earthing transformers

1.3.1.1.6 Lightning protection system

- Extensions and modifications to lightning protection system as required as per chapter 13 of Technical Specification, Grid Substation.

1.3.1.1.7 Water supply & drainage system

- a) Surface water drainage system
 - Extension to the existing surface water drainage system as per the specification

1.3.1.1.8 Construction & Maintenance of Roads

a) Access road and structures

- Extension to the existing access road as indicated in the drawings and as per chapter 13 of Technical Specification - Grid Substation.

1.3.1.1.9 Fence, Gates and Boundary Walls

a) Chain link fence

- The existing chain link fence shall be extended. For details refer drawings for fence and gates.

1.3.1.1.10 External Lighting & small power supply services

- Shall include all necessary extensions and modifications to Switchyard Street and security lighting.

1.3.1.1.11 Construction of Control & Other Buildings

- a) Required modifications to the Control building when erecting 36 kV GIS panels, control and protection panels come under this procurement.
- b) Site Office at Mannar

- Temporary building at site (Converted Container type Office).
- c) Temporary Works (Stores, access, contractor's offices etc)

1.3.1.1.12 Miscellaneous Works

- Any work other than listed above.

Hornation copy Not for Bidding

1.3.1.2.1 Cable Trenches & Ducts

- As per chapter 13 of Technical Specification Grid Substation.
- Provision shall be made for all future cables.

1.3.1.2.2 Foundations

- a) For take-off structures & switchgear
 - As required for all the equipment support structures.
- b) For Main power transformer including concrete firewall
- c) Earthing transformers
 - -1 No Earthing transformer

1.3.1.2.3 Lightning protection system

- As per chapter 13 of Technical Specification - Grid Substation.

1.3.1.2.4 Construction of Control & Other Buildings

a) Control Building

- Necessary modifications to the existing control building as per chapter 13 of Technical Specification - Grid Substation

b) Site Office at Nadukuda

-Temporary Building at site (Converted Container type Office).

c) Temporary Works (Stores, access, contractor's offices etc)

1.3.1.2.5 External Lighting & small power supply services

- Shall include all necessary extensions and modifications to Switchyard lighting.

1.3.1.2.6 Miscellaneous Works

- Any work other than listed above.

1.3.2 INSTALLATION

Erection, Installation and commissioning of structures, Plant & Equipment specified in the clause 1.2 of Employer's Requirements.

- (a) Mannar 220/33kV Grid Sub Station
- (b) Nadukuda 220/33kV Grid Substation

1.3.3 OTHER SERVICES

1.3.3.1 TRANSPORT

Transport for employer's representative should be provided as per import and supply basis as per Chapter 14 of Technical Specification – Grid Substation.

a) Four Wheel Drive SUV: 02 No.

Mileage to be covered is 3500km per month per vehicle including running and maintenance.

b) Four Wheel Drive Double Cabs: 03 Nos.

Mileage to be covered is 3000km per month per vehicle including running and maintenance.

In case the contractor fails to provide above vehicles as per the stipulated requirement of the tender document due to unavoidable reasons beyond the control of the contractor, the contractor is to provide transport facility for the above requirement.

1.3.3.2 ENGINEERS' LIVING ACCOMMODATION

Engineers living accommodation should be provided in close proximity to the following sites as per clause 14.1.2 of Technical Specifications-Grid Substations.

a) Mannar 220/33 kV Grid Substation

The contractor shall provide a fully furnished rented house/building from the contract commencement date. Further the contractor has to maintain the premises including the caretaker facility until completion of the project and handover to CEB.

1.3.4 TRAINING

- N/A

LOT B

AUGMENTATION OF EMBILIPITIYA 132/33 kV GRID SUBSTATION

whomailon copy. Not for Bidding

LOT B

2. SCOPE OF WORKS

2.1 GENERAL DESCRIPTION OF THE PROJECT

2.1.1 EMBILIPITIYA GRID SUBSTATION

Augmentation of Embilipitiya Grid Substation shall consist of following main features.

- 1. 36kV SF $_6$ gas insulated indoor switchgear with Single Bus bar arrangement comprising of
 - 02 Nos. 36kV Transformer bays

08 Nos. 36kV Line feeder bays

- 02 Nos. 36kV Generator feeder bays
- 01 No. 36kV Bus Section bay
- 2. 4 Nos. of 36kV Outdoor line gantries including 36kV cable terminations
- 3. Control, Metering, Monitoring and Protection of 36kV equipment
- 4. Addition/Modification to DC distribution to accommodate the scope of work of this contract and LVAC.
- 5. 50kW Roof-Top Solar PV System
- 6. SCADA & Addition/Modification to Communication equipment
- 7. Substation Automation System
- 8. Power and Control cables including terminations
- 9. Addition/Modification to existing Substation grounding system and shield earth wire system
- 10. 40kVA Diesel Generator
- 11. Electrical Civil and Mechanical works required for substation including control building and extension of control buildings
- 12. Spare parts

2.1.2 SCOPE OF WORKS RELATED TO FEEDING END GRID SUBSTATIONS

Not Applicable

Hornation copy Not for Bidding

2.1.3 TERMINAL POINTS

A. Embilipitiya 132/33kV Grid Substation

The following shall be the contract terminal points:-

- Existing Power Transformer and 36kV GIS interface
 This contract includes the connection between 36kV side of Power
 Transformers and 36kV GIS using underground cables, cable terminations, steel structures etc.
- (b) 36kV Overhead Line/ Switchgear interfaces 36kV overhead distribution lines terminate at the line bay gantries. This contract includes the connections and connectors from 36kV outdoor terminations to the 36kV line down droppers, which terminate at the line bay gantries.

Single-Stage: Two-Envelope

2.1.4 SITE ENVIRONMENTAL CONDITIONS

Altitude of site above sea level not exceeding	m	1000
Maximum ambient air temperature	^{0}C	40
Minimum ambient air temperature	0 C	7
Average ambient air temperature over 24 hours	⁰ C	32
Average yearly temperature	⁰ C	30
Relative humidity (24 hours)	%	90
Average annual rainfall	mm	2000
Maximum recorded rainfall for 24 hours	mm	392
Winds	Maximum 1 at 145 km p speed 6 km hours.	to 3 second gusts er hour. Mean per hour over 24
Winds	Maximum 1 at 145 km p speed 6 km hours. Frequency high	to 3 second gusts ber hour. Mean per hour over 24 of thunderstorms is
Winds Thunderstorms Average isokeraunic level	Maximum 1 at 145 km p speed 6 km hours: Frequency high 100 days pe	to 3 second gusts ber hour. Mean per hour over 24 of thunderstorms is er annum
Winds Thunderstorms Average isokeraunic level Atmospheric corrosive category (ISO 12944)	Maximum 1 at 145 km p speed 6 km hours. Frequency high 100 days pe C4	to 3 second gusts ber hour. Mean per hour over 24 of thunderstorms is er annum

2.1.5 ELECTRICITY, WATER, GAS AND OTHER SERVICES

The Contractor shall at his expense, provide all electricity, water, gas and other services necessary to execute and complete the Works on site. Prevailing tariff and service connection procedure shall be applicable.

2.1.6 ADHERENCE TO THE ENVIRONMENTAL MITIGATION MEASURES

Bidders are requested to comply with the requirements stated in the Chapter 1, Clause 1.7 of Section 6 Part B -Technical Specifications.

2.2 PLANT & EQUIPMENT INCLUDING MANDATORY SPARE PARTS

2.2.1 EMBILIPITIYA GRID SUBSTATION

2.2.1.1 OUTDOOR SWITCHGEAR

2.2.1.1.1 02 Nos. 36kV Transformer bays each comprising:-

- 1 Lot Set of connections, connectors, clamps, access ladders, structures, cable sealing end or terminal arrangement suitable to connect the 36kV cable from 36kV Gas Insulated Switchgear.
- 1 Lot Complete set of miscellaneous items required for the safe and efficient operation of the switchgear.

2.2.1.1.2 08 Nos. 36kV Feeder bays for outgoing lines each comprising:-

- 3 Nos. 36kV, 10kA, Class 2 Surge arresters with counters.
- 1 Lot Set of bay connections, connectors, and clamps, etc.
- 1 Lot Set of cable connection between indoor switchgear and outdoor equipment including set of connections, connectors, clamps, structures, access ladders, cable terminating structure, sealing end or terminal arrangement suitable for incoming 36kV cables etc. to terminate the 36kV cable and connected to the 36kV take-off structure.

2.2.1.1.3 02 Nos. 36kV Feeder bays for incoming generation each comprising:-

- 3 Nos. 36kV, 10kA, Class 2 Surge arresters with counters.
- 1 Lot Set of bay connections, connectors, and clamps, etc.

Set of cable connection between indoor switchgear and outdoor equipment including set of connections, connectors, clamps, structures, access ladders, Cable terminating structure, sealing end or terminal arrangement suitable for incoming 36kV cables etc. to terminate the 36kV cable and connected to the 36kV take-off structure.

Note: The current rating of generator feeders is 800A, and hence all connections, connectors and clamps shall be selected accordingly.

2.2.1.2 SF₆ INSULATED INDOOR SWITCHGEAR

Panel design which allows removal of panel with lowest disturbance to adjacent panels is preferred.

1 Lot

2.2.1.2.1 02 Nos. 36kV Transformer bays each comprising:-

- 1 Set 36kV, 2500A, 25kA, three phase busbars.
- 1 No 1250A, 36kV, 25kA, three phase busbar disconnector with earth switch and motor operating mechanism.
- 1 No 1250A, 36kV, 25kA, three phase circuit breaker complete with operating mechanism.
- 3 Nos. 36kV current transformers with cores as follows:-Class 5P20, ratio 800/1A for HV Main 1 protection and control IED

Class 5P20, ratio 800/1A for HV Main 2 protection and control IED, AVR and LV protection and control IED, DFR

Class 0.2 ratio 800/1 for metering.

3 Nos. - Single phase voltage transformers with cores as follows:-

Class 3P ratio 33,000/ $\sqrt{3}$ V:110/ $\sqrt{3}$ V for HV Main 1 protection and control IED

Class 3P ratio 33,000/ $\sqrt{3}$ V:110/ $\sqrt{3}$ V for HV Main 2 protection and control IED, AVR and LV protection and control IED

Class 0.2 ratio $33,000/\sqrt{3}$ V:110/ $\sqrt{3}$ V for energy metering system

- 1 Lot Cable terminating chamber, complete with cable box, sealing end or terminal arrangement suitable for incoming 36kV cables.
- 1 Lot
 Complete set of miscellaneous items required for the safe and efficient operation of the switch gear, including cables, independently lockable shutters over busbar, cable and voltage transformer spouts (as appropriate), facility to enable busbar or cable to be earthed through circuit breakers, terminal boxes for multi-core cables, busbar end covers or link to adjacent switch panel as appropriate etc.

2.2.1.2.2 08 Nos. of 36kV Feeder bays for outgoing lines each comprising:-

- 1 Set 36kV, 2500A, 25kA three phase busbars.
- 1 No. 1250A, 36kV, 25kA three phase busbar disconnector with earth switch and motor operating mechanism.
- 1 No. 1250A, 36kV, 25kA three phase circuit breaker complete with operating mechanism.
- 3 Nos. 36kV current transformers with cores as follows: Class 5P20, 400/1A for over current and earth fault protection. Class 0.2, 400/1A for Energy metering system.

- 3 Nos. Single phase voltage transformers, ratio $33,000/\sqrt{3}V:110/\sqrt{3}V:110/\sqrt{3}V$ Class 0.2 for energy metering and Class 3P for protection.
- 1 Lot Set of cable terminating chamber, complete with cable box, sealing ends or terminal arrangement suitable for incoming 36kV cables including all terminating accessories, cable lugs etc.
- 1 Lot Complete set of miscellaneous items required for the safe and efficient operation of the switchgear, including cables, independently lockable shutters over busbar, cable and voltage transformer spouts (as appropriate), facility to enable busbar or cable to be earthed through circuit breakers, terminal boxes for multi-core cables, busbar end covers or link to adjacent switch panel as appropriate etc.

2.2.1.2.3 02 Nos. of 36kV Feeder bay for incoming generations each comprising:-

- 1 Set 36kV, 2500A, 25kA three phase busbars.
- 1 No. 1250A, 36kV, 25kA three phase busbardisconnector with earth switch and motor operating mechanism.
- 1 No. 1250A, 36kV, 25kA three phase circuit breaker complete with operating mechanism.
- 3 Nos. 36kV current transformers with cores as follows: Class 5P20, 800/400/1A for directional over current, directional earth fault, over current and earth fault protection. Class 0.2, 800/400/1A for Energy metering system.
- 3 Nos. Single phase voltage transformers, ratio 33,000/√3V:110/√3V:110/√3V Class 0.2 for energy metering of incoming generation and Class 3P for protection.
- 1 Lot Set of cable terminating chamber, complete with cable box, sealing ends or terminal arrangement suitable for incoming 36 kV cables including all terminating accessories, cable lugs etc.
- 1 Lot Complete set of miscellaneous items required for the safe and efficient operation of the switch gear, including cables, independently lockable shutters over busbar, cable and voltage transformer spouts (as appropriate), facility to enable busbar or cable to be earthed through circuit breakers, terminal boxes for multi-core cables, busbar end covers or link to adjacent switch panel as appropriate etc.

2.2.1.2.4 01 No. of 36kV Bus Section bay comprising:-

1 Set - 36kV, 2500A, 25kA three phase busbars.

- 1 No 2500A, 36kV, 25kA, three phase circuit breaker complete with operating mechanism.
- 2 Nos. 2500A, 36kV, 25kA three phase disconnector with earth switch and motor operating mechanism.
- 3 Nos. Current transformers with core as follows:-Class 5P20, ratio 2500/1A for over current and earth fault protection and for metering with interposing current transformer.
- 6 Nos. Single phase voltage transformers with cores as follows:-

Class 3P ratio 33,000/ $\sqrt{3}$ V:110/ $\sqrt{3}$ V for Protection and control IED Class 0.2 ratio 33,000/ $\sqrt{3}$ V:110/ $\sqrt{3}$ V for Energy metering system

1 Lot - Complete set of miscellaneous items required for the safe and efficient operation of the switch gear, including cables, independently lockable shutters over busbar, cable and voltage transformer spouts (as appropriate), facility to enable busbar or cable to be earthed through circuit breakers, terminal boxes for multi-core cables, busbar end covers or link to adjacent switch panel as appropriate etc.

2.2.1.3 LVAC SWITCH BOARDS

400V switchboards, for supplies to substation services, free standing and for indoor installation, are to be supplied and installed. The incoming supplies to each switchboard are to be interlocked to automatically establish supply to the busbar in the event of failure of the incoming supply and not to parallel any supplies. In case of failure of incoming, Diesel Generator shall be automatically switched on for emergency supplies.

2.2.1.3.1 400V Main switchboard at New Control Building comprising:-

Auto changeover logic for Bus-section breakers, Incoming Breakers & Generator Breaker initiated by:

Incomer No. 1 from 200kVA, 33/0.4kV Auxiliary transformers 1.

Incomer No. 2 from 200kVA, 33/0.4kV Auxiliary transformers 2.

Incomer No. 3 from 40kVA Diesel Generator for emergency supply.

Incomer No. 4 from 50kW Solar PV system

- 1 Set Busbars (3 Phases, Neutral and Earth).
- 9 Nos. 4 pole MCCBs for two incomer, one solar PV system, one bus section, one Generator and four outgoing (rating shall be according to the load required).
- 1 Set Equipment required for interlocking and automatic switch over between incomer 1, incomer 2 and diesel generator including auto changeovers.

- 3 Sets Indicator lamps for each distribution board.
- 3 Nos Ammeters.
- 3 Nos Voltmeters.

2.2.1.3.2 400V Distribution panel comprising:-

MCB for following distribution Circuits (Number of Phases and rating shall be according to the load required.)

Essential loads

Storage Battery Charger No.1 for 110V

Storage Battery Charger No. 1 for 48V

COPY. Not for Bidding Main transformer No. 1 OLTC & cooling fans

Main transformer No. 2 OLTC & cooling fans

Outdoor & Perimeter lighting

Indoor lighting

Guard House

Inverter Supply

Others as necessary

Spares

Panel No.1

Storage Battery Charger No.2 for 110V 145kV Switchgear Auxiliary Power 36kV Switchgear Auxiliary Power Cubicle lighting & space heater Distribution Panel No. 1 for small power supply Air Conditioning and Ventilation Outdoor Lighting panel Power outlet Water Supply Pump Others as necessary Spares

Panel No.2

145kV Switchgear Auxiliary Power

36kV Switchgear Auxiliary Power

Cubicle lighting & space heater

Distribution Panel No. 2 for small power supply

Air Conditioning and Ventilation

Power outlet

Pumps

Others as necessary

Spares

A separate circuit shall be provided for Oil Filtering as shown in the LVAC drawing.

2.2.1.4 ADDITIONS/MODIFICATIONS OF DC DISTRIBUTION BOARDS AND INVERTER EQUIPMENT

Existing 110V DC Distribution board shall be modified to accommodate the scope of works of this contract.

2.2.1.4.1 Inverter System for Substation Automation System

2 Sets - Inverters with automatic load transfer facility by means of automatic transfer system, instrument and alarms described in Technical Specification. (20% of spare capacity shall be provided in each inverter system)

2.2.1.4.2 Roof-Top solar power system

- a) 50kW solar PV system shall be installed on top of the roof of control building as per clause 3,23 of Technical Specification.
- b) Supply and installation of inverter as per clause 3.23.3 of Technical Specification.
- c) Supply and installation of combiner boxes as per clause 3.23.4 of Technical Specification.
- d) Supply and installation of monitoring and data acquisition system as per clause 3.23.7 of Technical Specification.
- e) All required cables, accessories and earthing works.

<u>Note:</u> The requested SCADA signals of the Solar PV system as per the NSCC SCADA Signal List (Annex A3) shall be made available to the NSCC and shall be commissioned up to the NSCC.

2.2.1.5 PROTECTION, METERING, MONITORING AND CONTROL

2.2.1.5.1 Substation Automation System:-

Substation Automation system must be provided as per the Clause: 5.24 of Technical Specification - Grid Substation and typical architecture drawing provided in Volume 06 of bidding document by the SAS manufacturer.

All facilities and requirements including necessary hardware and software shall be provided as specified in all the relevant clauses in Chapter 5 of Technical Specification - Grid Substation.

Remote Web HMI Workstation shall be provided at the existing control room by the SAS manufacturer.

2.2.1.5.2 36kV Protection & Control facilities: -

(Relays may be installed in 36kV switchgear compartment)

2.2.1.5.2.1 For 08 Nos. 36kV feeders for outgoing lines each comprising with:-

IEDs shall be provided as per the requirements given in Chapter 5 of Technical Specification -Grid Substation for following functions.

Clause 5.11.1

Clause 5.11.4

-Protection/Control Functions Required in 11kV/33kV Feeder Protection (All the clauses under this shall be complied for TCS, BF protection etc.)

Clause 5.11.5

Clause 5.11.6

Clause 5.49 Clause 5.8.1 and clause 5.8.2 - Trip Matrix

General Requirements

- Interlocking

- Trip Circuit Supervision.

- Control IED'S on 36kV level

Operation counter auto-trip for circuit-breaker.

C,C

Operation counter hand-trip for circuit breaker.

2.2.1.5.2.2 For 02 Nos. 36kV feeders for incoming generations each comprising with:-

IEDs shall be provided as per the requirements given in Chapter 5 of Technical Specification -Grid Substation for following functions.

Clause 5.11.1	- General Requirements
Clause 5.11.4	 Protection/Control Functions Required in 11kV/33kV Feeder Protection (All the clauses under this shall be complied for TCS, BF protection etc.)
Clause 5.11.5	- Trip Matrix

Clause 5.11.6	- Interlocking								
Clause 5.19	- Trip Circuit Supervision.								
Clause 5.8.1 and clause 5.8.2	- Control IED'S on 36kV level								
Clause 5.8.5	- Synchro-check & Synchronizing								
Operation counter auto-trip for circuit-breaker.									

Operation counter hand-trip for circuit breaker.

2.2.1.5.2.3 For 02 Nos. 36kV Transformer bays each comprising with:-

IEDs shall be provided as per the requirements given in Chapter 5 of Technical Specification -Grid Substation for following functions.

Clause 5.12.2

Clause 5.19

Clause 5.9.5.2

Clause 5.8.1 and clause 5.8.2

- Directional and Non-directional Over current protection for LV side

- Directional and Non-directional Residual Earth fault protection for LV side

- BCU function for LV side
- Synchronism Check function for the LV side

Monitoring of Lockout relay

- Trip circuit supervision
- Synchrocheck & Synchronizing
- Control IED'S on 36kV level

Operation counter auto-trip for circuit breaker.

Operation counter hand-trip for circuit breaker.

2.2.1.5.2.4 For 01 No. 36kV Bus Section bay each comprising with: -

IEDs shall be provided as per the requirements given in Chapter 5 of Technical Specification -Grid Substation for following functions.

Clause 5.16	- Bus Section Bay General requirements
Clause 5.16.4	- General Requirements for 33kV Bus Section Protection including directional OC/EF.
Clause 5.19	- Trip Circuit Supervision.
Clause 5.8.1 and clause 5.8.2	- Control IED'S on 36kV level
Operation counter auto-trip for circ	cuit-breaker.

Operation counter hand-trip for circuit breaker.

2.2.1.5.2.5 Auxiliary LVAC Control

IEDs shall be provided for indication in Automation System.

2.2.1.5.2.6 Gas Pressure Monitoring System

Gas pressure monitoring system shall be provided

Clause 2.2.1.8 (e) –Gas monitoring device

2.2.1.5.3 Energy Metering panels comprising with: -

Not Applicable

2.2.1.6 COMMUNICATION EQUIPMENT AND SCADA GATEWAYS/RTUS

2.2.1.6.1 Fiber Optic Multiplexer at Embilipitiya Grid Substation

The existing Fiber Optic Multiplexer (FO615 by ABB) shall be extended with following interfaces.

1 No. - Optical interface module of type SAMO5 with SFP and patch cable for Matara GSS direction

The required extension modules shall be supplied as loose materials. The installation and commissioning work of the existing fibre optic multiplexer at Embilipitiya GS shall be carried out by CEB.

information

2.2.1.6.2 Required SCADA for Embilipitiya Substation

SCADA Gateway

Gateway System Comprising:

- 2 Nos. Gateway Computers with 1+1 redundancy and Gateway to be independent from SAS and shall be installed inside a server rack
- 1 No. Separate Software Access Keys (Separate Dongle/License key) shall be provided

- 1 No. Laptop/Software tool to access the Gateway computer, for maintenance purposes.
- 1 Lot 500% of the total Gateway Data points as spare Data points
- 4 Nos. 10/100Mbps Ethernet Ports (electrical) with redundancy for each Gateway

All these ports should not be built in a single interface module. There should be separate interface modules for these ports to provide 1+1 redundancy. All the ports shall be surge protected.

Final configuration of Database, Project file and Gateway image (Acronis true image) backup files shall be submitted in the form of Portable external hard disk.

Required SCADA Signals and Commissioning of Embilipitiya GSS

All the signals relevant to the Embilipitiya Substation mentioned in the "Signal List for Embilipitiya Substation- Annex A3" shall be made available as per the IEC 60870 - 5 - 104 protocol for integration and configuration to the National System Control Center (NSCC) SCADA System through the gateways. The Gateway configuration parameters for each signal are given in Annex B. The communication interfaces shall be configured as in Annex C. Finalized Signal List shall be submitted at least 02 weeks prior to the commissioning as per the format given in Annex D.

Required SCADA Signals and Commissioning of Embilipitiya GSS to proposed DCC

All the signals relevant to the Embilipitiya Substation mentioned in the "Signal List for Embilipitiya Substation-Annex A3" shall be made available as per the IEC 60870 – 5– 104 protocol for integration and configuration to the Distribution Control Center (DCC) SCADA System through the gateways. The Gateway configuration parameters and the communication interfaces shall be provided at the commissioning stage. Finalized Signal List shall be submitted at least 04 weeks prior to the commissioning as per the format given in Annex D. Configuration of DCC SCADA Master Station for integration of the signals shall be done by the CEB. The integrated signals shall be tested up to the DCC by the contractor.

All the signals relevant to the augmented bays of Embilipitiya GSS mentioned in the "Signal List for Embilipitiya Grid Substation- Annex A3" shall be made available as per the IEC 60870 - 5 - 104 protocol for integration and configuration to the National System Control Center (NSCC) SCADA System through the gateway. The Gateway configuration parameters for each signal are given in Annex B. The communication interfaces shall be configured as in Annex C. Finalized Signal List shall be submitted

at least 02 weeks prior to the commissioning as per the format given in Annex D. The separate remote control level for NSCC operations shall be configured through the gateway and all the interlocking operations shall be activated for the NSCC operations as well. Configuration of NSCC SCADA Master Station for integration of the signals shall be done by the CEB. The integrated signals shall be tested up to the NSCC by the contractor.

2.2.1.7 ADDITIONS / MODIFICATION OF SUBSTATION EARTHING SYSTEM COMPRISING:-

The existing substation earthing system shall be modified and extended to accommodate the augmentation works as per the requirements stated in Chapter 7 of the Technical Specification – Grid Substation. This shall include excavation, backfilling and reinstatement of the ground, driving the earth rods and making of the connections. This shall include additional earth materials if required to reach the specified value of earth resistance.

2.2.1.8 ADDITIONS / MODIFICATION LIGHTNING PROTECTION SYSTEM COMPRISING:-

Additions and Modification of existing lightning protection system shall include design and erection of lightning protection system with shield earth wires to accommodate the augmentation works. The earth wire to ground the lightning rods shall be provided with suitable insulation fevel from building and installed not to be touched by a person easily.

2.2.1.9 ADDITIONS / MODIFICATIONS OF GROUNDING SYSTEM COMPRISING:-

The existing grounding system shall be extended to accommodate the augmentation work including connections of all steel structures and electrical apparatus to earth mesh and grounding electrodes.

2.2.1.10 POWER AND CONTROL CABLES

The Contractor shall be responsible for the supply, installation, termination and testing of all cables for the execution of the works.

The Contractor is on a turnkey basis and the prices for Definite Works entered by the Bidder in Schedule of Rates & Prices shall only be varied if the Contract requirements are altered, up or down. For the purpose of such variations, the rates shall be those in Schedule of Prices & Rates.

The rates for supply and installation shall be those appropriate to order of drum lengths as appropriate to each type and rating of cable.

The cable installation rates shall include excavation, backfilling and reinstatement of the ground, installation in concrete trenches and ducts and fixing to cable tracks and supports as necessary.

Control and power cables shall be armoured and they shall be laid in concrete trenches, in the switchyard and within the buildings, they shall be cleated to cable trays. However, any direct buried cables are not permitted in the substation. Cable trays and supports shall be supplied and installed in accordance with the Specification and included in the prices for Definite Work in Schedule of Prices & Rates.

2.2.1.10.1 36kV Power cables and terminations

- 02 Lots 36kV, XLPE insulated, Cu wire or Tape screen, PVC sheathed, Armoured single core cables for connections between Power transformer and 36kV indoor switchgear and termination accessories.
- 08 Lots 36kV, XLPE insulated, Cu wire or Tape screen, PVC sheathed, Armoured single core cables for connections from indoor switchgear panels to outdoor gantries for Line feeders and termination accessories.
- 02 Lots 36kV, XLPE insulated, Cu wire or Tape screen, PVC sheathed, Armoured single core cables for connections from indoor switchgear panels to outdoor gantries for Generator feeders and termination accessories.

2.2.1.10.2 All lowvoltage AC power cables and terminations

2.2.1.10.3 All DC power and control cables and terminations

2.2.1.10.4 All cables required for Protection, Control, Instrumentation, Communication, SCADA and termination.

2.2.1.10.5 All cables required for station lighting, small power, fire protection, ventilation equipment.

All cables required for station lighting, small power, fire protection, ventilation equipment. The Contractor shall be responsible for the supply, installation, and termination and testing of all cables for the execution of the works.

The Contractor is on a turnkey basis and the prices for Definite Works entered by the Bidder in Schedule of Rates & Prices shall only be varied if the Contract requirements are altered, up

or down. For the purpose of such variations, the rates shall be those in Schedule of Prices & Rates.

The rates for supply and installation shall be those appropriate to order of drum lengths as appropriate to each type and rating of cable.

The cable installation rates shall include excavation, backfilling and reinstatement of the ground, installation in concrete trenches and ducts and fixing to cable tracks and supports as necessary.

Control and power cables shall be armoured and they shall be laid in concrete trenches, in the switchyard and within the buildings, they shall be cleated to cable trays. Cable trays and supports shall be supplied and installed in accordance with the Specification and included in the prices for Definite Work in Schedule of Prices & Rates.

2.2.1.11 DIESEL GENERATOR SYSTEM

A Diesel generator to supply the substation 400V emergency supply with a minimum capacity of 40kVA. The Generator shall be rated for continuous operation for at least 24 hours.

2.2.1.12 SUPPORTING STRUCTURES INCLUDING GANTRIES

The existing 36kV gantries shall be used to terminate the 36kV feeders. New gantries shall be constructed for 4 Nos. of 36kV Feeders as shown in the drawing No. MNEGSAP/EMB/03-02. All support structures necessary for the works and all terminating lines specified under the Employer's Requirements shall be provided by the Contractor. Materials used for the structures shall comply with the Technical Specification – Grid Substation.

2.2.1.13 MISCELLANEOUS WORKS

Any work other than listed above.

2.2.1.14 SPARE PARTS

As per the price schedule

2.2.1.15 TOOLS AND INSTRUMENTS

As per the price schedule.

2.3 CIVIL WORKS, INSTALLATION, OTHER SERVICES AND TRAINING

2.3.1 CIVIL WORKS

2.3.1.1 EMBILIPITIYA GRID SUB STATION

2.3.1.1.1 Preliminary Works

- a) Site Survey
 - As per chapter 13 of Technical Specification Grid Substation.
- b) Sub Soil Investigations
 - As per chapter 13 of Technical Specification Grid Substation

2.3.1.1.2 Site Clearing

- a) Removing existing concrete/ masonry foundations
- Removing existing outdoor gantries of 2Nos. of 36kV Feeders as shown in the drawing No. MNEGSAP/EMB/03-01 & 02.
- c) Removing the portion of existing control building and wash room as shown in the drawing No. MNEGSAP/EMB/03-01 & 02.
- d) Removing existing 36kV Indoor Air Insulated Switchgears and existing buried Power cables. This includes disposal of the Indoor Air Insulated Switchgears from the Embilipitiya Grid Substation.
- e) Removing existing chain link fence as shown in the drawing no. MNEGSAP/EMB/03-02.
- f) Any other removals required for the execution of the contract

2.3.1.1.3 Site formation and up keeping

- a) Cutting and filling earth.
 - Formation level shall be existing switch yard level.
- b) Rock excavation
 - If rock excavation is required during earth works, payment shall be made for actual quantities of rock volume based on the volume ranges mentioned in the price schedule 4 of Volume 2.
- c) Earth retaining structures
 - Earth retaining walls

- Adequate erosion protection (retaining wall for the boundary) where required.

- All the embankments shall be protected as per specifications and drawings.

- Rubble pitching work
- d) Anti-Termite soil treatment

- Anti termite treatment with more than 10 years guaranty shall be done for the control building area.

e) Surface Chipping

- Area covered by the new earth mat.

2.3.1.1.4 Cable Trenches & Ducts

- As per chapter 13 of Technical Specification Grid Substation.
- Provision shall be made for all future cables.

2.3.1.1.5 Foundations

- a) For takeoff structures & switchgear
- As required for all the equipment support structures

2.3.1.1.6 Lightning protection system

- Extensions and modifications to lightning protection system as required, as per chapter 13 of Technical Specification - Grid Substation.

Water supply & drainage system 2.3.1.1.7

- a) Water supply system for new control building and temporary site office
 - As per the Specifications
- b) Waste water sewerage system for new control building and temporary site office
 - As per the specifications
- c) Surface water drainage system for the area covered by new earth mat

- As per the specification

2.3.1.1.8 **Construction & Maintenance of Roads**

a) Access road and structures

- Extension to the access road as shown in the Drwg No. MNEGSAP/EMB/03-02 and as per chapter 13 of Technical Specification -Grid Substation.

2.3.1.1.9 Fence, Gates and Boundary Walls

a) Chain link fence

- The existing chain link fence shall be extended as shown in the drawing No. MNEGSAP/EMB/03-02. For details refer drawings for fence and gates.

2.3.1.1.10 External Lighting & small power supply services

- Shall include all necessary extensions and modifications to Street and security lighting for the area of new 36kV gantry, new control building and extension of access road.

2.3.1.1.11 Construction of Control & Other Buildings

a) Control Building at Embilipitiya 132/33kV GSS

- As indicated in the drawings and as per chapter 13 of Technical Specification - Grid Substation

- b) Temporary Site Office at Embilipitiya 02 Nos. of 20ft containers with required facilities as shown in the drawing No. MNEGSAP/EMB/03-12
- c) Temporary Works (Stores, access, contractor's offices etc)
- d) House for Diesel Generator.
 - 1 No. Diesel generator shall be covered with a permanent structure.

2.3.1.1.12 Construction of Building Services

a) Air conditioning & ventilation system

- Refer chapter 13 of Technical Specification - Grid Substation.

- b) Fire protection
 - Refer chapter 13 of Technical Specification Grid Substation.
- c) Internal Lighting & small power supply services.
 - Refer chapter 130 Technical Specification Grid Substation

2.3.1.1.13 Miscellaneous Works

Any work other than listed above.

2.3.2 INSTALLATION

Erection, Installation and commissioning of structures Plant & Equipment specified in the clause 2.2 of Employer's Requirements

a) Embilipitiya 132/33 kV Grid Sub Station

2.3.3 OTHER SERVICES

2.3.3.1 ENGINEERS' LIVING ACCOMMODATION

Engineers living accommodation should be provided in close proximity to the following sites as per clause 14.1.2 of Technical Specifications-Grid Substations.

b) Embilipitiya 132/33 kV Grid Substation

informat

The contractor shall provide a fully furnished rented house/building from the contract commencement date. Further the contractor has to maintain the premises including the caretaker facility until completion of the project and handover to CEB.

2.3.4 TRAINING

The contractor shall provide the following training modules at OEM premises as specified in clause 14.2 of Technical Specification Grid Substation;

 Minimum Fifteen (15) days training for 02 Electrical Engineers covering the Training module given in 14.2.6: Substation Automation System for offered new SAS by a competent person from OEM

Annex A

Signal List (NSCC)

whomain conversion but the second

Mannar 220/33 kV GS

																					Anne	x A1	
		VOLTAGE	220/3 T/	33 kV F 2	220/3 T/I	0/33 kV 33 kV T/F 3																	
	1 1	BAY No	208	311	209	319	307	308	309	310	312	313	315	316	317	318	320	321	306	314			1
Mannar 220/33 kV GS	TYPE OF SIGNAL	BAY TYPE	220 kV side	33 kV side	220 kV side	33 kV side	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16	BS 1	BS 2	BB 1	BB 2	Station
CONTROLS		ACTION															┢───┥			\square			
Circuit Breaker	DPC	Open/Close	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	\square		
B Isolator 1	DPC	Open/Close	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	\square		
3B Isolator 2	DPC	Open/Close	2		2														2	2	\square		
ine Isolator	DPC	Open/Close					2	2	2		2	2	2	2	2	2	2	2		\square'	\square'		
Capacitor Bay Isolators	DPC	Open/Close						•												\square'	\square		
Earth Switch	DPC	Open/Close						S													\square		1
ap Changer (AVR) Raise / Lower	DPC	Raise/Lower	2		2			V												<u> </u>	\square		
ap Changer (AVR) Auto / Manual	DPC	Auto /Manual	2		2															\square	\square		
AVR Operating mode (One of the 2 modes will be available)	DPC DPC	Master/ Follower Minimum Circulation Current	2		2	S	0								\square			\square		\square	P		
VR Independent / Parallel	SPC	Independent/Parallel	1		1	×														<u> </u>			
Protection Master Relay Reset /(Protection Reset Command K86.1) (/Lockout Relay Reset) Protection Master relay Reset Command K86.2	SPC SPC	Reset Reset	1	1	1														1	1			
rolection Reset Command R90 (DD/DCF relay Reset)	SPC ODO	Reset	└── ┘	⊢ ′′	• 1	1					⊢ – /		⊢		┢──┤			┣──┦	<u> </u>	<u> </u>	\vdash	┢───╊	
Load Shedding OFF	SPC	On/Off	┥ ┥							/			┢──╁			\vdash		┥──┦		⊢ _'	∟	┢───╂	
	i I	l					ļ			↓/	/		↓			/		1/		⊢ '	←'	\vdash	
			\frown							\square			$ \longrightarrow $							⊢ _'	←'	$ \longrightarrow $	
STATUS INDICATIONS		STATUS	\mathbf{N}							\square			$ \longrightarrow $							⊢ _'	←'	$ \longrightarrow $	
Circuit Breaker	DPI	Open/Close	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	<u>ب</u>	\square	
BB Isolator 1	DPI	Open/Clo <mark>s</mark> e	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	<u> </u>		
BB Isolator 2	DPI	Open/Close	2		2														2	2	<u> '</u>		1
ine Isolator	DPI	Open/Close					2	2	2	2	2	2	2	2	2	2	2	2		\square'	\square'		
Capacitor Bay Isolator	DPI	Open/Close																		<u> </u>	\square		
Earthing Switch	DPI	Open/Close		2		2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	\square		
																				<u> </u>	\square		
Bay Control	DPI	Local/Superv/Remote	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	\square		1
																			\square	<u> </u>	\square		
RANSFORMER																\square			\square	\square	\square		1
Fap Control	DPI	Local/Superv	2		2														\square	<u> </u>	\square		1
T/F AVR Operating mode	DPI	Manual /Auto	2		2														\square	<u> </u>	\square		
, ,	DRI	Master/Follower																		'	\frown		
T/F AVR Operating mode (One of the 2 modes will be available)		Minimum Circulation	2		2																\square		
· · · · · · · · · · · · · · · · · · ·	DPI	Current	1 '								1 1	1 '	1		1	1 1		1 /	1	1 '	1 '	1 1	1
AVR Parallel / Indipendent	SPI	Paralle/ Indipendant	1		1															<u> </u>	\square		1
																					\square		
Capacitor Bank		1																			\square		
Capacitor Bank Operating Mode	SPI	Manual /Auto																		<u> </u>	\square		
																				<u> </u>	\square		
A L A R M INDICATIONS																				<u> </u>	<u> </u>		
																				<u> </u>	<u> </u>		
	i – 1	//											<u> </u>								<u> </u>		1
	└────┦			⊢′			-			┣──┦	⊢/		┝──┼		\vdash			┣──┦	⊢	<u> </u>	—′	┢───╊	
Circuit Breaker Triping Indication	SPI	Healthy/Faulty	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-1'	<u> </u>		
																				<u> </u>	<u> '</u>		1
Breaker Fault (critical) - ***	SPI	Healthy/Faulty	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1 7	(T	. 7
a SF6 Gas Presure low. (2nd stage)	!																			<u> </u>	\frown		
b Trip Circuit Supervision Fail 1 (Trip circuit faulty)					Ī	1	Ī	1	Ī										$ \neg $		\square	-	

	Mannar	220/33	kV	GS
--	--------	--------	----	----

		VOLTAGE	220/ T/	33 kV F 2	220/3 T/I	33 kV F 3 33 kV																	
		BAY No	208	311	209	319	307	308	309	310	312	313	315	316	317	318	320	321	306	314			
Mannar 220/33 kV GS	TYPE OF SIGNAL	BAY TYPE	220 kV side	33 kV side	220 kV side	33 kV side	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16	BS 1	BS 2	BB 1	BB 2	Station
c Trip Circuit Supervision Fail 2 ((Trip circuit 2 faulty)																							
d Spring Not Charge (Spring Supervision)																							
e Hydraulic Pressure Low											2											1	
f Pneumatic Pressure Low.																	I		I				
g CB Pole Discrepancy											•						µ		µ				
h Irip Lockout/Close Lockout (SF6 Lock out)										5													
i Control Voltage Failure (DC MCB trip)									\mathbf{O}							\vdash		\vdash	<u> </u>	<u> </u>		ł	
j Internal Arc trip b SE6 Gas Prosure Jow in Pus Par Chambor								\mathbf{O}								\vdash	 	\vdash	 	<u> </u>		ł	
Pay Fault (Non pritical) - ***	CDI	Hoalthy/Faulty	4	4					-	4			1	1	1	- 1	4	- 1	4			 	
a SE6 Gas Pressure Low - First sten	371	nealiny/Faulty	1	1	1			+	1				1	I	1	⊢ '		⊢ '		⊢ '	 	-	
PT Secondary MCB Trin (Protection V/T MCB Failed/ Incoming Voltage MCB																\vdash		\vdash		<u> </u>			
h trip/ VT MCB trip)						<u> </u>	\mathbf{C}										1		1				
c AC/DC Voltage Failure Indication (Auxiliary Fail)	-					¥																	
						~															_		
TRANSFORMER MECHANICAL PROTECTION																							
Tap Changer Mechanism Fault (OLTC failure)	SPI	Healthy/Faulty	1	1	1	1																	
Tap out of step (TAP OUT ERROR)	SPI	Onset/Reset	1	1	· 1	1											<u> </u>		<u> </u>				
Transf Buchholz Alarm - ***	SPI	Onset/Reset	1	1	1	1																	
a Transf Buchholz Alarm			4																				
b OLTC Buchholz Alarm			()														/		ļ[,	
Transf Buchholz Trip	SPI	Operated/Normal	1	1	1	1											µ		ļ]		,	,	
OLIC Buchholz Trip (OLIC OIL Flow Relay Trip)	SPI	Operated/Normal	1	1	1	1																	
ET Transf Buchholz Trip	SPI	Operated/Normal	1	1	1	1										\vdash		\vdash		┝──┦		ł	
	SPI	Operated/Normar														\vdash	 	\vdash	 	<u> </u>		ł	
I emperature Alarm - """	SPI	Onset/Reset	1	1	1	1										\vdash		\vdash	 	\vdash			
a Oli Temperature Alarm																\vdash		\vdash	 			ł	
D Winding IV Temperature Alarm	-															\vdash		\vdash		⊢ – –		ł	
	SDI	Operated/Normal	1	1	1	1											— 		—	\vdash			
2 Oil Temperature trip	351	operateu/Normai	- 1	- 1	- 1	-										⊢−−┦		⊢−−┦		⊢−−┦	 		
b Winding HV Temperature trip																	— 			\vdash			
c Winding LV Temperature trip																							
General Alarm - ***	SPI	Onset/Reset	1	1	1	1																	
a Cooling Fan Fail (Group 1/Group 2)	\mathbf{O}	0110001100001	· · ·																				
b Transformer Oil Level Iow																							
c OLTC Oil level low																					1		
General Trip - ***	SPI	Operated/Normal	1	1	1	1										\square		\square					
a OLTC Surge Trip		•																					
b Main tank Presure Release Valve (PRV) Trip																							
c OLTC Pressure Release Valve																							
d Transformer Oil Level low TRIP																							
e OLTC Oil level low																\square	µ]	\square	µ]	\square	 		
PROTECTION SIGNALS																							
LINE PROTECTION																							
																шJ		шJ	<u>لـــــا</u>	\square	I	[
Main 1 - Differential protection operated	SPI	Operated /Normal														\square	با	\square	ا	\square	<u> </u>		
Main 1 - Distance Zone 1 operated	SPI	Operated /Normal		1	I		I	I								1		1	. 1				. 1

Mannar 220/33 kV GS

		VOLTAGE	220/3 T/I	33 kV = 2	220/ T/	33 kV F 3	kV 3																
		BAY No	208	311	209	319	307	308	309	310	312	313	315	316	317	318	320	321	306	314			1
Mannar 220/33 kV GS	TYPE OF SIGNAL	BAY TYPE	220 kV side	33 kV side	220 kV side	33 kV side	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16	BS 1	BS 2	BB 1	BB 2	Station
Main 1 - Distance Zone 2 operated	SPI	Operated /Normal																					1
Main 1 - Distance Zone 3 operated	SPI	Operated /Normal																					
Main 1 - Distance Zone 3 operated	SPI	Operated /Normal							-														
Main 1 - Distance protection operated	901 901	Operated /Normal							•														
Main 1 -Distance protection operated	SFI	Operated /Normal									-												
Main 1 - Directional Earth Fault Operated	5P1 9D1	Operated /Normal																	-				
	3F1	Operated /Normal								-													
								O															
Main 2. Differential protection energted	CDI	Oneveted (Nerman																	-				
Main 2- Diletential protection operated	SPI	Operated /Normal																					
Main 2 - Distance Zone 1 operated	SPI	Operated /Normal							-										-				
Main 2 - Distance Zone 2 operated	SPI	Operated /Normal					\mathbf{O}	Ť															
Main 2 - Distance Zone 3 operated	SPI	Operated /Normal																					µ
Main 2 - Distance Zone 4 operated	SPI	Operated /Normal																					L
Main 2 - Distance protection operated	SPI	Operated /Normal																					
Main 2 - Directional Earth Fault operated	SPI	Operated /Normal																					1
Main 2 - Distance Protection Aided Trip	SPI	Operated /Normal																					
Over Current Protection trip	SPI	Operated /Normal					1	1	1	1	1	1	1	1	1	1	1	1	1	1			L
Earth Fault Protection Operated	SPI	Operated /Normal					1	1	1	1	1	1	1	1	1	1	1	1	1	1			µ
																							L
Pole Discrepancy Protection Operated	SPI	Operated /Normal	\mathbf{O}																				µ
Auto Recloser Operated / Success / Progress	SPI	Operated /Normal																	-				
Direct Intertrip Send	SPI	Operated /Normal																	-				
Direct Intertrip Received	SPI	Operated /Normal																					J
Permissive Intertrip Send (carrier send)	SPI	Operated /Normal																					
Permissive Intertrip Received (carrier receive)	SPI	Operated /Normal																					
DEF Protection carrier Send	SPI	Operated (Normal																					
DEF Protection carrier Receive	SPI	Operated /Normal				-		-															·
Communication Fail (Differential block)	5F1	Operated /Normal							-										-				
Switch On To Fault trip (SOTE trip)		Operated /Normal																	-				
Over Voltage trip (OV)	SP	Operated /Normal																					
Breaker Failure Protection Operated	SPI	Operated /Normal	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			
Trip Relay Operated/ Protection Relay K86.1 /Lockout Relay operated	SPI	Set/Reset	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			
Trip Relay Operated/Protection Relay K86.2	SPI	Set/Reset	1		1														1	1			
Protection Relay K96	SPI	Set/Reset																	1	1			
Under Frequency Trip	SPI	Operated /Normal					1	1	1	1	1	1	1	1	1	1	1	1					1
Over Frequency Trip	SPI	Operated /Normal					1	1	1	1	1	1	1	1	1	1	1	1					
				-																			
					L					I													
Main 1 Protection Relay Fail	SPI	Healthy/ Fail	1		1					I													
Main 2 Protection Relay Fail	SPI	Healthy/ Fail	1		1	ļ				I													·
Back Up Protection Relay Fail	SPI	Healthy/ Fail	1		1	ļ				I													·
Auto Reicose ON/OFF	SPI	ON / OFF			I	ļ				I													
33KV protection Operated	SPI	Operated /Normal			<u> </u>	<u> </u>				I			<u> </u>						——				
BUSDAK PROTECTION	CDI	Operated /Normal	4		-														4	4			
		Operated /Normal			<u> </u>					1													

Mannar 220/33 kV GS

		VOLTAGE	220/: T/	33 kV F 2	220/ T/	/33 kV /F 3	3 KV 3																
		BAY No	208	311	209	319	307	308	309	310	312	313	315	316	317	318	320	321	306	314			
Mannar 220/33 kV GS	TYPE OF SIGNAL	BAY TYPE	220 kV side	33 kV side	220 kV side	33 kV side	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16	BS 1	BS 2	BB 1	BB 2	Station
																				L			L
TRANSFORMER PROTECTION)										<u> </u>	L
Differential Protection Operated	SPI	Operated /Normal	1		1	1																	L
HV Restricted Earth Fault	SPI	Operated /Normal	1		1	1					·												L
LV Restricted Earth Fault	SPI	Operated /Normal	1		1	1				5													L
Transformer earth Fault Protection Operated	SPI	Operated /Normal	1	1	1	1 1		•															
Transformer Stand By EF Protection Operated	SPI	Operated /Normal	1	1	1	1															<u> </u>		
Transformer Over Current Protection trip (OCProtection I>trip)	SPI	Operated /Normal	1	1	1	1			D													<u> </u>	<u> </u>
Over Voltage Protection	SPI	Operated /Normal	1		1	1																	
Over Fluxing Protection	SPI	Operated /Normal	1		1	1																	
T/F Thermal Overload	SPI	Operated /Normal	1		1																		
CAPACITOR BANK							\sim																
Phase OverVoltage Operated	SPI	Operated /Normal				×																	
						~																	
STATION ALARMS																							
Under Frequency Load Shedding Operated	SPI	Operated/Normal					1	1	1	1	1	1	1	1	1	1	1	1					
Bus Voltage Failure - ***	SPI	Healthy/Faulty																					
a Auxialary Supply Voltage	SPI	Healthy/Faulty																					
b DC Voltage Failure (110V DC MCB Trip)	SPI	Healthy/Faulty																					
Gateway Alarm(Running A/Running B)	SPI	Healthy/Faulty			-			-								-				├ ──			1
Communication Alarm (Communication Malfuntion)	SPI	Healthy/Faulty																		1	<u> </u>	┟──┤	
Better: Charger Failure (Communication) ***			\mathbf{N}	-																1			1
Battery Charger Failure (Communication) -	581	Healthy/Faulty							-											—		┣──┘	I
a 48V Battery Charger 2 Fail			<u> </u>																	—		┣──┘	I
b [48V Battery Charger 1 Fail /(Rectifier 1 Fault)	0.51																			 	_	<u> </u>	1
	SPI	Healthy/Faulty																		—		┣──┘	I
a 220 V Battery Charger 2 Fail /(Rectifier 1 Fault)																				 	_	<u> </u>	1
b [220 V Battery Charger 1 Fail (Rectifier 2Fault)																				 	_	<u> </u>	1
Station Urgent Fault - ***	SPI	Operated /Normal																			<u> </u>		
a Fox Faulty Urgent Alarm																					<u> </u>		
Station Non Urgent Fault - ***	SPI	Operated/Normal																					
a Diesel Generator Alarm																							
b Fox Faulty Non Urgent Alarm		•																					
Station Control Remote/Supervisory	DPI	Remote/Superviosry																					
	\sim																						
ENERGY MEASUREMENTS																							
Active Energy	AI	MWh																					
Re-Active Energy	AI	Mvarh																					
MEASUREMENTS		UNITS																					
Voltage	AI	Volts	1	1	1	1 1	1	1	1	1	1	1	1	1	1	1	1	1			1	1	
Frequency	AI	Hertz	1	1	1	1 1															1	1	
Active Power	AI	MW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1
Reactive Power	AI	MVAr	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
Current	AI	Amperes	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	t –
Transformer Tap Position	AI	Tap number	1	1		1	1	1	1								1	1	1		Ì	1	<u> </u>
Power Factor	AI	PF	1		1	1	1	1		1							Ī	1	Ī	L	1	1	
		İ	1		1	1	1	1	1												t —		
GENERAL	l	İ	1		1	1	1	1	1												t —		
Air Condition Temprature	AI	Celcius	1		1	1	1	1	1												t —		1
Humidity	Al	RH %	1		1	1	1	1	1	1								1					1

									•		\sim	り											
		VOLTAGE	220/: T/	33 kV F 2	220/: T/	33 kV = 3		ò	6	0.				33	kV								
		BAY No	208	311	209	319	307	308	309	310	312	313	315	316	317	318	320	321	306	314			
Mannar 220/33 kV GS	TYPE OF SIGNAL	BAY TYPE	220 kV side	33 kV side	220 kV side	33 kV side	E5	F6	77	F8	F9	F10	F11	F12	F13	F14	F15	F16	BS 1	BS 2	BB 1	BB 2	Station
Solar Iradiance	Al	W/m ²																					

ろ

Legend

Jus Bar BS= Bus Sec. Al Analogue Measurement AO Analogue Output BC = BusCoupler T/F = Transformer G = Generator C = Capacitor F = Feeder BB= Bus Bar BS= Bus Section MH= Mini Hydro D= Dendro Power GF=Generator Feeder BSC= Capacitor Bank

TYPE OF SIGNAL

- DPC Double Point Control Command
- SPC Single Point Control Command
- DPI Double point indication input
- SPI Single point indciation input

Double points are counted individually

*** :- Grouped Alarms

			Annex A2	
		VOLTAGE	220/33 kV	Г/F 4
Nadukuda 220/33 kV GS	TYPE OF	BAY No	207	318
	SIGNAL	ΒΑΥ ΤΥΡΕ	220 kV side	33 kV side
CONTROLS		ACTION		
Circuit Breaker	DPC	Open/Close	2	2
BB Isolator 1	DPC	Open/Close	2	2
BB Isolator 2	DPC	Open/Close	2	
Capacitor Bay Isolators	DPC	Open/Close		
Earth Switch	DPC	Open/Close		
Tap Changer (AVR) Raise / Lower	DPC	Raise/Lower	2	1
Tap Changer (AVR) Auto / Manual	DPC	Auto /Manual	2	
AVR Operating mode (One of the 2 modes will be available)	DPC	Master/ Follower Minimum Circulation	2	
AV/P Independent / Parallel	DPC	Current	1	
	3PC	Independent/Parallel	I	
Protection Master Relay Reset /(Protection Reset Command K86.1) (/Lockout Relay Reset)	SPC	Reset	1	1
Protection Master relay Reset Command K86.2	SPC	Reset	1	1
Protection Reset Command K96 (BB/BCF relay Reset)	SPC	Reset		1
Load Snedding UFF	SPC	Un/Ott		
			•	<u> </u>
STATUS INDICATIONS		STATUS		
Circuit Breaker	DPI	Onen/Close	2	2
BB Isolator 1	DPI	Open/Close	2	2
BB Isolator 2	DPI	Open/Close	2	
Line Isolator	DPI	Open/Close		[]
Capacitor Bay Isolator	DPI 🌔	Open/Close		
Earthing Switch	DPI 💆	Open/Close	4	2
	X	•		
Bay Control	DPI	Local/Superv/Remote	2	2
Tan Control	DPI	Local/Superv	2	
T/F AVR Operating mode	DPI	Manual /Auto	2	
T/F AVR Operating mode (One of the 2 modes will be available)	DPI	Master/Follower Minimum Circulation	2	
	DPI	Current		
AVR Parallel / Indipendent	SPI	Paralle/ Indipendant	1	
Companition Bowle				
Capacitor Bank	SPI	Manual /Auto		
	011	Manual /Auto		
CIRCUIT BREAKER				[
Circuit Breaker Trining Indication	SPI	Healthy/Faulty	1	1
	0.1	incutiny/r duity		•
Breaker Fault (critical) - ***	SPI	Healthy/Faulty	1	1
a SE6 Gas Presure low (2nd stage)	011	riounity/r duity		
b Trip Circuit Supervision Fail (Trip circuit faulty)				
c Trip Circuit Supervision Fail 2 ((Trip circuit 2 faulty)				
d Spring Not Charge (Spring Supervision)				
e Hydraulic Pressure Low				
t Pneumatic Pressure Low.				l
g CB Pole Discrepancy				
i Control Voltage Failure (DC MCB trin)				
j Internal Arc trip	1			
h SF6 Gas Presure low in Bus Bar Chamber				1
Bay Fault (Non critical)- ***	SPI	Healthy/Faulty	1	1
a SF6 Gas Pressure Low - First step				
PT Secondary MCB Trip (Protection VT MCB Failed/ Incoming Voltage MCB				
b [trip/ VT MCB trip)	ļ			
c AC/DC Voltage Failure Indication (Auxiliary Fail)				
<u>} </u>				
TRANSFORMER MECHANICAL PROTECTION				<u> </u>
Tap Changer Mechanism Fault (OLTC failure)	SPI	Healthv/Faultv	1	1
Tap out of step (TAP OUT ERROR)	SPI	Onset/Reset	1	1
Transf Buchholz Alarm - ***	SPI	Onset/Reset	1	1
a Transf Buchholz Alarm	1			[
b OLTC Buchholz Alarm				

Nadukuda 220/33 kV GS Tree of isohat Eax to by Tope 207 318 Transf Buchtoz, Trip OLTG, Buchtoz, Trip OLTG, Buchtoz, Trip OLTG, Buchtoz, Trip OLTG, Buchtoz, Trip OLTG, Buchtoz, Trip OLTG, Buchtoz, Trip Tempetator Atam PP Operated/Normal 1 1 OLTG, Buchtoz, Trip OLTG, Buchtoz, Trip OLTG, Buchtoz, Trip Tempetator Atam SPI Operated/Normal 1 1 Tempetator Atam SPI Operated/Normal 1 1 1 Bit Tope Status Atam SPI Operated/Normal 1 1 1 Bit Words (V) Tempetature Atam SPI Operated/Normal 1 1 1 Bit Monds (V) Tempetature Atam SPI Operated/Normal 1 1 1 Bit Monds (V) Tempetature Trip SPI Operated/Normal 1 1 1 Control Tempetature Trip SPI Operated/Normal 1 1 1 Bit Monds (V) Tempetature Trip SPI Operated/Normal 1 1 1 Bit Monds (V) Tempetature Trip SPI Operated/Normal 1 1 1			VOLTAGE	220/33 kV	T/F 4
Note: BAY TYPE 220 kV side 33 kV side Timed Suchtikz, Trig Operated/Normal 1 1 Cline Buthitz, Trig SPI Operated/Normal 1 1 All Timed Buthitz, Trig SPI Operated/Normal 1 1 All Timed Buthitz, Trig SPI Operated/Normal 1 1 All Timed Buthitz, Trig SPI Operated/Normal 1 1 Bitty Triggenture Alarm SPI Operated/Normal 1 1 Bitty Triggenture Alarm SPI Operated/Normal 1 1 Bitty Triggenture Trig	Nadukuda 220/33 kV GS	TYPE OF	BAY No	207	318
Transf Scholz Trp Sin OperatedNormal 1 1 ET Transf Scholz Trp SPI OperatedNormal 1 1 ET Transf Scholz Trp SPI OperatedNormal 1 1 Transf Scholz Trp SPI OperatedNormal 1 1 Transf Scholz Trp SPI OperatedNormal 1 1 Transf Scholz Trp SPI OperatedNormal 1 1 Transf Scholz Trp SPI OperatedNormal 1 1 OWndig UY Temperature trp SPI OperatedNormal 1 1 1 B Windig UY Temperature trp SPI Oncel/Reset 1		SIGNAL	BAY TYPE	220 kV side	33 kV side
Ol. TO Exception Try (OLT COL Flow Reley Try) SPI Operated/Normal 1 1 Conscription To point SPI Operated/Normal 1 1 Transportation To point SPI Operated/Normal 1 1 Di Transportation Alam SPI Operated/Normal 1 1 Di Moding UV Tengenture Alam SPI Operated/Normal 1 1 Di Moding UV Tengenture Alam SPI Operated/Normal 1 1 Di Moding UV Tengenture Alam SPI Operated/Normal 1 1 Di Moding UV Tengenture Alam SPI Operated/Normal 1 1 Di Moding UV Tengenture Alam SPI Operated/Normal 1 1 Di Colong Fan Fall (Secure V SPI Operated/Normal 1 1 Di Colong Fan Fall (Secure V SPI Operated/Normal 1 1 Di Colong Fan Fall (Secure V SPI Operated/Normal 1 1 Di Colong Fan Fall (Secure V SPI Operated/Normal 1 1	Transf Buchholz Trip	SPI	Operated/Normal	1	1
If Taref Buchniz Trip SP1 Operated/Kormal 1 Tremp Output SP1 Operated/Kormal 1 1 Temp Autom Trie SP1 Operated/Kormal 1 1 Temp Autom Trie SP1 Operated/Kormal 1 1 Ownong UV Temperature Autom P Operated/Kormal 1 1 Ownong UV Temperature Kip SP1 Operated/Kormal 1 1 Ownong UV Temperature Kip SP1 Operated/Kormal 1 1 Ownong VV Temperature Kip SP1 Operated/Kormal 1 1 1 Ownong VV Temperature Kip SP1 Operated/Kormal 1	OLTC Buchholz Trip (OLTC OIL Flow Relay Trip)	SPI	Operated/Normal	1	1
Art Transmittant SP1 Operated Name 1 1 Art Transmittant SP1 Operated Name 1 1 B Minong MY Temperature Alarm Image Name	ET Transf Buchholz Trip	SPI	Operated/Normal	1	1
Interpretation 4 Autom Shift Ontercheeter 1 1 0 Winding UV Temperature Alarm		SPI	Operated/Normal	1	1
a) Winding UV Temperature Alarm	I emperature Alarm -	SPI	Unset/Reset	1	1
c Wonding LV Temperature Name SPI Operated Normal 1 1 a D1 Temperature trip SPI Operated Normal 1 1 b Minding LV Temperature trip SPI Oncel/Reset 1 1 c Minding LV Temperature trip SPI Oncel/Reset 1 1 c Colong Fan Fal (Group 2) SPI Oncel/Reset 1 1 c Colong Fan Fal (Group 2) SPI Operated Normal 1 1 1 c Colong Fan Fal (Group 2) SPI Operated Normal 1 1 1 c Colong Fan Fal (Group 2) SPI Operated Normal 1 1 1 c Colong Fan Fal (Group 2) SPI Operated Normal 1 1 1 c Colong Fan Fal (Group 2) SPI Operated Normal 1 1 1 1 c Colong Fan Fal (Group 2) SPI Operated Normal 1 1 1 1 1	b Winding HV Temperature Alarm				
Temperature trip .**** SPI Operated Normal 1 1 b Winding LV Temperature trip	c Winding LV Temperature Alarm				
a Control Temperature trip b Minding IV Temperature trip c Min rule Trendson Level low c Min rule Trendson Level low c Min rule Trendson Level low d Min rule Trendson Release Valve (PRV) Trip d Out Coll level low d Min rule Trendson Release Valve (PRV) Trip d Min rule Trendson Release Valve (PRV) Trip d Out Coll level low d Differential protection operated diff rule Trendson Release Valve (PRV) Trip Differential protection operated diff rule Trendson Release Valve (PRV) Trip Differential protection operated diff rule Trendson Release Valve (PRV) SPI	Temperature trip - ***	SPI	Operated/Normal	1	1
b Minding LV Temperature trip	a Oil Temperature trip				
c Mindig LV Temperature trip.	b Winding HV Temperature trip				
General Alarm.*** SPI Onsel/Reset 1 a Cooling Fail (Group 1/Group 2)	c Winding LV Temperature trip				
a Cooling Fan Fail (Group 1/Group 2) Cooling Fan Fail (Group 1/Group 2) Constraints of Level low Concernant Trajer Version Role and Valve (PRV) Trip Main tark Frequer Roleade Valve (PRV) Trip Main tark Frequer Roleade Valve Transformer Role well tow TRIP Constraints of Level low TRIP Constraints of Level	General Alarm - ***	SPI	Onset/Reset	1	1
o Instability of the set low Image: SPI operated Normal 1 Gut Co User Top SPI operated Normal 1 1 Gut Co Supe Trip Image: SPI operated Normal 1 1 Gut Co Supe Trip Image: SPI operated Normal 1 1 Gut Co Supe Trip Image: SPI operated Normal 1 1 Gut Co Supe Trip Image: SPI operated Normal 1 1 Gut Co Supe Trip Image: SPI operated Normal 1 1 Gut Co Supe Trip Image: SPI operated Normal 1 1 Main 1 - Distance Zone 1 operated SPI operated Normal 1 1 Main 1 - Distance Zone 3 operated SPI operated Normal 1 1 Main 1 - Distance Zone 3 operated SPI operated Normal 1 1 Main 1 - Distance Zone 4 operated SPI operated Normal 1 1 Main 1 - Distance Zone 3 operated SPI operated Normal 1 1 Main 2 - Distance Zone 3 operated SPI operated Normal 1 1 Main 2 - Distance Zone 4 operated SPI operated Normal<	a Cooling Fan Fail (Group 1/Group 2)				
Lo Defined Trip SPI Operated Normal 1 1 Main tark Nersure Relaxes Valve (PRV) Trip SPI Operated Normal 1 1 Main tark Nersure Relaxes Valve (PRV) Trip SPI Operated Normal 1 1 In Life Coll revel low SPI Operated Normal SPI SPI Revel Low SPI Operated Normal SPI SPI Main 1 - Distance Zone 1 operated SPI Operated Normal SPI Main 1 - Distance Zone 3 operated SPI Operated Normal SPI Main 1 - Distance Zone 3 operated SPI Operated Normal SPI Main 1 - Distance Zone 3 operated SPI Operated Normal SPI Main 1 - Distance Zone 3 operated SPI Operated Normal SPI Main 1 - Distance Zone 3 operated SPI Operated Normal SPI Main 1 - Distance Zone 3 operated SPI Operated Normal SPI Main 1 - Distance Zone 3 operated SPI Operated Normal SPI Main 2 - Distance Zone 3 operated SPI Operated Normal SPI Main 2 - Distance Zone 3 operated SPI Operated Normal SPI Main 2 - Distance Zone 3 operated SPI Operated Normal SPI	b Transformer Oil Level Iow				
General mini- Serie Operated Normal DLTC Surge Trip Image Series Image Series DLTC Oil level low File Image Series DLTC Oil level low Series Image Series DLTC Oil level low Series Image Series PROTECTION SIGNALS Image Series Image Series LIME PROTECTION Series Operated Normal Main 1 - Distance Zone 1 operated Series Operated Normal Main 1 - Distance Zone 2 operated Series Operated Normal Main 1 - Distance Zone 3 operated Series Operated Normal Main 1 - Distance Zone 4 operated SPI Operated Normal Main 1 - Distance Zone 4 operated SPI Operated Normal Main 1 - Distance Zone 4 operated SPI Operated Normal Main 1 - Distance Zone 4 operated SPI Operated Normal Main 1 - Distance Zone 4 operated SPI Operated Normal Main 2 - Distance Zone 4 operated SPI Operated Normal Main 2 - Distance Zone 4 operated SPI Operated Normal Main 2	Concret Trin ***		Onersted/Nermal		1
a Dict Construction Release Value (PRV) Trip c Dict Release Value (PRV) Trip c Dict Release Value (PRV) Trip c Dict Release Value (PRV) Trip c Dict Release Value (PRV) Trip c Dict Release Value (PRV) Trip c Dict Release Value (PRV) Trip c Dict Release Value (PRV) Trip c Dict Release Value (PRV) Trip c Dict Release Value (PRV) Trip c Dict Release Value (PRV) Trip c Dict Release Value (PRV) Trip diatin 1. Distance Zone 1 operated SPI Main 1. Distance Zone 3 operated SPI Main 1. Distance Zone 4 operated SPI Main 1. Distance Zone 4 operated SPI Main 1. Distance Zone 4 operated SPI Main 2. Differential protection operated SPI Main 2. Differential protection operated SPI Main 2. Distance Zone 4 operated SPI Main 2. Distance Zone 4 operated SPI Main 2. Distance Zone 4 operated SPI Main 2. Distance Zone 4 operated SPI Operated Normal Main 2. Distance Zone 4 operated <td>General Trip -</td> <td>SPI</td> <td>Operated/Normal</td> <td></td> <td>1</td>	General Trip -	SPI	Operated/Normal		1
c D11C Pressure Release Valve	h Main tank Presure Release Valve (PRV) Trin				
d Transformer OiL cevel low TRIP OLC Oil veel low OCT Coll veel lo	c OLTC Pressure Release Valve			•	
e DLTC Oil level low	d Transformer Oil Level Iow TRIP				
Link PROTECTION LINE PROTECTION Main 1- Distance Zone 1 operated SPI Main 1 - Distance Zone 2 operated SPI Main 1 - Distance Zone 3 operated SPI Main 1 - Distance Zone 3 operated SPI Main 1 - Distance Zone 3 operated SPI Main 1 - Distance Zone 4 operated SPI Main 1 - Distance Zone 4 operated SPI Main 1 - Distance Zone 4 operated SPI Main 1 - Distance Zone 4 operated SPI Main 1 - Distance Zone 4 operated SPI Main 1 - Distance Zone 4 operated SPI Operated Normal Main 1 - Distance Zone 4 operated Main 1 - Distance Zone 4 operated SPI Operated Normal Main 2 - Distance Zone 4 operated Main 2 - Distance Zone 4 operated SPI Operated Normal Main 2 - Distance Zone 4 operated Main 2 - Distance Zone 4 operated SPI Operated Normal <	e OLTC Oil level low				
PROTECTION SIGNALS SPI Operated Normal Line PROTECTION SPI Operated Normal Main 1 - Distance Zone 1 operated SPI Operated Normal Main 1 - Distance Zone 2 operated SPI Operated Normal Main 1 - Distance Zone 4 operated SPI Operated Normal Main 1 - Distance Zone 4 operated SPI Operated Normal Main 1 - Distance Zone 4 operated SPI Operated Normal Main 1 - Distance Protection operated SPI Operated Normal Main 1 - Distance Protection Alded Trip SPI Operated Normal Main 2 - Distance Zone 3 operated SPI Operated Normal Main 2 - Distance Zone 4 operated SPI Operated Normal Main 2 - Distance Zone 4 operated SPI Operated Normal Main 2 - Distance Zone 4 operated SPI Operated Normal Main 2 - Distance Zone 4 operated SPI Operated Normal Main 2 - Distance Zone 4 operated SPI Operated Normal Main 2 - Distance Zone 4 operated SPI Operated Normal Main 2 - Distance Protection nation SPI					
LINE PROTECTION Ani In Distance Zone 1 operated Ani 1 - Distance Zone 2 operated Ani 1 - Distance Zone 2 operated Ani 1 - Distance Zone 2 operated Ani 1 - Distance Zone 3 operated Ani 1 - Distance Zone 3 operated Ani 1 - Distance Zone 3 operated Ani 1 - Distance Zone 4 operated Ani 1 - Distance Zone 4 operated Ani 1 - Distance Zone 4 operated Ani 1 - Distance Zone 4 operated Ani 1 - Distance Zone 4 operated Ani 1 - Distance Zone 4 operated Ani 1 - Distance Zone 4 operated Ani 1 - Distance Zone 4 operated Ani 1 - Distance Zone 4 operated Ani 1 - Distance Zone 4 operated Ani 2 - Distance Protection Aided Trip Ani 2 - Distance P	PROTECTION SIGNALS				
Main 1 - Differential protection operated SRI Operated Normal Main 1 - Distance Zone 1 operated SPI Operated Normal Main 1 - Distance Zone 2 operated SPI Operated Normal Main 1 - Distance Zone 4 operated SPI Operated Normal Main 1 - Distance Zone 4 operated SPI Operated Normal Main 1 - Distance protection operated SPI Operated Normal Main 1 - Distance protection operated SPI Operated Normal Main 1 - Distance Protection operated SPI Operated Normal Main 2 - Distance Zone 3 operated SPI Operated Normal Main 2 - Distance Zone 1 operated SPI Operated Normal Main 2 - Distance Zone 3 operated SPI Operated Normal Main 2 - Distance Zone 3 operated SPI Operated Normal Main 2 - Distance Zone 4 operated SPI Operated Normal Main 2 - Distance Zone 4 operated SPI Operated Normal Main 2 - Distance Zone 4 operated SPI Operated Normal Main 2 - Distance Zone 4 operated SPI Operated Normal Main 2 - Distance Zone 4 operated SPI Operated Normal	LINE PROTECTION				
Main 1 - Differential protection operated SPL Operated Normal Main 1 - Distance Zone 2 operated SPI Operated Normal Main 1 - Distance Zone 2 operated SPI Operated Normal Main 1 - Distance Zone 4 operated SPI Operated Normal Main 1 - Distance Zone 4 operated SPI Operated Normal Main 1 - Distance Zone 4 operated SPI Operated Normal Main 1 - Distance Protection Aledt Fault operated SPI Operated Normal Main 1 - Distance Protection operated SPI Operated Normal Main 2 - Differential protection operated SPI Operated Normal Main 2 - Distance Zone 1 operated SPI Operated Normal Main 2 - Distance Zone 1 operated SPI Operated Normal Main 2 - Distance Zone 4 operated SPI Operated Normal Main 2 - Distance Zone 4 operated SPI Operated Normal Main 2 - Distance Protection Alede Trip SPI Operated Normal Main 2 - Distance Protection Alede Trip SPI Operated Normal Main 2 - Distance Zone 4 operated SPI Operated Normal Main 2 - Distance Protection Alede Trip SPI Opera		<u> </u>	O'		
Main 1 - Distance Zone 2 operated SPI Operated Normal Main 1 - Distance Zone 3 operated SPI Operated Normal Main 1 - Distance Zone 4 operated SPI Operated Normal Main 1 - Distance Zone 4 operated SPI Operated Normal Main 1 - Distance Protection operated SPI Operated Normal Main 1 - Distance Protection operated SPI Operated Normal Main 1 - Distance Protection Aided Trip SPI Operated Normal Main 2 - Distance Zone 1 operated SPI Operated Normal Main 2 - Distance Zone 2 operated SPI Operated Normal Main 2 - Distance Zone 2 operated SPI Operated Normal Main 2 - Distance Zone 3 operated SPI Operated Normal Main 2 - Distance Zone 4 operated SPI Operated Normal Main 2 - Distance Zone 4 operated SPI Operated Normal Main 2 - Distance Zone 4 operated SPI Operated Normal Main 2 - Distance Zone 4 operated SPI Operated Normal Main 2 - Distance Zone 4 operated SPI Operated Normal Main 2 - Distance Zone 4 operated SPI Operated Normal	Main 1 - Differential protection operated	SPI	Operated /Normal		
Main 1 - Distance Zone 3 operated SPI Operated /Normal Main 1 - Distance Zone 4 operated SPI Operated /Normal Main 1 - Distance Zone 3 operated SPI Operated /Normal Main 1 - Distance Zone 4 operated SPI Operated /Normal Main 1 - Distance Zone 4 operated SPI Operated /Normal Main 1 - Distance Zone 4 operated SPI Operated /Normal Main 1 - Distance Zone 1 operated SPI Operated /Normal Main 2 - Differential protection operated SPI Operated /Normal Main 2 - Distance Zone 2 operated SPI Operated /Normal Main 2 - Distance Zone 2 operated SPI Operated /Normal Main 2 - Distance Zone 3 operated SPI Operated /Normal Main 2 - Distance Zone 4 operated SPI Operated /Normal Main 2 - Distance protection operated SPI Operated /Normal Main 2 - Distance Protection Rided Trip SPI Operated /Normal Main 2 - Distance Protection operated SPI Operated /Normal Main 2 - Distance Protection nip SPI Operated /Normal Main 2 - Distance Protection nip SPI Operated /Normal	Main 1 - Distance Zone 1 operated	SPI	Operated /Normal		
Main 1 - Distance Zone 4 operated SPI Operated /Normal Main 1 - Distance Zone 4 operated SPI Operated /Normal Main 1 - Distance Zone 4 operated SPI Operated /Normal Main 1 - Distance Zone 4 operated SPI Operated /Normal Main 1 - Distance Protection Aided Trip SPI Operated /Normal Main 2 - Distance Zone 1 operated SPI Operated /Normal Main 2 - Distance Zone 2 operated SPI Operated /Normal Main 2 - Distance Zone 3 operated SPI Operated /Normal Main 2 - Distance Zone 4 operated SPI Operated /Normal Main 2 - Distance Zone 3 operated SPI Operated /Normal Main 2 - Distance Zone 4 operated SPI Operated /Normal Main 2 - Distance Zone 4 operated SPI Operated /Normal Main 2 - Distance Protection Aperated SPI Operated /Normal Main 2 - Distance Protection Aperated SPI Operated /Normal Main 2 - Distance Protection Aperated SPI Operated /Normal Main 2 - Distance Protection Aperated SPI Operated /Normal Main 2 - Distance Protection Aperated SPI Operated /Normal<	Main 1 - Distance Zone 2 operated	SPI	Operated /Normal		
Main 1 - Distance Zone 4 operated SPI Operated /Normal Main 1 - Directional Earth Fault operated SPI Operated /Normal Main 1 - Directional Earth Fault operated SPI Operated /Normal Main 1 - Directional Earth Fault operated SPI Operated /Normal Main 2 - Distance Protection operated SPI Operated /Normal Main 2 - Distance Zone 1 operated SPI Operated /Normal Main 2 - Distance Zone 2 operated SPI Operated /Normal Main 2 - Distance Zone 3 operated SPI Operated /Normal Main 2 - Distance protection operated SPI Operated /Normal Main 2 - Distance protection operated SPI Operated /Normal Main 2 - Distance protection operated SPI Operated /Normal Main 2 - Distance Protection operated SPI Operated /Normal Main 2 - Distance Protection Aided Trip SPI Operated /Normal Cover Current Protection trip SPI Operated /Normal Earth Fault Protection Operated SPI Operated /Normal Pole Discrepancy Protection Cerrated SPI Operated /Normal Dired Interitip Send SPI Operated	Main 1 - Distance Zone 3 operated	SPI	Operated /Normal		
Main 1 - Distance Protection Operated SPI Operated Normal Main 1 - Distance Protectional Earth Fault operated SPI Operated Normal Main 2 - Distance Zone 1 operated SPI Operated Normal Main 2 - Distance Zone 1 operated SPI Operated Normal Main 2 - Distance Zone 2 operated SPI Operated Normal Main 2 - Distance Zone 3 operated SPI Operated Normal Main 2 - Distance Zone 4 operated SPI Operated Normal Main 2 - Distance Zone 4 operated SPI Operated Normal Main 2 - Distance Zone 4 operated SPI Operated Normal Main 2 - Distance protection operated SPI Operated Normal Main 2 - Distance protection aperated SPI Operated Normal Main 2 - Distance Protection Aided Trip SPI Operated Normal Main 2 - Distance Protection facth Fault operated SPI Operated Normal Main 2 - Distance Protection for perated SPI Operated Normal Main 2 - Distance Protection for perated SPI Operated Normal Main 2 - Distance Protection for perated SPI Operated Normal Main 3 - Directin fore SPI <	Main 1 - Distance Zone 4 operated	SPI	Operated /Normal		
Main 1 - Distance Protection Aided Trip SP1 Operated /Normal Main 1 - Distance Protection operated SP1 Operated /Normal Main 2 - Distance Zone 1 operated SP1 Operated /Normal Main 2 - Distance Zone 2 operated SP1 Operated /Normal Main 2 - Distance Zone 3 operated SP1 Operated /Normal Main 2 - Distance Zone 4 operated SP1 Operated /Normal Main 2 - Distance Zone 4 operated SP1 Operated /Normal Main 2 - Distance Zone 4 operated SP1 Operated /Normal Main 2 - Distance Zone 4 operated SP1 Operated /Normal Main 2 - Distance Protection operated SP1 Operated /Normal Main 2 - Distance Protection Aided Trip SP1 Operated /Normal Over Current Protection Nig SP1 Operated /Normal Over Current Protection Operated SP1 Operated /Normal Direct Intering Send SP1 Operated /Normal Pole Discrepancy Protection Operated SP1 Operated /Normal Direct Intering Send Carrier send) SP1 Operated /Normal Direct Intering Send Carrier send SP1 Operated /Normal <tr< td=""><td>Main 1 -Distance protection operated</td><td>SPI</td><td>Operated /Normal</td><td></td><td></td></tr<>	Main 1 -Distance protection operated	SPI	Operated /Normal		
Main 2- Differential protection operated SPI Operated /Normal Main 2- Distance Zone 1 operated SPI Operated /Normal Main 2- Distance Zone 2 operated SPI Operated /Normal Main 2- Distance Zone 3 operated SPI Operated /Normal Main 2- Distance Zone 3 operated SPI Operated /Normal Main 2- Distance Zone 4 operated SPI Operated /Normal Main 2- Distance Zone 4 operated SPI Operated /Normal Main 2- Distance Protection operated SPI Operated /Normal Main 2- Distance Protection Aided Trip SPI Operated /Normal Main 2- Distance Protection Aided Trip SPI Operated /Normal Main 2- Distance Protection Operated SPI Operated /Normal Current Protection Operated SPI Operated /Normal Main 2- Distance Protection Operated SPI Operated /Normal Direct Intertrip Received SPI Operated /Normal Direct Intertrip Received SPI Operated /Normal Direct Intertrip Received (carrie receive) SPI Operated /Normal Direct Intertrip Received (carrie receive) SPI Operated /Normal	Main 1 - Directional Earth Fault Operated	SPI SPI	Operated /Normal		
Main 2. Distance Zone 1 operated SPI Operated /Normal Main 2. Distance Zone 2 operated SPI Operated /Normal Main 2. Distance Zone 3 operated SPI Operated /Normal Main 2. Distance Zone 4 operated SPI Operated /Normal Main 2. Distance Zone 4 operated SPI Operated /Normal Main 2. Distance Zone 4 operated SPI Operated /Normal Main 2. Distance Protection operated SPI Operated /Normal Main 2. Distance Protection Alded Trip SPI Operated /Normal Main 2. Distance Protection Alded Trip SPI Operated /Normal Over Curent Protection rtip SPI Operated /Normal Distance Del Discrepancy Protection Operated SPI Operated /Normal Direct Interrip Send SPI Operated /Normal SPI Operated /Normal Direct Interrip Send (Struces / Progress SPI Direct Interrip Received SPI Operated /Normal Direct Interrip Received (Carrier send) SPI DEF Protection Carrier Sen		011	operated Adominar		
Main 2. Differential protection operated SPI Operated /Normal Main 2. Distance Zone 2 operated SPI Operated /Normal Main 2. Distance Zone 2 operated SPI Operated /Normal Main 2. Distance Zone 2 operated SPI Operated /Normal Main 2. Distance Zone 3 operated SPI Operated /Normal Main 2. Distance protection operated SPI Operated /Normal Main 2. Distance protection operated SPI Operated /Normal Main 2. Distance protection Aided Trip SPI Operated /Normal Main 2. Distance Protection trip SPI Operated /Normal Over Current Protection Operated SPI Operated /Normal Over Current Protection Operated SPI Operated /Normal Operated /Normal SPI Operated /Normal Direct Intertrip Received SPI Operated /Normal Direct Intertrip Receive SPI Operated /Norma					
Main 2 - Distance Zone 1 operated SPI Operated /Normal Main 2 - Distance Zone 3 operated SPI Operated /Normal Main 2 - Distance Zone 3 operated SPI Operated /Normal Main 2 - Distance Zone 4 operated SPI Operated /Normal Main 2 - Distance Zone 4 operated SPI Operated /Normal Main 2 - Distance protection Aided Trip SPI Operated /Normal Main 2 - Distance Protection Aided Trip SPI Operated /Normal Main 2 - Distance Protection Aided Trip SPI Operated /Normal Over Current Protection Operated SPI Operated /Normal Earth Fault Protection Operated SPI Operated /Normal Pole Discrepancy Protection Operated SPI Operated /Normal Direct Intertrip Send SPI Operated /Normal Direct Intertrip Received SPI Operated /Normal Permissive Intertrip Received (carrier receive) SPI Operated /Normal DEF Protection carrier Receive SPI Operated /Normal DEF Protection carrier Receive SPI Operated /Normal Distance Volction Block SPI Operated /Normal	Main 2- Differential protection operated	SPI	Operated /Normal		
Main 2 - Distance Zone 3 operated SPI Operated /Normal Main 2 - Distance Zone 4 operated SPI Operated /Normal Main 2 - Distance Zone 4 operated SPI Operated /Normal Main 2 - Distance Zone 4 operated SPI Operated /Normal Main 2 - Distance Zone 4 operated SPI Operated /Normal Main 2 - Distance Protection operated SPI Operated /Normal Main 2 - Distance Protection rip SPI Operated /Normal Over Current Protection rip SPI Operated /Normal Earth Fault Protection Operated SPI Operated /Normal Pole Discrepancy Protection Operated SPI Operated /Normal Nuto Recloser Operated Success / Progress SPI Operated /Normal Direct Intertrip Send SPI Operated /Normal Direct Intertrip Send (carrier receive) SPI Operated /Normal DEF Protection carrier Receive SPI Operated /Normal Dist	Main 2 - Distance Zone 1 operated	SPI	Operated /Normal		
Main 2 - Distance Zone 3 operated SPI Operated /Normal Main 2 - Distance protection operated SPI Operated /Normal Main 2 - Distance protection operated SPI Operated /Normal Main 2 - Distance protection operated SPI Operated /Normal Main 2 - Distance protection Aided Trip SPI Operated /Normal Over Current Protection Trip SPI Operated /Normal Earth Fault Protection Operated SPI Operated /Normal Ver Current Protection Operated SPI Operated /Normal Auto Recloser Operated Normal SPI Operated /Normal Pole Discrepancy Protection Operated SPI Operated /Normal Direct Intertrip Send SPI Operated /Normal Direct Intertrip Received SPI Operated /Normal Permissive Intertrip Received (carrier send) SPI Operated /Normal DEF Protection carrier Receive SPI Operated /Normal Distance Protection Fail (Differential block) SPI Operated /Normal Distance Protection Parted /Normal SPI Operated /Normal Distance Protection Relay K86.1/Lockout Relay operated SPI Operated /No	Main 2 - Distance Zone 2 operated	SPI	Operated /Normal		
Main 2 - Distance Zone 4 operated SPI Operated /Normal Main 2 - Discance protection operated SPI Operated /Normal Main 2 - Distance Protection Aided Trip SPI Operated /Normal Main 2 - Distance Protection Aided Trip SPI Operated /Normal Over Current Protection Operated SPI Operated /Normal Cover Current Protection Operated SPI Operated /Normal Earth Fault Protection Operated SPI Operated /Normal Learth Fault Protection Operated SPI Operated /Normal Direct Intertrip Received SPI Operated /Normal Direct Intertrip Received (carrier send) SPI Operated /Normal Permissive Intertrip Received (carrier receive) SPI Operated /Normal DEF Protection carrier Receive SPI Operated /Normal Distance Protection Biok SPI Operated /Normal Distance Protection Biok SPI Operated /Normal	Main 2 - Distance Zone 3 operated	SPI	Operated /Normal		
Main 2 - Distance protection operated SPI Operated /Normal Main 2 - Directional Earth Fault operated SPI Operated /Normal Main 2 - Distance Protection Aided Trip SPI Operated /Normal Over Current Protection Operated SPI Operated /Normal Earth Fault Protection Operated SPI Operated /Normal Earth Fault Protection Operated SPI Operated /Normal Pole Discrepancy Protection Operated SPI Operated /Normal Auto Recloser Operated /Normal SPI Operated /Normal Direct Intertrip Received SPI Operated /Normal Permissive Intertrip Received (carrier send) SPI Operated /Normal Permissive Intertrip Received (carrier receive) SPI Operated /Normal DEF Protection carrier Receive SPI Operated /Normal DEF Protection carrier Receive SPI Operated /Normal Distance Protection Block SPI Operated /Normal Communication Fail (Differential block) SPI Operated /Normal Svitch On To Fault trip (SOTF trip) SPI Operated /Normal Over Voltage trip (OV) SPI Operated /Normal <td>Main 2 - Distance Zone 4 operated</td> <td>SPI</td> <td>Operated /Normal</td> <td></td> <td></td>	Main 2 - Distance Zone 4 operated	SPI	Operated /Normal		
Main 2 - Directional Earth Fault operated SPI Operated /Normal Main 2 - Distance Protection Aided Trip SPI Operated /Normal Over Current Protection Operated SPI Operated /Normal Earth Fault Protection Operated SPI Operated /Normal Pole Discrepancy Protection Operated SPI Operated /Normal Direct Intertrip Received SPI Operated /Normal Direct Intertrip Received SPI Operated /Normal Permissive Intertrip Received (carrier receive) SPI Operated /Normal PEF Protection carrier Send SPI Operated /Normal DEF Protection carrier Receive SPI Operated /Normal Distance Protection Block SPI Operated /Normal Communication Fail (Differential block) SPI Operated /Normal Switch On To Fault trip (SOTF trip) SPI Operated /Normal Over Votage trip (OV) SPI Operated /Normal I	Main 2 - Distance protection operated	SPI	Operated /Normal		
Main 2 - Distance Protection Aided Trip SPI Operated /Normal Over Current Protection trip SPI Operated /Normal Earth Fault Protection Operated SPI Operated /Normal Pole Discrepancy Protection Operated SPI Operated /Normal Auto Recloser Operated /Success / Progress SPI Operated /Normal Direct Intertrip Received SPI Operated /Normal Direct Intertrip Received SPI Operated /Normal Permissive Intertrip Received SPI Operated /Normal DEF Protection carrier send SPI Operated /Normal DEF Protection carrier Receive SPI Operated /Normal Distance Protection Block SPI Operated /Normal Communication Fail (Differential block) SPI Operated /Normal Switch On To Fault trip (SOTF trip) SPI Operated /Normal Over Voltage trip (OV) SPI Operated /Normal Breaker Failure Protection Relay K86.1 /Lockout Relay operated SPI Operated /Normal Over Voltage trip (QV) SPI Operated /Normal 1 Trip Relay Operated/Protection Relay K86.2 SPI Operated /Normal	Main 2 - Directional Earth Fault operated	SPI	Operated /Normal		
Over Current Protection trip SPI Operated /Normal Earth Fault Protection Operated SPI Operated /Normal Pole Discrepancy Protection Operated SPI Operated /Normal Auto Recloser Operated Success / Progress SPI Operated /Normal Direct Intertrip Received SPI Operated /Normal Permissive Intertrip Received (carrier receive) SPI Operated /Normal Permissive Intertrip Received (carrier receive) SPI Operated /Normal DEF Protection carrier Send SPI Operated /Normal DEF Protection carrier Receive SPI Operated /Normal Distance Protection Biok SPI Operated /Normal Communication Fail (Differential block) SPI Operated /Normal Switch On To Fault trip (SOTF trip) SPI Operated /Normal Over Voltage trip (OV) SPI Operated /Normal Breaker Failure Protection Relay K86.1 /Lockout Relay operated SPI Operated /Normal Over Voltage trip (QV) SPI Operated /Normal 1 1 Trip Relay Operated/Protection Relay K86.2 SPI SPI Set/Reset 1 1	Main 2 - Distance Protection Aided Trip	SPI	Operated /Normal		
Over Current Protection Operated SPI Operated /Normal Earth Fault Protection Operated SPI Operated /Normal Pole Discrepancy Protection Operated SPI Operated /Normal Auto Recloser Operated / Success / Progress SPI Operated /Normal Direct Intertrip Send SPI Operated /Normal Direct Intertrip Received SPI Operated /Normal Permissive Intertrip Received (carrier receive) SPI Operated /Normal Permissive Intertrip Received (carrier receive) SPI Operated /Normal DEF Protection carrier Receive SPI Operated /Normal Distance Protection Block SPI Operated /Normal Communication Fail (Differential block) SPI Operated /Normal Switch On To Fault trip (SOTF trip) SPI Operated /Normal Over Voltage trip (OV) SPI Operated /Normal Breaker Failure Protection Relay K86.1 /Lockout Relay operated SPI Operated /Normal Ortip Relay Operated/Protection Relay K86.2 SPI SPI Set/Reset 1 Trip Relay Operated /Protection Relay K86.2 SPI Set/Reset 1 1 P	Ourse Ourseast Destantion trip		On enoted (Nermal		
Land Hote Hote to Operated SPI Operated /Normal Pole Discrepancy Protection Operated SPI Operated /Normal Direct Intertrip Received SPI Operated /Normal Direct Intertrip Received SPI Operated /Normal Permissive Intertrip Received (carrier send) SPI Operated /Normal DEF Protection carrier Send SPI Operated /Normal Distance Protection carrier Receive SPI Operated /Normal Distance Protection carrier Receive SPI Operated /Normal Distance Protection carrier Receive SPI Operated /Normal Distance Protection Block SPI Operated /Normal Communication Fail (Differential block) SPI Operated /Normal Switch On To Fault trip (SOTF trip) SPI Operated /Normal Over Voltage trip (OV) SPI Operated /Normal Breaker Failure Protection Relay K86.1 /Lockout Relay operated SPI Operated /Normal Trip Relay Operated/Protection Relay K86.2 SPI Operated /Normal 1 Trip Relay Operated/Protection Relay K86.2 SPI Set/Reset 1 1 Under Frequency Trip SPI	Over Current Protection trip	SPI	Operated /Normal		
Pole Discrepancy Protection Operated SPI Operated /Normal Auto Recloser Operated /Success / Progress SPI Operated /Normal Direct Intertrip Received SPI Operated /Normal Direct Intertrip Received SPI Operated /Normal Permissive Intertrip Received (carrier send) SPI Operated /Normal Permissive Intertrip Received (carrier receive) SPI Operated /Normal DEF Protection carrier Send SPI Operated /Normal DEF Protection carrier Receive SPI Operated /Normal Distance Protection Block SPI Operated /Normal Communication Fail (Differential block) SPI Operated /Normal Switch On To Fault trip (SOTF trip) SPI Operated /Normal Over Voltage trip (OV) SPI Operated /Normal Breaker Failure Protection Relay K86.1 /Lockout Relay operated SPI Operated /Normal Trip Relay Operated/Protection Relay K86.2 SPI SPI Set/Reset Protection Relay K96 SPI Set/Reset 1 Under Frequency Trip SPI Operated /Normal					
Auto Recloser Operated / Success / Progress SPI Operated /Normal Image: Comparison of the second of the seco	Pole Discrepancy Protection Operated	SPI	Operated /Normal		
Direct Intertrip Send SPI Operated /Normal Direct Intertrip Received SPI Operated /Normal Permissive Intertrip Received (carrier send) SPI Operated /Normal Permissive Intertrip Received (carrier receive) SPI Operated /Normal DEF Protection carrier Send SPI Operated /Normal DEF Protection carrier Receive SPI Operated /Normal Differential block SPI Operated /Normal Communication Fail (Differential block) SPI Operated /Normal Switch On To Fault trip (SOTF trip) SPI Operated /Normal Over Voltage trip (OV) SPI Operated /Normal Breaker Failure Protection Relay K86.1 /Lockout Relay operated SPI Operated /Normal Trip Relay Operated/Protection Relay K86.1 /Lockout Relay operated SPI Set/Reset 1 1 Protection Relay K96 SPI Set/Reset 1 1 1 Under Frequency Trip SPI Operated /Normal 1 1 Under Frequency Trip SPI Operated /Normal 1 1 Under Frequency Trip SPI </td <td>Auto Recloser Operated Success / Progress</td> <td>SPI</td> <td>Operated /Normal</td> <td></td> <td></td>	Auto Recloser Operated Success / Progress	SPI	Operated /Normal		
Direct Intertrip ReceivedSPIOperated /NormalPermissive Intertrip Received (carrier send)SPIOperated /NormalPermissive Intertrip Received (carrier receive)SPIOperated /NormalDEF Protection carrier SendSPIOperated /NormalDEF Protection carrier ReceiveSPIOperated /NormalDistance Protection BlockSPIOperated /NormalCommunication Fail (Differential block)SPIOperated /NormalSwitch On To Fault trip (SOTF trip)SPIOperated /NormalOver Voltage trip (OV)SPIOperated /NormalBreaker Failure Protection Relay K86.1 /Lockout Relay operatedSPIOperated /NormalTrip Relay Operated/Protection Relay K86.2SPISet/Reset1Protection Relay K96SPISPISet/Reset1Under Frequency TripSPIOperated /NormalOver Frequency TripSPIOperated /Normal	Direct Intertrip Send	SPI	Operated /Normal		
Permissive Intertrip Send (carrier send) SPI Operated /Normal Permissive Intertrip Received (carrier receive) SPI Operated /Normal DEF Protection carrier Send SPI Operated /Normal DEF Protection carrier Receive SPI Operated /Normal Distance Protection Block SPI Operated /Normal Communication Fail (Differential block) SPI Operated /Normal Switch On To Fault trip (SOTF trip) SPI Operated /Normal Over Voltage trip (OV) SPI Operated /Normal Breaker Failure Protection Relay K86.1 /Lockout Relay operated SPI Operated /Normal Trip Relay Operated/Protection Relay K86.2 SPI SPI Set/Reset Protection Relay K96 SPI Set/Reset 1 1 Under Frequency Trip SPI Operated /Normal Over Frequency Trip SPI Operated /Normal Over Frequency Trip SPI Operated /Normal Over Frequency Trip SPI Operated /Normal Over Frequency Trip SPI	Direct Intertrip Received	SPI	Operated /Normal		
DEF Protection carrier Send SPI Operated /Normal DEF Protection carrier Receive SPI Operated /Normal Distance Protection Block SPI Operated /Normal Communication Fail (Differential block) SPI Operated /Normal Switch On To Fault trip (SOTF trip) SPI Operated /Normal Over Voltage trip (OV) SPI Operated /Normal Breaker Failure Protection Relay K86.1 /Lockout Relay operated SPI Operated /Normal Trip Relay Operated/Protection Relay K86.1 /Lockout Relay operated SPI Set/Reset 1 Protection Relay K96 SPI Set/Reset 1 1 Under Frequency Trip SPI Operated /Normal Under Frequency Trip SPI Operated /Normal Over Frequency Trip SPI Operated /Normal	Permissive Intertrip Send (carrier send)	SPI	Operated /Normal		
DEF Protection carrier Receive SPI Operated /Normal	DEE Protection carrier Send	SPI	Operated /Normal		
Distance Protection Block SPI Operated /Normal	DEF Protection carrier Receive	SPI	Operated /Normal		
Communication Fail (Differential block) SPI Operated /Normal Image: Communication Fail (Differential block) Switch On To Fault trip (SOTF trip) SPI Operated /Normal Image: Communication Communicatind Communication Communication Communication Communica	Distance Protection Block	SPI	Operated /Normal		
Switch On To Fault trip (SOTF trip) SPI Operated /Normal Image: Constraint of the system of th	Communication Fail (Differential block)	SPI	Operated /Normal		
Over Voltage trip (OV) SPI Operated /Normal Breaker Failure Protection Operated SPI Operated /Normal 1 1 Trip Relay Operated/ Protection Relay K86.1 /Lockout Relay operated SPI Set/Reset 1 1 Trip Relay Operated/Protection Relay K86.2 SPI Set/Reset 1 1 Protection Relay K96 SPI Set/Reset 1 1 Under Frequency Trip SPI Operated /Normal 1 1 Over Frequency Trip SPI Operated /Normal 1 1	Switch On To Fault trip (SOTF trip)	SPI	Operated /Normal		
Breaker Failure Protection Operated SPI Operated /Normal 1 1 Trip Relay Operated/ Protection Relay K86.1 /Lockout Relay operated SPI Set/Reset 1 1 Trip Relay Operated/Protection Relay K86.2 SPI Set/Reset 1 1 Protection Relay K96 SPI Set/Reset 1 1 Under Frequency Trip SPI Operated /Normal 1 Over Frequency Trip SPI Operated /Normal	Over Voltage trip (OV)	SPI	Operated /Normal		
Implicitie SPI Set/Reset 1 1 Trip Relay Operated/Protection Relay K86.2 SPI Set/Reset 1 Protection Relay K96 SPI Set/Reset 1 Under Frequency Trip SPI Operated /Normal	Breaker Hallure Protection Operated	SPI	Operated /Normal	1	1
Implementation focular focula	Trip Relay Operated/ Protection Relay K86.1 /LOCKOUT Relay Operated	5PI 9Di	Set/Reset	1	1
Image: Second	Protection Relay K96	SPI	Set/Reset		
Under Frequency Trip SPI Operated /Normal Over Frequency Trip SPI Operated /Normal			200110000		
Over Frequency Trip SPI Operated /Normal	Under Frequency Trip	SPI	Operated /Normal		
	Over Frequency Trip	SPI	Operated /Normal		

		VOLTAGE 220/33 kV		/ T/F 4	
Nadukuda 220/33 kV GS	TYPE OF SIGNAL	BAY No	207	318	
		BAY TYPE	220 kV side	33 kV side	
Main 1 Protection Relay Fail	SPI	Healthy/ Fail	1		
Main 2 Protection Relay Fail	SPI	Healthy/ Fail	1		
Back Up Protection Relay Fail	SPI	Healthy/ Fail	1		
Auto Relcose ON/OFF	SPI	ON / OFF			
	SPI	Operated /Normal			
BUSBAR PROTECTION Bus Bar Protection Operated	SPI	Operated /Normal	1		
	011	Operated Morrial			
TRANSFORMER PROTECTION					
Differential Protection Operated	SPI	Operated /Normal	1		
HV Restricted Earth Fault	SPI	Operated /Normal	1		
LV Restricted Earth Fault	SPI	Operated /Normal	1		
Transformer earth Fault Protection Operated	SPI	Operated /Normal	1	1	
I ransformer Stand By EF Protection Operated	SPI	Operated /Normal	1	1	
Transformer Over Current Protection trip (OCProtection I>trip)	SPI	Operated /Normal	1	1	
Over Voltage Protection	SPI	Operated /Normal	1		
	SPI	Operated /Normal			
	3F1				
Phase OverVoltage Operated	SPI	Operated /Normal			
	0.1				
STATION ALARMS					
Under Frequency Load Shedding Operated	SPI	Operated/Normal			
Bus Voltage Failure - ***	SPI	Healthy/Faulty			
a Auxialary Supply Voltage	SPI	Healthy/Faulty			
b DC Voltage Failure (110V DC MCB Trip)	SPI 🌈	Healthy/Faulty			
Gateway Alarm(Running A/Running B)	SPI 🔻	Healthy/Faulty			
Communication Alarm (Communication Malfuntion)	SPIC	Healthy/Faulty			
Battery Charger Failure (Communication) - ***	SPI	Healthy/Faulty			
a 48V Battery Charger 2 Fail	\sim				
b 48V Battery Charger 1 Fail /(Rectifier 1 Fault)	1				
Battery Charger Failure (Station)-***	SPI	Healthy/Faulty			
a 220 V Battery Charger 2 Fail /(Rectifier 1 Fault)					
b 220 V Battery Charger 1 Fail (Rectifier 2Fault)					
Station Urgent Fault - ***	SPI	Operated /Normal			
a Fox Faulty Urgent Alarm					
Station Non Urgent Fault - ***	SPI	Operated/Normal			
a Diesel Generator Alarm					
b Fox Faulty Non Urgent Alarm					
Station Control Remote/Supervisory	DPI	Remote/Superviosry			
Active Energy	AI	MWh			
Re-Active Energy	AI	Mvarh			
		UNITS			
Voltage	Al	Volts	1	1	
Frequency	Al	Hertz	1	1	
	AI AI	IVIVV M\/Ar	1	1	
			1	1	
Transformer Tap Position		Tan number	1	1	
Power Factor	Al	PF		· ·	
GENERAL					
Air Condition Temprature	Al	Celcius			
Humidity	Al	RH %			
Solar Iradiance	AI	W/m ²			

Legend

BC = BusCoupler T/F = Transformer G = Generator C = Capacitor F = Feeder	BB= Bus I	Bar BS= Bus Section
MH= Mini Hydro D= Dendro Power GF=Generator Feeder BSC= Capacitor Bank		
TYPE OF SIGNAL		
DPC Double Point Control Command	AI	Analogue Measurement

SPC Single Point Control Command

DPI Double point indication input

SPI Single point indciation input

Double points are counted individually

*** :- Grouped Alarms

AO

Analogue Output
																		Anne	x A3	
		VOLTAGE	132/ T/	33 kV F 1	132/ T/	33 kV F 2						3:	3 kV							
		BAY No	103	303	107	310	301	302	304	305	308	309	311	312	306	313	307			
Embilipitiya 132/33 kV GIS	TYPE OF SIGNAL	BAY TYPE	20 kV side	33 kV side	20 kV side	33 kV side	E	F2	E	F4	F5	F6	F7	F8	F9	F10	BS 1	BB 1	BB 2	Station
							0	5												
CONTROLS		ACTION																		
Circuit Breaker	DPC	Open/Close	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2			
BB Isolator 1	DPC	Open/Close	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2			
BB Isolator 2	DPC	Open/Close															2			
Line Isolator	DPC	Open/Close			-															
Capacitor Bay Isolators	DPC	Open/Close																		
Earth Switch	DPC	Open/Close		\	7															
Tap Changer (AVR) Raise / Lower	DPC	Raise/Lower	2		2															L
Tap Changer (AVR) Auto / Manual	DPC	Auto /Manual	2		2															L
	DPC	Master/ Follower																		L
AVR Operating mode (One of the 2 modes will be available)		Minimum Circulation	2		2														1	
	DPC	Current															-			<u> </u>
AVR Independent / Parallel	SPC	Independent/Parallel	1		1														$ \longrightarrow $	<u> </u>
Protection Master Relay Reset /(Protection Reset Command K86.1) (/Lockout Relay Reset)	SPC	Reset	1	1	1	1											1			
Protection Master relay Reset Command K86.2	SPC	Reset	1	1	1	1											1			
Protection Reset Command K96 (BB/BCF relay Reset)	SPC	Reset	1	1	1	1											1			
Load Shedding OFF	SPC	On/Off															-			
		$\mathbf{\Lambda}$																		
STATUS INDICATIONS		STATUS																		
Circuit Breaker	DPL	Open/Close	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2			
BB Isolator 1	DPI	Open/Close	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2			
BB Isolator 2	DPI	Open/Close															2		\square	
Line Isolator	DPI	Open/Close																		
Capacitor Bay Isolator	DPI	Open/Close																		
Earthing Switch	DPI	Open/Close		2		2	2	2	2	2	2	2	2	2	2	2	4			L
																				L
Bay Control	DPI	Local/Superv/Remote	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2			<u> </u>
																				L
TRANSFORMER																				I
Tap Control	DPI	Local/Superv	2		2														\vdash	ļ
I/F AVR Operating mode	DPI	Manual /Auto	2		2														\vdash	<u> </u>
T/F AVR Operating mode (One of the 2 modes will be available)		Minimum Circulation	2		2															
AVR Parallel / Indipendent	SPI	Paralle/ Indipendant	1		1		1													<u> </u>
			i – – – – –		i .		1													
Capacitor Bank				1	1		1													
Capacitor Bank Operating Mode	SPI	Manual /Auto			1		1													
			1		İ		İ	i l												
A L A R M INDICATIONS		1			1		1													
				-	-		-			_				_		_	_			

		VOLTAGE	132/ T/	'33 kV /F 1	132/ T/	33 kV /F 2						33	3 kV							
		BAY No	103	303	107	310	301	302	304	305	308	309	311	312	306	313	307			
Embilipitiya 132/33 kV GIS	TYPE OF SIGNAL	BAY TYPE	220 kV side	33 kV side	220 kV side	33 kV side	F1	F2	F 3 F3	E4	F5	F6	F7	F8	F9	F10	BS1	BB 1	BB 2	Station
CIRCUIT BREAKER									C C											
									5									l		
Circuit Breaker Triping Indication	SPI	Healthy/Faulty	1	1	1	1	Q		1	1	1	1	1	1	1	1	1			
				· .	<u> </u>			· .												
Breaker Fault (critical) - ***	SPI	Healthy/Faulty	1	1	1		1	1	1	1	1	1	1	1	1	1	1		\square	
a SF6 Gas Presure low. (2nd stage)							-												\vdash	
c Trip Circuit Supervision Fail 1 (Trip Circuit faulty)		1				Ň	1											┣──┘	┢──┦	
d Spring Not Charge (Spring Supervision)					X															
e Hydraulic Pressure Low			1	• (
f Pneumatic Pressure Low.																				
g CB Pole Discrepancy																				
h Trip Lockout/Close Lockout (SF6 Lock out)																				
i Control Voltage Failure (DC MCB trip)																				
j Internal Arc trip																				
h SF6 Gas Presure low in Bus Bar Chamber																				
Bay Fault (Non critical) - ***	SPI	Healthy/Faulty	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			
a SF6 Gas Pressure Low - First step																				
PT Secondary MCB Trip (Protection VT MCB Failed/ Incoming Voltage MCB b trip/ VT MCB trip)		C C																		
c AC/DC Voltage Failure Indication (Auxiliary Fail)																				
		$\mathbf{\Lambda}$																		
TRANSFORMER MECHANICAL PROTECTION																				L
Tap Changer Mechanism Fault (OLTC failure)	SPI	Healthy/Faulty	1	1	1	1	-	-												
Tap out of step (TAP OUT ERROR)	SPI	Unset/Reset	1	1	1	1														
Transf Buchholz Alarm - ***	SPI	Onset/Reset	1	1	1	1														L
a Transt Buchnoiz Alarm																				
D OLIC Buchnolz Alarm	CDI	Operated/Normal	1	1	1	1														
	SPI	Operated/Normal	1	1	1	1													⊢ – +	
ET Transf Buchholz Trin	SPI	Operated/Normal	1	1	1	1 1														
AT Transf Buchholz Trip	SPI	Operated/Normal	1	1	1	1														
Temperature Alarm - ***	SPI	Onset/Reset	1	1	1	1														
a Oil Temperature Alarm	0	0110001100001	· ·	· ·		· ·														
b Winding HV Temperature Alarm																				
c Winding LV Temperature Alarm																				
Temperature trip - ***	SPI	Operated/Normal	1	1	1	1														
a Oil Temperature trip			1	İ	1	† .	1	1												
b Winding HV Temperature trip	Ī		1	1	1	1	Ī	Ī												
c Winding LV Temperature trip	1		1																	
General Alarm - ***	SPI	Onset/Reset	1	1	1	1														
a Cooling Fan Fail (Group 1/Group 2)	1	1	1	1	t –	1	1	1												
b Transformer Oil Level low	1		1	1	1	1	1	1												
c OLTC Oil level low																				
General Trip - ***	SPI	Operated/Normal	1	1	1	1														
a OLTC Surge Trip																				

		VOLTAGE	132/ T/	'33 kV /F 1	132/: T/	33 kV F 2						33	3 kV							
		BAY No	103	303	107	310	301	302	304	305	308	309	311	312	306	313	307			
Embilipitiya 132/33 kV GIS	TYPE OF SIGNAL	BAY TYPE	220 kV side	33 kV side	220 kV side	33 kV side	F1	F2	F 3 F3	E4	Fs	F6	F7	F8	F9	F10	BS1	BB 1	BB 2	Station
b Main tank Presure Release Valve (PRV) Trip									5											
c OLTC Pressure Release Valve								1.0												
d Transformer Oil Level low TRIP																				
e OLTC Oil level low																				
PROTECTION SIGNALS																				<u> </u>
		ł			1	h														I
		}				\sim						<u> </u>								I
Main 1 Differential protection energted	0 DI	Operated /Nerra-			X															
	SPI	Operated /Normal																		
Main 1 - Distance Zone 1 operated	SPI	Operated /Normal																		
Main 1 - Distance Zone 2 operated	SPI	Operated /Normal																		L
Main 1 - Distance Zone 3 operated	SPI	Operated /Normal			1															
Main 1 - Distance Zone 4 operated	SPI	Operated /Normal																		
Main 1 -Distance protection operated	SPI	Operated /Normal																		1
Main 1 - Directional Earth Fault operated	SPI	Operated /Normal																		
Main 1 - Distance Protection Aided Trip	SPI	Operated /Normal																		
			2																	
Main 2- Differential protection operated	SPI	Operated /Normal																		
Main 2 Distance Zone 1 operated	011 SDI	Operated /Normal					-				-									
Main 2 - Distance Zone 1 operated													-							I
Main 2 - Distance Zone 2 operated	SPI	Operated /Normal																		I
Main 2 - Distance Zone 3 operated	SPI	Operated /Normal																		
Main 2 - Distance Zone 4 operated	SPI	Operated /Normal																		L
Main 2 - Distance protection operated	SPI	Operated /Normal																		
Main 2 - Directional Earth Fault operated	SPI	Operated /Normal																		1
Main 2 - Distance Protection Aided Trip	SPI	Operated /Normal																		
Over Current Protection trip	SPI	Operated /Normal					1	1	1	1	1	1	1	1	1	1	1			
Earth Fault Protection Operated	SPI	Operated /Normal					1	1	1	1	1	1	1	1	1	1	1			
()`																				L
Pole Discrepancy Protection Operated	SPI	Operated /Normal																		L
Auto Recloser Operated / Success / Progress	SPI	Operated /Normal																		
Direct Intertrip Send	SPI	Operated /Normal																		
Direct Intertrip Received	SPI	Operated /Normal																		
Permissive Intertrip Send (carrier send)	SPI	Operated /Normal																		
Permissive Intertrip Received (carrier receive)	SPI	Operated /Normal																		
DEF Protection carrier Send	SPI	Operated /Normal																		<u> </u>
DEF Protection carrier Receive	SPI	Operated /Normal	<u> </u>		<u> </u>		I	<u> </u>												┢───
	5PI	Operated /Normal	<u> </u>	<u> </u>	I	<u> </u>	<u> </u>	<u> </u>				<u> </u>								ļ
Communication Fail (Differential block)	SPI	Operated /Normal	<u> </u>		I		I	<u> </u>												
	SPI	Operated /Normal			I															
Over voltage trip (OV)	SPI	Operated /Normal	<u> </u>	<u> </u>		<u> </u>	<u> </u>	<u> </u>		<u> </u>					<u> </u>		<u> </u>			ļ
Dieakei Failure Protection Operated	521	Operated /Normal	1	1		1			1	1		1	1	1	1	1	1			I
Trip Relay Operated/Protection Relay K86.1 /Lockout Relay operated	SPI	Set/Reset		1	1	1	1	1	1	1	1	1	1	1	1	1				
Protoction Polov, K06	୍ୟା	Set/Reset	1	<u> </u>				<u> </u>									1			I
	JEI	JENRESEL			<u> </u>		1										'			I
				1		1														4

		VOLTAGE	132/ T/	/33 kV /F 1	132/ T/	33 kV F 2						3	3 kV							
		BAY No	103	303	107	310	301	302	304	305	308	309	311	312	306	313	307			
Embilipitiya 132/33 kV GIS	TYPE OF SIGNAL	BAY TYPE	220 kV side	33 kV side	220 kV side	33 kV side	F1	F2	F3	E4	F5	F6	F7	F8	F9	F10	BS 1	BB 1	BB 2	Station
Under Frequency Trip	SPI	Operated /Normal					1		\bigcirc	1	1	1	1	1	1	1				
Over Frequency Trip	SPI	Operated /Normal					1	1	1	1	1	1	1	1	1	1				
Main 1 Protection Relay Fail	SPI	Healthy/ Fail	1		1															
Main 2 Protection Relay Fail	SPI	Healthy/ Fail	1		1															
Back Up Protection Relay Fail	SPI	Healthy/ Fail	1		1															
Auto Relcose ON/OFF	SPI	ON / OFF																		
33kV protection Operated	SPI	Operated /Normal			5															
BUSBAR PROTECTION				\																
Bus Bar Protection Operated	SPI	Operated /Normal	1		1												1			L
																				L
																				L
																				L
TRANSFORMER PROTECTION																				L
Differential Protection Operated	SPI	Operated /Normal	1		1															L
HV Restricted Earth Fault	SPI	Operated /Normal			1		-					ļ								<u> </u>
LV Restricted Earth Fault	SPI	Operated /Normal	1		1															<u> </u>
Transformer earth Fault Protection Operated	SPI	Operated /Normal	1	1	1	1													┝──┦	
Transformer Stand By EF Protection Operated	SPI	Operated /Normal	1	1	1	1	-					-								<u> </u>
Protection trip (OCProtection I>trip)	SPI	Operated /Normal	1	1	1	1													┝──┦	
Over Voltage Protection	SPI	Operated /Normal	1		1		-					-								<u> </u>
	SPI	Operated /Normal	1		1		-					-								<u> </u>
	SEI	Operated /Normal	- ·		- ·		-													
CAPACITOR BANK	CDI	Operated /Normal					-													
Filase Over voltage Operated	JP1	Operated /Normal											-							
STATION ALARMS	<u>~</u> 0~		1		1		-	-												
Under Frequency Load Shedding Operated	SPI	Operated/Normal					1	1	1	1	1	1	1	1	1	1				
Bue Voltago Failuro - ***		Healthy/Foulty	1	1	1	1	1 '	<u> </u>		<u> </u>			-						\vdash	1
a Auvialary Supply Voltage	OF1 QDI	Healthy/Faulty	I				<u> </u>												┢──┦	<u> </u>
	SPI	Healthy/Faulty																	⊢	
Gateway, Alarm/Running A/Running B)	SPI	Healthy/Faulty																		1
Communication Alarm (Communication Malfuntion)	SPI	Healthy/Faulty	1		1		-	-												1
Battery Charger Failure (Communication) - ***	SDI	Healthy/Faulty																		1
Allery Charger Failure (Communication) -	351	riealitiy/Faulty	-		-		-					-								<u> </u>
d 40V Dattery Charger 1 Fail //Rectifier 1 Fault)													-							
Battery Charger Failure (Station).***	SPI	Healthy/Faulty	1	+	1	+	1													1
a 220 V Battery Charger 2 Fail /(Rectifier 1 Fault)	011	ricalitiy/r adity	1		1		-	-												<u> </u>
b 220 V Battery Charger 1 Fail (Rectifier 2Fault)	1	1	1	<u> </u>	1	1	1	l												
Station Urgent Fault - ***	SDI	Operated /Normal	1	<u> </u>	1	1	1	l												1
a Fox Faulty Lirgent Alarm		operated /Normal	1	+		+	1												\vdash	<u> </u>
	0.01	Operate -//bl	1	+		+	1												\vdash	4
	51	Operated/Normal	I	 	I	 	<u> </u>												\vdash	\vdash
a Diesei Generator Alarm			I		I			<u> </u>												
D FOX Faulty Non Urgent Alarm	DDI	Demete (C	I		I			<u> </u>											\vdash	_
Station Control Remote/Supervisory	DPI	Remote/Superviosry		+				<u> </u>											┝──┦	2
			I				 												\vdash	
		1	1		1			I				1							1	I

		VOLTAGE	132/: T/	33 kV F 1	132/: T/	33 kV F 2						3	3 kV							
		BAY No	103	303	107	310	301	302	304	305	308	309	311	312	306	313	307		\square	
Embilipitiya 132/33 kV GIS	TYPE OF SIGNAL	BAY TYPE	220 kV side	33 kV side	220 kV side	33 kV side	F	F2	F3	E4	E E	F6	F7	F8	F9	F10	BS 1	BB 1	BB 2	Station
Active Energy	AI	MWh							D			1								
Re-Active Energy	Al	Mvarh																	\square	
MEASUREMENTS		UNITS																		
Voltage	AI	Volts	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1
Frequency	AI	Hertz	1	1	1	1												1	1	
Active Power	AI	MW	1	1	1		1	1	1	1	1	1	1	1	1	1	1			Í
Reactive Power	AI	MVAr	1	1	1		1	1	1	1	1	1	1	1	1	1	1		\square	
Current	AI	Amperes	1	1	V 1	1	1	1	1	1	1	1	1	1	1	1	1			Í
Transformer Tap Position	AI	Tap number		1	~	1													\square	
Power Factor	AI	PF		~																Í
GENERAL																				
Air Condition Temprature	AI	Celcius																		1
Humidity	AI	RH %																		1
Solar Iradiance	AI	W/m ²																		

Legend

BC = BusCoupler T/F = Transformer G = Generator C = Capacitor F = Feeder BB = Bus Bar BS = Bus Section MH = Mini Hydro D = Dendro Power GF = Generator Feeder BSC = Capacitor Bank

TYPE OF SIGNAL

DPC Double Point Control Command

SPC Single Point Control Command

DPI Double point indication input

SPI Single point indciation input

Double points are counted individually *** :- Grouped Alarms



Annex B

Gateway/RTU Configuartion Parameters of Signals

Single-Stage: Two-Envelope

whomain conversion by the second

Gateway/RTU Configuartion Parameters of Signals

Annex B

				Signal Type	Descript	ion	
		Turne Of	For IEC	60870 - 5 - 101	For IEC	60870 - 5 - 104	Llear Data of
	Signal Description	Signal					Class
		e.g.u.	Type ID	Description	Type ID	Description	0.000
			No.		No.		
	Control Command						
	Circuit Breaker	DPC	46	C_DC_NA_1	46	C_DC_NA_1	Class 1
	BB Isolator 1	DPC	46	C_DC_NA_1	46	C_DC_NA_1	Class 1
	BB Isolator 2	DPC	46	C_DC_NA_1	46	C_DC_NA_1	Class 1
	Line isolator Capacitor Bay Isolators	DPC	46	C_DC_NA_1	46	C_DC_NA_1	Class 1
	Earth Switch	DPC	40	C DC NA 1	40	C DC NA 1	Class 1
	TRANSFORMER AVR/TC						
	Tap Changer(Raise/Lower)	DPC	46	C_DC_NA_1	46	C_DC_NA_1	Class 1
	Tap Changer (AVR) Auto / Manua	DPC	46	C_DC_NA_1	46	C_DC_NA_1	Class 1
	AVR Operating mode (One of the 2 modes will be available)						
	Master/Follower	DPC	46	C_DC_NA_1	46	C_DC_NA_1	Class 1
	AVR Independent / Parallel	SPC	40	C SC NA 1	40	C SC NA 1	Class 1
	VARIABLE REACTOR TAP CONTROL						
	Tap Changer(Raise/Lower)	DPC	46	C_DC_NA_1	46	C_DC_NA_1	Class 1
	Tap Changer (AVR) Auto / Manua	DPC	46	C_DC_NA_1	46	C_DC_NA_1	Class 1
<u> </u>	MW Setpoint	۵0	50	C SE NC 1	50	C SF NC 1	flace1
<u> </u>	MVAr Setpoint	AO	50	C SE NC 1	50	C SE NC 1	Class 1
L	MW Control	DPC	46	<u>C_DC_NA 1</u>	46	C_DC_NA 1	Class 1
	MVAr Control	DPC	46	C_DC_NA_1	46	C_DC_NA_1	Class 1
1	Protection Master Relay Reset /(Protection Reset Command	CDC	45		45		Class 1
	Not. () (/LUCKOUI Kelay Kesel) Protection Master relay Reset Command K86 2	SPC	45 45	C SC NA 1	45 45		Class 1
	Protection Reset Command K96 (BB/BCE relay Reset)	SPC	45	C SC NA 1	45	$C_{SC} NA_{1}$	Class 1
-	Load Shedding OFF	SPC	45	C SC NA 1	45	C SC NA 1	Class 1
					X		
	Status Indications						
	Circuit Breaker	DPI	4	M_DP_TA_1	31	M_DP_TB_1	Class 1
	BB Isolator 1	DPI	4	M_DP_TA_1	31	M_DP_TB_1	Class 2
	BB Isolator 2	DPI	4	M DP TA 1	31	M DR TR 1	Class 2
	Line Isolator	DPI	4		31	M DP TB 1	Class 2
	Earthing Switch	DPI	4	M DP TA 1	31	M DP TB 1	Class 2
	Bay Control	DPI	4	M_DP_TA_1	31	M_DP_TB_1	Class 2
	TRANSFORMER AVR/TC						
	Tap Control (Local/Remote)	DPI	4	M_DP_TA_1	31	M_DP_TB_1	Class 1
	Tap Changer (AVR) Auto / Manual	DPI	4	M_DP_IA_1	31	M_DP_IB_1	Class 1
	Master/Follower	DPI	4	M DP TA 1	31	M DP TB 1	Class 1
	Minimum Circulation Curren	DPI	4	M_DP_TA_1	31	M_DP_TB_1	Class 1
	AVR Independent / Parallel	SPI	2	M_SP_TA_1	30	M_SP_TB_1	Class 1
	VARIABLE REACTOR TAP CONTROL						
	Tap Changer(Raise/Lower)	DPI	4	M_DP_TA_1	31	M_DP_TB_1	Class 1
	Tap Changer (AVR) Auto / Manua	- DPI	4	M_DP_IA_1	31	M_DP_IB_1	Class 1
	CAPACITOR BANK/REACTOR BAY						
	Capacitor Bank Operating Mode	DPI	4	M_DP_TA_1	31	M_DP_TB_1	Class 1
	Reactor Operating Mode	DPI	4	M_DP_TA_1	31	M_DP_TB_1	Class 1
<u> </u>							
<u> </u>	Oper mode of Governor	וסח	л		21		Class 1
	Oper. mode of Gen. AVR	DPI	4	M DP TA 1	31	M DP TB 1	Class 1
	Gen ready to Start	DPI	4	M_DP_TA 1	31	M_DP_TB 1	Class 1
	Generator Status	DPI	4	M_DP_TA_1	31	M_DP_TB_1	Class 1
	Generator Control	DPI	4	M_DP_TA_1	31	M_DP_TB_1	Class 1
<u> </u>	Setpoint Validation	SPI	2	M_SP_TA_1	30	M_SP_TB_1	Class 1
<u> </u>	Raise /Lower Enable	SPI	2	INI_SP_IA_1	30	M_SP_IB_1	Class 1
<u> </u>	Alarm Indications						
	CIRCUIT BREAKER						
	Breaker Fault (critical) -***	SPI	2	M_SP_TA_1	30	M_SP_TB_1	Class 1
a	SF6 Gas Presure low. (2nd stage)						
0	Trip Circuit Supervision Pail 1 (Trip Circuit Taulty						
d	Spring Not Charge (Spring Supervision						
е	Hydraulic Pressure Low						
f	Pneumatic Pressure Low.						
g r	UB Pole Discrepancy						
n i	Control Voltage Failure (DC MCB trip)						
i	Internal Arc trip						
k	SF6 Gas Presure low in Bus Bar Chambei						
	Bay Fault (Non critical)-***	SPI	2	M_SP_TA_1	30	M_SP_TB_1	Class 1
а	SF6 Gas Pressure Low - First step						
h	Voltage MCB trip/ VT MCB trip)						
c	AC/DC Voltage Failure Indication (Auxiliary Fail						
	TRANSFORMER MECHANICAL PROTECTION						

				Signal Type	Descript	ion	
		Type Of	For IEC	60870 - 5 - 101	For IEC	60870 - 5 - 104	User Data of
	Signal Description	Signal			-		Class
		_	Type ID No	Description	Type ID	Description	
	Tan Changer Mechanism Fault	SDI	2	M SP TA 1	30	M SP TR 1	Class 1
	Tap out of step	SPI	2	M SP TA 1	30	M_SP_TB_1	Class 1
	Transf Buchholz Alarm - ***	SPI	2	M_SP_TA_1	30	M_SP_TB_1	Class 1
а	Transf Buchholz Alarm						
b	OLTC Buchholz Alarm	-					
	Transf Buchholz Trin	SPI	2	M SP TA 1	30	M SP TB 1	Class 1
	OLTC Buchholz Trip (OLTC OIL Flow Relay Trip	SPI	2	M SP TA 1	30	M SP TB 1	Class 1
	ET Transf Buchholz Trip	SPI	2	M_SP_TA_1	30	M_SP_TB_1	Class 1
	AT Transf Buchholz Trip	SPI	2	M_SP_TA_1	30	M_SP_TB_1	Class 1
	Tomporaturo Alarm - ***	CDI	2	M CD TA 1	20	M CD TD 1	Class 1
а	Oil Temperature Alarm	5P1	2	IVI_3P_1A_1	50	W_3P_1B_1	Class 1
b	Winding HV Temperature Alarm						
С	Winding LV Temperature Alarm						
	T	601	2	NA 60 TA 4	20	M CD TD 4	<u> </u>
а	Oil Temperature trip - """	SPI	2	M_SP_IA_1	30	M_SP_IB_1	Class 1
b	Winding HV Temperature trip	1					
С	Winding LV Temperature trip						•
	General Alarm- ***	SPI	2	M_SP_TA_1	30	M_SP_TB_1	Class 1
a	Cooling Fan Fail (Group 1/Group 2)	-					
D C		ł					
U	General Trip- ***	SPI	2	M SP TA 1	30	M SP TB 1	Class 1
а	OLTC Surge Trip						<u>v</u>
b	Main tank Presure Release Valve (PRV) Trip						
C	OLIC Pressure Release Valve						
u e							
Ŭ						1	
					. (
	PROTECTION SIGNALS/ALARMS				X		
	Main 1 Differential protection operated	CDI	2		20	M CD TD 1	Class 1
	Main 1 - Differential protection operated	SPI	2		30	M SD TD 1	Class 1
	Main 1 - Distance Zone 2 operated	SPI	2	M SP TA 1	30	M_SP_TB_1	Class 1
	Main 1 - Distance Zone 3 operated	SPI	2	M SP TA 1	30	M SP TB 1	Class 1
	Main 1 - Distance Zone 4 operated	SPI	2	M SP TA 1	30	M SP TB 1	Class 1
	Main 1 -Distance protection operated	SPI	2	M_SP_TA_1	30	M_SP_TB_1	Class 1
	Main 1 - Directional Earth Fault operated	SPI	2	M_SP_TA_1	30	M_SP_TB_1	Class 1
	Main 1 - Distance Protection Aided Trip	SPI	2	M_SP_TA_1	30	M_SP_TB_1	Class 1
	Main Q. Differential protection encroted	601	\sim		20	M CD TD 4	C 1
	Main 2- Differential protection operated	SPI	2	M_SP_TA_1	30	M_SP_IB_1	Class 1
	Main 2 - Distance Zone 2 operated	SDI SDI	2	M SP TA 1	30	M SP TR 1	Class 1
	Main 2 - Distance Zone 3 operated	SPI	2	M SP TA 1	30	M_SP_TB_1	Class 1
	Main 2 - Distance Zone 4 operated	SPI	2	M SP TA 1	30	M SP TB 1	Class 1
	Main 2 - Distance protection operated	SPI	2	M_SP_TA_1	30	M_SP_TB_1	Class 1
	Main 2 - Directional Earth Fault operated	SPI	2	M_SP_TA_1	30	M_SP_TB_1	Class 1
	Main 2 - Distance Protection Aided Trip	SPI	2	M_SP_TA_1	30	M_SP_TB_1	Class 1
	Over Current Protection trin	CDI	2	M CD TA 1	20	M CD TD 1	Class 1
	Earth Fault Protection Operated	SPI	2	M SP TA 1	30	M_SP_TB_1 M_SP_TB_1	Class 1
		511	-	3i_iA_1		01_10_1	51035 1
	Pole Discrepancy Protection Operated	SPI	2	M_SP_TA_1	30	M_SP_TB_1	Class 1
	Auto Recloser Operated / Success / Progress	SPI	2	M_SP_TA_1	30	M_SP_TB_1	Class 1
	Direct Intertrip Send	SPI CDI	2	M SD TA 1	30	M SD TD 1	Class 1
	Permissive Intertrip Send (carrier send	SPI	2	M SP TA 1	30	M SP TB 1	Class 1
	Permissive Intertrip Received (carrier receive)	SPI	2	M_SP_TA_1	30	M_SP_TB_1	Class 1
	DEF Protection carrier Send	SPI	2	M_SP_TA_1	30	M_SP_TB_1	Class 1
	DEF Protection carrier Receive	SPI	2	M_SP_TA_1	30	M_SP_TB_1	Class 1
	Distance Protection Block	SPI	2	M_SP_TA_1	30	M_SP_IB_1	Class 1
	Switch On To Fault trip (SOTF trip	SPI	2	M SP TA 1	30	M SP TB 1	Class 1
	Over Voltage trip (OV)	SPI	2	M_SP_TA_1	30	M_SP_TB_1	Class 1
	Breaker Failure Protection Operated	SPI	2	M_SP_TA_1	30	M_SP_TB_1	Class 1
	Trip Relay Operated/ Protection Relay K86.1 /Lockout Relay						
	uperated(IT any) Trin Relay Operated/Protection Relay, K86 2/if any	SPI CDI	2	M SD TA 1	30	M SD TD 1	Class 1
	Protection Relay K96	SPI	2	M SP TA 1	30	M_3F_1B_1 M_SP_TB_1	Class 1
	Under Voltage Trip	SPI	2	M_SP_TA_1	30	M_SP_TB_1	Class 1
	Under Frequency Trip	SPI	2	M_SP_TA_1	30	M_SP_TB_1	Class 1
	Over Frequency Trip	SPI	2	M_SP_TA_1	30	M_SP_TB_1	Class 1
	resincted Earth Fault Protection Operated (Main 2	251	2	IVI_SP_1A_1	30	IVI_SP_1B_1	Class 1
-							
	Main 1 Protection Relay Fail	SPI	2	M_SP_TA_1	30	M_SP_TB_1	Class 1
	Main 2 Protection Relay Fail	SPI	2	M_SP_TA_1	30	M_SP_TB_1	Class 1
	Back Up Protection Relay Fail	SPI	2	M_SP_TA_1	30	M_SP_TB_1	Class 1
-	Auto Relicose ON/OFF 33kV protection Operated	SPI SPI	2	M SP TA 1	30	N SP TR 1	Class 1 Class 1
		511	-	91_1A_1		0,_10_1	51035 1
	GENERATOR PROTECTION INDICATIONS						
	Gen. Prot. Operated (critical)	SPI	2	M_SP_TA_1	30	M_SP_TB_1	Class 1

2of3

				Signal Type	Descript	ion	
	Signal Description	Type Of	For IEC	60870 - 5 - 101	For IEC	60870 - 5 - 104	User Data of
	- g.a p.o.	Signal	Type ID No.	Description	Type ID No.	Description	Class
	Gen. Prot. Operated (non critical)	SPI	2	M_SP_TA_1	30	M_SP_TB_1	Class 1
	Over /Under voltage protection operated	SPI	2	M_SP_TA_1	30	M_SP_TB_1	Class 1
	Over /Under Frequency protection operatec	SPI	2	M_SP_TA_1	30	M_SP_TB_1	Class 1
	Over speed protection operated	SPI	2	M_SP_TA_1	30	M_SP_TB_1	Class 1
	BUSBAR PROTECTION						
	Bus Bar Protection Operated	SPI	2	M_SP_TA_1	30	M_SP_TB_1	Class 1
	Differential Protection Operated	CDI	2	MACD TA 1	20	M CD TD 1	Class 1
	HV Restricted Earth Fault	SPI	2		30	M SP TB 1	Class 1
	LV Restricted Earth Fault	SPI	2	M SP TA 1	30	M SP TB 1	Class 1
	Transformer earth Fault Protection Operatec	SPI	2	M_SP_TA_1	30	M_SP_TB_1	Class 1
	Transformer Stand By EF Protection Operated	SPI	2	M_SP_TA_1	30	M_SP_TB_1	Class 1
	Transformer Over Current Protection trip (OCProtection I>trip	SPI	2	M_SP_TA_1	30	M_SP_TB_1	Class 1
	Over Voltage Protection	SPI	2	M_SP_TA_1	30	M_SP_TB_1	Class 1
	T/E Thermal Overload	SPI SPI	2	M SP TA 1	30	M_SP_TB_1 M_SP_TB_1	Class 1 Class 1
		511	2	M_31_1A_1	50	I	Clubb 1
	STATION ALARMS						\sim
	Under Frequency Load Shedding Operated	SPI	2	M_SP_TA_1	30	M_SP_TB_1	Class 1
_	Bus Voltage Failure - ***	SPI	2	M_SP_TA_1	30	M_SP_TB_1	Class 1
a h	DC Voltage Eailure (110V DC MCB Trip)						
~	RTU Alarm	SPI	2	M SP TA 1	30	M SP TB 1	Class 1
	Communication Alarm (Communication Malfuntion	SPI	2	M_SP_TA_1	30	M_SP_TB_1	Class 1
	Battery Charger Failure (Communication) - ***	SPI	2	M_SP_TA_1	30	M_SP_TB_1	Class 1
a	48V Battery Charger 2 Fail						
D	48V Battery Charger 1 Fail /(Rectifier 1 Fault,	SDI	2	M SP TA 1	30	M SP TR 1	Class 1
а	220 V Battery Charger 2 Fail /(Rectifier 1 Fault)	351	2	IN1	30	WI_3F_IB_1	Class I
b	220 V Battery Charger 1 Fail (Rectifier 2Fault)				50)	
	Station Urgent Fault - ***	SPI	2	M_SP_TA_1	30	M_SP_TB_1	Class 1
а	Fox Faulty Urgent Alarm	601	2		10	M CD TD 4	<u> </u>
a	Station Non Urgent Fault - """ Diesel Generator Alarm	SPI	2	M_SP_TA_T	30	M_SP_IB_1	Class 1
b	Fox Faulty Non Urgent Alarm						
	Station Control Remote/Supervisory	DPI	4	M_DP_TA_1	31	M_DP_TB_1	Class 1
	ENERGY MEASUREMENTS		12		10	MANE NO 1	Class 2
	Re-Active Energy		13	M_ME_NC_1	13	M_ME_NC_1	Class 2 Class 2
	The House Energy				15		61035 2
	Measurements		N				
	Voltage	A	13	M_ME_NC_1	13	M_ME_NC_1	Class 2
	Active Dewer	A	13	M_ME_NC_1	13	M_ME_NC_1	Class 2
	Reactive Power		13	M_ME_NC_1	13	M_ME_NC_1	Class 2 Class 2
	Current	AI	13	M ME NC 1	13	M ME NC 1	Class 2
	Transformer Tap Position	AI	13	M_ME_NC_1	13	M_ME_NC_1	Class 2
	GENERATOR MEASUREMENTS	AL	13	M ME NC 1	13	M ME NC 1	Class 2
	Active Power (included above)	Al	13	M_ME_NC_1	13	M ME NC 1	Class 2
	Reactive Power (included above)	AI	13	M_ME_NC_1	13	M_ME_NC_1	Class 2
	Active Energy	AI	13	M_ME_NC_1	13	M_ME_NC_1	Class 2
	Reactive Energy	AI	13	M_ME_NC_1	13	M_ME_NC_1	Class 2
	Uroop Setting - Hand dressed	AI	13	M_ME_NC_1	13	M_ME_NC_1	Class 2
	GENERAL						
	Air Condition Temprature	AI	13	M_ME_NC_1	13	M_ME_NC_1	Class 2
	Humidity	AI	13	M_ME_NC_1	13	M_ME_NC_1	Class 2

LEGEND

DPI - Double Point Indication

SPI - Single Point Indication DPC - Double Point Command

SPC - Single Pont Command BCP - Binary Coaded Measurement Al - Analog Input AO - Analog Out Put

- TC -Tap Controller

ASDU Type ID C_DC_NA_1 :- Double Command C_SC_NA_1 :- Single Command

C_SC_NA_1 -- Single Command M_DP_TA_1 :- Double Point Information with time tag M_SP_TA_1 :- Single Point Information with time tag M_ME_NC_1 :- Measured Value, short floating point number M_DP_TB_1 :- Double Point Information with time tag CP56Time2a M_SP_TB_1 :- Single Point Information with time tag CP56Time2a M_TT_NA_1 :- Integrated Totals C_SE_NC_1 :- Set Point Command Short Election point

C_SE_NC_1:- Set Point Command, Short Floating point

C_SC_TA_1 :- Single point Command with Timetag CP56Time2a

C_DC_TA_1:- Double point Command with Timetag CP56Time2a

*** For Grouped Signals

Annex C

Communication Path Configurations (NSCC & Communication Branch)

whormation copy Notion Bidding

Communication Path Configurations for Embilipitiya Grid Substation Gateway

a) SCADA Protocol -IEC 60870-5-104

	Speed of the TCP/IP connection	: 10/100Mbps
۶	Gateway IP address	: will be provided at commissioning period.
	IP address of the Master Station	: 10.3.1.8 & 10.3.1.9
	Subnet Mask	: 255.255.255.240

Application Layer

Fixed lengths are defined in the protocol as below.

- Common Address of ASDU : 2 octets
- Information object address : 3 octets
 - Cause of transmission : 2 octets
- Length of APDU : Maximum length of APDU per system (253)

b) SCADA Protocol -IEC 60870-5-101

SCADA communication link is Serial, Asynchronous, Unbalanced (Master Slave) and Multipoint Party Line System.

> Physical Layer

The transmission speed should be 9600 bits per seconds.

Link Layer

Link transmission procedure

: Unbalanced transmission

- Application Layer
 - Link Address (Polling Address) : will be provided at commissioning period.
 - Station Address (Common address of Application Service Data Unit) : will be provided at commissioning period.
 - Length of Link address :1 byte(1 Octet)
 - Length of ASDU : 1 byte(1 Octet)
 - Length of IOA(Information Object Address) : 2 bytes(2 Octets)
 - Length of Cause of Transmission : 1 byte(1 Octet)

Note: There should have a facility to change Length of Link address, Length of ASDU & Length of Cause of Transmission as Octet 1 or 2.

Annex D

NSCC SIGNAL LIST - SINGLE POINT INDICATIONS

Single-Stage: Two-Envelope

whomain conversion bidding

Annex D

(Name of GSS) NSCC SIGNAL LIST - SINGLE POINT INDICATIONS

Bay	Bay Name	Signal Description	Type Of Signal		Signal Ty	pe Descriptio	n	User Data	Information Object	Remarks	Test Results
No.	-			For IEC	60870 - 5 - 101	For IEC 6	0870 - 5 - 104	of Class	Address		(OK/Alarm)
				Type ID No.	Description	Type ID No.	Description	D	, lauress		
							\mathbf{V}				
							<u>`</u> 0`				
						¢O,					

T/F AVR Operating mode(Manual/Auto) - High(1)=..... Low(0)=.....

Tap Control(Local/Remote) - High(1)=..... Low(0)=.....

T/F AVR Operating mode (Master/Follower; Minimum Circulation) - High(1)=..... Low(0)=...

AVR Parallel / Indipendent- High(1)=..... Low(0)=.....

.....

	(Name of the Station) NS	SCC SIGNAL	LIST - C	<u>ONTROLS A</u>	AND DOU	<u>BLE POINT II</u>	NDICATIC	<u>)NS</u>		
Bay No.	Bay Name	Signal	Type Of		Signal Type	Description		User Data of	Information Object	Remarks
		Description	orginar	For IEC 6087	0 - 5 - 101	For IEC 6087	5 - 104	01033	Address	
				Type ID No.	Description	Type ID No.	Description	l		
								1		
					X)		1		
					 					
					\sim					
					\sim					
86/96 reset command - High(1)= Tap Position Command(DPC) - High T/F AVR Operating mode(Auto/Mai T/F AVR Operating mode (Master/F AVR Parallel / Indipendent(SPC)- Hi		command comr nd; Low(01)= n(10)=	mand command	command d; Low(01)=	со	mmand				

....

	<u>Intallie of (</u>	the station								
Bay No.	Bay Name	Signal	Type Of		Signal Type	e Description		User Data of	Information Object	Remarks
		Description	Signal	For IEC 6087	70 - 5 - 101	For IEC 6087	0_5 - 104	Class	Address	
				Type ID No.	Description	Type ID No.	Description		, luur ess	
						\cdot				
						5				
					5					
				2						

(Name of the Station) NSCC SIGNAL LIST - MEASUREMENTS

homaion

Checked By Name: Signature: Date: CEB (Project Name) :

Tested By Name: Signature: Date: (Name of the Contrator): (Project Name) :

1

3

(Name of the Substations) NSCC SIGNALS - SIGNAL GROUPING DETAILS



Annex E

Specification of Fiber Optic Splicing Machine (Single Mode and Multimode)

Fiber Optic Splicing Machine used for Fiber Fusion Splicer and Welding Splicer with following features and tools.

- Fusion splicer main unit
- Fiber Optic Cleaver (Single Mode and Multimode), High Precision Cleaver
- Fiber Optical Power Meter (Single Mode and Multimode)
- Fiber Optical Power Source (Multimode)
- Fiber Optical Power Source (Single Mode)
- Core Alignment Fusion Splicer Kit, OTDR 33/31dB, Power Meter, Laser Source, VFL

Optical fiber requirements are Material Silica glass Profile types SMF (ITU-T G.652), MMF (ITU-T G.651), DSF (ITU-T G.653), NZDSF (ITU-T G.655), BIF (ITU-T G.657), EDF Fiber diameter Cladding diameter: 80 μm ~ 150 μm, Coating diameter: 100 μm ~ 1,000 μm Applicable fiber or cable size up to φ1,000 μm Drop cable (2.0x3.1 mm) Indoor cable (2.0x2.0 mm) Cleave length 5~16 mm 10 mm Standard performance Splice loss (typical) SMF: 0.02 dB, MMF: 0.01 dB, DSF: 0.04 dB, NZDSF: 0.04 dB.

Bidding Document for MNEGSAP