SCHEDULE A-A- 400KV GIS

Summary & Main System Parameters

Site and substation condition	400/132/33 kV AAWDCP (MAIN SS) substation
	New SS
Substation type	GIS
Site Altitude (m a.s.l.)	≤1000
Minimum ambient temperature (°C)	-10
Design temperature	
Outdoor	50 (°C)
Indoor	40 (°C)
Highest average daily temperature (°C)	38
Relative humidity (%)	4÷100
The climate –day	Dry & Hot
The climate – night	Cold
Pollution level	Heavy airborne contamination
Insulator creepage distance (mm/kV)	38
Wind velocity (m/s)	50
Ice loading, radial thickness (mm)	10
Isoceraunic level (days/annum)	15
Average annual rainfall (cm)	cca. 23
Seismic Conditions	Zone 2B
Solar radiation (W/m2)	1150
Short circuit rating	
400 kV switchgear	40 / 1 sec.
132 kV switchgear	40 / 3 sec.
33 kV switchgear	31.5 / 3 sec.
11 KV side	40 kA / 1 sec.
BUSBAR current rating (A)	
400 kV switchgear	3150
132 kV switchgear	3150
33 kV switchgear	2500
11 KV side	3150

- All outdoor equipment must be suitable for live washing.
- The insulator outdoor creepage distance should be based on 420 kV for 400 kV, 145kV for 132kV, 36kV for 33kV and 12kV for 11 kV.

SUMMARY OF DEFINITE WORK

SECTION A

	Section for purpose of payment and taking over	SECTION A			
1	Approximate location of substation	AQABA / AAWDCP substation			
		420 KV side		132 kV side	33 kV side
2	Rated system voltage	420kV	36 kV	145kV	36kV
3	Normal current rating of Busbars	3150A	2500 A	3150A	2500A
4	Type of switching arrangement	GIS, Double Busbar	AIS, Single Busbar 33kV Switchgear	GIS, Double Busbar	AIS, Single Busbar 33kV Switchgear
5	Number of OHL / outgoing circuits	4	-	4	acc. SLD
6	Number of Capacitors circuits	-	4	-	acc. SLD
7	Number of Reactors circuits	-	2	-	acc. SLD
8	Number of Auto-transformer circuits	2	2	2	-
9	Number of bus section circuits	1	-	1	3
10	Number of bus coupler circuits	1	-	1	-
11	Number of power transformer circuits	-	-	4	4
11	Future expansion				
11.1	Number of spare circuits	4 set OHL 1 set TR 1	-	- -	-
11.2	Number of spaces for circuits	1 for TR + 2 two OHL	4 circuits	1 circuit from each side	6
12	Rating of transformer bay (Auto transformer connections)	1250A	2500A	3150A	2500 A
13	Rating of OHTL bay / capacitor and reactor	1600A	1250 A	1600A	acc. To SCHD. A scope of work
14	Rating of transformer bay (80 MVA transformer connections)	-	-	2500 A	2500 A
15	Short circuit current	40kA/1sec	31.5kA/3sec	40kA/3sec	31.5kA/3sec
16	Required completion date	As mentioned in appendix to tender			

Schedule A/A

Item No.	Description	Quantity
A	**AAWDCP /AQABA MAIN – 400kV GIS SUBSTATION**	
	400kV Line feeder OHTL	
A1	**400kV OHTL Line feeder outdoor equipment (MAAN NO.1), (MAAN NO.2), (ATPS NO.1), (ATPS NO.2)**	4 set
A1.1	Single-phase, oil-insulated, capacitive Voltage Transformer (CVT), for outdoor installation, complete with supporting steel structure, terminal boxes for multicore cables, MCBs, etc…, all in accordance with IEC 61869-1&5, with three (3) secondary windings with the following characteristics: a. Core I: Rated transformation ratio: 400/√3/0,11/√3 "kV/kV", accuracy class 3P for (main 1) Line differential protection relay with Distance facility and fault location feature with Directional Earth Fault protection, synchronization, and OV\UV relay with appropriate VA rated output, b. Core II: Rated transformation ratio: 400/√3/0,11/√3 "kV/kV", accuracy class 3P for (main 2) Line differential protection relay with Distance facility and fault location feature with Directional Earth Fault protection and fault recorder equipment with appropriate VA rated output, c. Core III: Rated transformation ratio: 400/√3/0,11/√3 "kV/kV", accuracy class 0.5 for Instruments (digital power meter, Transducers, …etc), with appropriate VA rated output. Note: The capacitive voltage transformer in middle (Y) phase shall be suitable for mounting of Line Trap and HF Coupling Unit, complete with brackets for mounting and other necessary auxiliaries.	3 sets
A1.2	Surge arrester complete with bypass arrangement for the surge counters	3 set
A1.3	400kV three phase motorized operated, line earth switch completes with locks, electrical interlocks, auxiliary switches and labels.	3 set

Item No.	Description	Quantity
A1.4	Gantry steel structures including access ladders and screens. Line landing gantry to have facilities for the termination of up to 200m slack span connections from the overhead line terminal towers.	1 set
A1.5	Flexible and tube connections to interconnect above items and to connect to the GIS with all fittings, clamps and accessories	1 set
A1.6	SF6/air bushing, complete with all clamps and connectors	LOT
A1.7	Gas insulated bus duct (GIB) for interconnection between bushings and respective unit bays of GIS with all required accessories. (GIB shall be covered with metallic sun shielding)	LOT
A1.8	Insulator's post and string	1 set
A1.9	Equipment supports structures as required for each item of outdoor equipment.	1 set
A2	**400 kV OHTL line feeder GIS equipment (MAAN NO.1), (MAAN NO.2), (ATPS NO.1), (ATPS NO.2) AND 4 BAYS FOR FUTURE**	8 set
A2.1	Line disconnector located on line side of circuit breaker, 3 phase, power operated, complete with and power operated maintenance earth switch on circuit side (OHL)	1 set
A2.2	Power operated fault making earth switch (High Speed Earthing Switch) on circuit (OHL) side	1 set
A2.3	Current transformers on feeder side of circuit breakers as follows:	

Item No.	Description	Quantity
	Single-phase, ring type GIS Current Transformer (CT), of 1600 A rated current all in accordance with IEC 61869-1&2, with five (5) cores with the following characteristics: a. Core I: Rated transformation ratio: 1600/800/1 A, accuracy class PX for (main 1) Line differential protection relay with Distance facility and fault location feature with Directional Earth Fault protection, Circuit Breaker Fail (1) relay and fault recorder equipment. b. Core II: Rated transformation ratio: 1600/800/1 A, accuracy class PX for (main 2) Line differential protection relay with Distance facility and fault location feature with Directional Earth Fault protection, Circuit Breaker Fail (2) relay. c. Core III: Rated transformation ratio: 1600/800/1 A, accuracy class 0.5, minimum rated output of 10 VA for Instruments (digital power meter, Transducers, …etc). d. Core IV: Rated transformation ratio: 3000/1500/1 A, accuracy class PX for Busbar zone Main protection, e. Core V: Rated transformation ratio: 3000/1500/1 A, accuracy class PX for Busbar zone Check protection.	3 sets
A2.4	Circuit breaker, 3-phase 1600A.	1 set
A2.5	Maintenance earth switch, power operated, located between the busbar selector disconnectors and the circuit breaker.	1 set
A2.6	Disconnector, power operated, 3 phase for circuit breaker busbar selection.	2 sets
A2.7	Single phase busbars arranged as duplicate 3 phase busbar units. (main and reserve).	1 set
A2.8	Structural support steelwork, access ladders, access ways and platforms to provide permanent access to all operative components	1 set

Item No.	Description	Quantity
A2.9	Local control cubicle completed with mimic diagram, control switches for power operated switches & position indication for manually operated switches, Ammeter with reversible scale (0-800A, 0-1600A), Voltmeter scale 0-420kV with selector switch, Local/Remote selector switch and alarm annunciator for alarms with accept, cancel and lamp test, including all those necessary for the safety and efficient operation of the switchgear. In addition to all necessary cabling and wiring from switchgear and local control cabinet (Bay controller unit is acceptable)	1 set
	400kV Auto-Transformer bays	
A3	**400kV Auto-Transformer circuit GIS equipment** **ATR NO.1, ATR NO.2 AND ONE FUTURE**	3 sets
A3.1	Disconnector, 3 phase, for circuit breaker busbar selection, power operated.	2 sets
A3.2	Maintenance earth switch, power operated, located between the busbar disconnectors and the circuit breaker.	1 set
A3.3	Circuit breaker, 3 phase 1250A.	1set
A3.4	Current transformers on transformer side of circuit breaker as follows: Single-phase, ring type GIS Current Transformer (CT), of 2500 A rated current all in accordance with IEC 61869-1&2, with five (5) cores with the following characteristics: a. Core I: 2000/1000/1A for overall transformer high impedance differential protection, class PX b. Core II: 600/300/1A for biased differential protection, and Circuit Breaker Fail 1, Class PX c. Core III: 600/300/1A for backup overcurrent, earth fault, circuit breaker Fail 2, instrumentation & FR Class 1/5P20 d. Core IV: Rated transformation ratio: 3000/1500/1 A, accuracy class PX for Busbar zone Main protection, e. Core V: Rated transformation ratio: 3000/1500/1 A, accuracy class PX for Busbar zone Check protection.	3 sets
A3.5	Transformer disconnector located on transformer side of circuit breaker, 3-phase power operated, complete with power operated maintenance earth switch on circuit breaker side of disconnector.	1 set
A3.6	Power operated fault making earth switch (High Speed Earthing Switch) on transformer side.	1 set
A3.7	Single-phase busbars arranged as duplicate 3 phase busbar units. (Main and reserve).	1 set

Item No.	Description	Quantity
A3.8	GIS Surge arrestors (station high SH) complete with bypass arrangement for the surge counters.	3 sets
A3.9	Single-phase, inductive type Voltage Transformer (VT), in accordance with IEC 61869-1&3, with two (2) secondary windings with the following characteristics: a. Core I: Rated transformation ratio: 400/√3/0,11/√3 "kV/kV", accuracy class 3P for Over Flux, synchronization, and fault recorder equipment with appropriate VA rated output. b. Core II: Rated transformation ratio: 400/√3/0,11/√3 "kV/kV", accuracy class 0.5 for Instrumentations.	3 sets
A3.10	SF6/Oil bushing, complete with all clamps and connectors.	1-3ph set
A3.11	Gas insulated bus duct (GIB) for interconnection between bushings and respective unit bays of GIS.	1-3ph set
A3.12	Equipment supports structures, Structural support steelwork, access ladders, access ways and platforms to provide permanent access to all operative component.	1 set
A3.13	Local control cubicle completed with mimic diagram, control switches for power operated switches & position indication for manually operated switches, Ammeter with reversible scale (0-300A, 0-600A), Voltmeter scale 0-420kV with selector switch, Local/Remote selector switch and alarm annunciator for alarms with accept, cancel and lamp test, including all those necessary for the safety and efficient operation of the switchgear. In addition to all necessary cabling and wiring from switchgear and local control cabinet (Bay controller unit is acceptable).	1 set
	Bus Coupler GIS bays	
A4	**Bus Coupler GIS equipment**	1 set
A4.1	Circuit breaker, 3 phase 3150A	1 set
A4.2	Disconnector, 3 phase, for circuit breaker isolation, power operated, complete with power operated maintenance earth switch on circuit breaker side of disconnector	2 sets
A4.3	Current transformers on each side of circuit breaker containing 2 cores as follows:	

Item No.	Description	Quantity
A4.3.1	Single-phase, ring type GIS Current Transformer (CT), all in accordance with IEC 61869-1&2, with two (2) cores with the following characteristics: a. Core I: Rated transformation ratio: 3000/1500/1 A, accuracy class 5P20, minimum rated output of 15 VA for over-current protection, earth fault protection, CB failure 1, CB failure 2 and Fault Recorder. b. Core II: Rated transformation ratio: 3000/1500/1 A, accuracy class PX for Busbar zone Main protection.	3 sets
A4.3.2	Single-phase, ring type GIS Current Transformer (CT), all in accordance with IEC 61869-1&2, with two (2) cores with the following characteristics: a. Core I: Rated transformation ratio: 3000/1500/1 A, accuracy class 0.5, minimum rated output of 10 VA for instrumentation. b. Core II: Rated transformation ratio: 3000/1500/1 A, accuracy class PX for Busbar zone Reserve protection.	3 sets
A4.4	Single phase busbars arranged as duplicate 3 phase busbar units (main and reserve)	1 set
A4.5	Structural support steelwork, access ladders, access ways and platforms to provide permanent access to all operative components	1 set
A4.6	Local control cubicle completed with mimic diagram, control switches for power operated switches & position indication for manually operated switches, Ammeter with reversible scale (0-1500A, 0-3000), Voltmeter scale 0-420kV with selector switch, Local/Remote selector switch and alarm annunciator for alarms with accept, cancel and lamp test, including all those necessary for the safety and efficient operation of the switchgear. In addition to all necessary cabling and wiring from switchgear and local control cabinet (Bay controller unit is acceptable)	1 set
A5	**Bus section GIS bay**	1 set
A5.1	**Bus Section Main Bar GIS equipment**	1 set
A5.1.1	Circuit breaker, 3 phase 3150A	1set
A5.1.2	Disconnector, 3 phase, 3150A, for circuit breaker isolation, power operated, complete with power operated maintenance earth switch on circuit breaker side of disconnector	2 sets
A5.1.3	Current transformers **on each side** of circuit breaker containing 2 cores as follows:	

Item No.	Description	Quantity
A5.1.3.1	Single-phase, ring type GIS Current Transformer (CT), all in accordance with IEC 61869-1&2, with two (2) cores with the following characteristics: a. Core I: Rated transformation ratio: 3000/1500/1 A, accuracy class 5P20, minimum rated output of 15 VA for over-current protection, earth fault protection, CB failure 1, CB failure 2 and Fault Recorder. b. Core II: Rated transformation ratio: 3000/1500/1 A, accuracy class PX for Busbar zone Main1 protection.	3 sets
A5.1.3.2	Single-phase, ring type GIS Current Transformer (CT), all in accordance with IEC 61869-1&2, with two (2) cores with the following characteristics: a. Core I: Rated transformation ratio: 3000/1500/1 A, accuracy class 0.5, minimum rated output of 10 VA for instrumentation. b. Core II: Rated transformation ratio: 3000/1500/1 A, accuracy class PX for Busbar zone Main2 protection.	3 sets
A5.1.4	Single phase busbars arranged as duplicate 3 phase busbar units.	1 set
A5.1.5	Structural support steelwork, access ladders, access ways and platforms to provide permanent access to all operative components	1 set
A5.1.6	Local control cubicle completed with mimic diagram, control switches for power operated switches & position indication for manually operated switches, Ammeter with reversible scale (0-1500A, 0-3000), Voltmeter scale 0-420kV with selector switch, Local/Remote selector switch and alarm annunciator for alarms with accept, cancel and lamp test, including all those necessary for the safety and efficient operation of the switchgear. In addition to all necessary cabling and wiring from switchgear and local control cabinet (Bay controller unit is acceptable)	1 set
A5.2	**Bus Section Reserve Bar GIS equipment**	1 set
A5.2.1	Disconnector, 3 phase, 3150A, complete with power operated maintenance earth switch (as shown in SLD of protection).	2 sets
A5.2.2	Maintenance earth switch, power operated, located between the bus section disconnectors.	1 set
A5.2.3	Single phase busbars arranged as duplicate 3 phase busbar units.	1 set
A5.2.4	Structural support steelwork, access ladders, access ways and platforms to provide permanent access to all operative components	1 set

Item No.	Description	Quantity
A5.2.5	Local control cubicle completed with mimic diagram, control switches for power operated switches & position indication for manually operated switches, Ammeter with reversible scale (0-1500A, 0-3000A), Voltmeter scale 0-420kV with selector switch, Local/Remote selector switch and alarm annunciator for alarms with accept, cancel and lamp test, including all those necessary for the safety and efficient operation of the switchgear. In addition to all necessary cabling and wiring from switchgear and local control cabinet (Bay controller unit is acceptable).	1 set
A6	**Main and reserve busbar**	
A6.1	**Busbar Main 1 and 2 GIS equipment**	**1 set**
A6.1.1	Power operated maintenance earth switch.	4 sets
A6.1.2	Single-phase, inductive type Voltage Transformer (VT), to be connected in the middle phase (Y) on Main 1 & 2 busbar all in accordance with IEC 61869-1&3, with two (2) secondary windings with the following characteristics: • Core I: Rated transformation ratio: $\frac{400}{\sqrt{3}} / \frac{0,11}{\sqrt{3}}$ kV/kV, accuracy class 0.5 for synchronization with appropriate rated output. • Core II: Rated transformation ratio: $\frac{400}{\sqrt{3}} / \frac{0,11}{\sqrt{3}}$ kV/kV, accuracy class 0.5 for Instrumentations & FR with appropriate rated output.	2 sets
	Note: disconnectors for the Busbar VTs can be added according to manufacturer design. The earth switches can be embedded also in these disconnectors.	
A6.2	**Busbar Reserve 1 and 2 GIS equipment**	**1 set**
A6.2.1	Power operated maintenance earth switch.	2 sets
A6.2.2	Single-phase, inductive type Voltage Transformer (VT), to be connected in the middle phase (Y) on Reserve 1 & 2 busbar all in accordance with IEC 61869-1&3, with two (2) secondary windings with the following characteristics: • Core I: Rated transformation ratio: $\frac{400}{\sqrt{3}} / \frac{0,11}{\sqrt{3}}$ kV/kV, accuracy class 0.5 for synchronization with appropriate rated output. • Core II: Rated transformation ratio: $\frac{400}{\sqrt{3}} / \frac{0,11}{\sqrt{3}}$ kV/kV, accuracy class 0.5 for Instrumentations & FR with appropriate rated output.	2 sets
	Note: disconnectors for the Busbar VTs can be added according to manufacturer design. The earth switches can be embedded also in these disconnectors.	
A7	**SF6 gas handling equipment for 400kV GIS.**	1 set

Item No.	Description	Quantity
A8	**Multicore and auxiliary cables to complete all interconnections required between the switchgear, local control cubicles and other items to complete.**	1 set
A9	**Crane for the GIS Building with lifting capacity not less than 10 Tons.** **(The lifting capacity shall be suitable for the weight of the GIS bays)**	1 set
	Control and Protection panels and equipment	
A10	**Control Panels for 400kV system for OHTL Control Panel (MAAN NO.1), (MAAN NO.2), (ATPS NO.1), (ATPS NO.2) AND 4 BAYS FOR FUTURE** **Should be equipped with the following:**	**8 set**
	Mimic diagram with discrepancy type control switches for, circuit breaker, isolators and discrepancy indicator for earth switches with buzzer in panel to indicate a discrepancy condition.	**1 set**
	Multifunction Digital power meter (P ,Q ,I ,V)	**1 set**
	Transducers for supervisory indications (P, Q, I, V).	**1 set**
	Lockable control selector switch (“Remote/Supervisory”).	**1 set**
	Lockable Off/Synchro/sys-synch selector switch with Indicating lamb for sys-synch position and off position.	**1 set**
	Interposing relays for supervisory control of circuit breaker, disconnectors and earth switches etc.… **(50vdc)...**	**1 set**
	All necessary switches, auxiliary relays, interposing transformers transducers, fuse links, test points, terminals, wiring, etc. to complete the scheme.	**1 set**
	Annunciator with accept, reset and lamp test push buttons with alarms according to Contractor’s Design approved by Client (with at least 20% spare),	**1 set**
A11	**400 KV OHTL protection** equipment to be installed on no less than two separate panels **(MAAN NO.1), (MAAN NO.2), (ATPS NO.1), (ATPS NO.2) AND 4 BAYS FOR FUTURE** **Should be equipped with the following:**	8 set

Item No.	Description	Quantity
A11.1	**Main 1 Protection Panel** - Line differential protection relay with Distance facility and fault location feature. - Directional Earth fault associated with first Line differential protection relay. - Auto reclose and synch check relay - Voltage protection relay (over voltage / under voltage). - Auto reclose selector switch (1P/3P/1+3P/Off) with indicating lamp in case Off position. - CBF 1 protection relay - Selector switch “Protection in Service/out of service”, for CBF relay with indicating lamp in case out of service. - Voltage monitoring relay for interlocking - Self-reset trip relay - Trip circuit supervision relays - Test plug for each protection relay - Inter-trip sends and receive relays, circuit test switch with appropriate test push buttons, signal lamps for distance, directional earth fault and direct inter trip signals. All necessary switches, auxiliary relays, interposing relays and transformers, fuse links, test block, MCBs, terminals, wiring, etc., to complete the scheme.	1set

Item No.	Description	Quantity
A11.2	**Main 2 Protection Panel** – Line differential protection relay with Distance facility and fault location feature (different manufacturer than main 1) Directional Earth fault associated with first Line differential protection relay. – CBF 2 protection relay – Selector switch "Protection in Service/out of service", for CBF relay with indicating lamp in case out of service. – Self-reset trip relay – Trip circuit supervision relays – Test plug for each protection relay – Inter-trip sends and receive relays, circuit test switch with appropriate test push buttons, signal lamps for distance, directional earth fault and direct inter trip signals All necessary switches, auxiliary relays, interposing relays and transformers, fuse links, test block, MCBs, terminals, wiring, etc., to complete the scheme.	1 set
A12	**Additional protection relays for ATPS s/s**	
A12.1	Line differential protection relay with Distance facility and fault location feature same type as MAIN1.	**2 sets**
A12.2	Line differential protection relay with Distance facility and fault location feature same type as MAIN2.	**2 sets**
A13	**Control Panels for 400kV system for Auto transformer Control Panel (ATR NO.1), (ATR NO.2) AND one (1) FOR FUTURE** **Should be equipped with the following:**	**3 set**
	Mimic diagram with discrepancy type control switches for, circuit breaker, isolators and discrepancy indicator for earth switches with buzzer in panel to indicate a discrepancy condition.	**1 set**
	Multifunction Digital power meter (P ,Q ,I ,V)	**1 set**
	Transducers for supervisory indications (P, Q, I, V).	**1 set**
	Lockable control selector switch ("Remote/Supervisory").	**1 set**
	Lockable Off/Synchro selector switch with Indicating lamb for off position.	**1 set**

Item No.	Description	Quantity
	Interposing relays for supervisory control of circuit breaker, disconnectors and earth switches etc.… **(50vdc)...**	**1 set**
	All necessary switches, auxiliary relays, interposing transformers transducers, fuse links, test points, terminals, wiring, etc. to complete the scheme.	**1 set**
	Annunciator with accept, reset and lamp test push buttons with alarms according to Contractor's Design approved by Client (with at least 20% spare),	**1 set**
A14	**400 kV Auto transformer protection** equipment to be installed on not less than two separate panels **(ATR NO.1), (ATR NO.2) AND one (1) FOR FUTURE** **Should be equipped with the following:**	3 set
A14.1	**Main 1 Protection Panel** – High impedance protection relay. – Circuit breaker fail 1 protection relay. – Transformers mechanical (physical) protection voltage operated relays with hand reset indicators flags for the alarms according to Contractor's Design – Selector switch "Protection in Service/out of service", for CBF relay with indicating lamp in case out of service. – Trip circuit supervision relays – Electrically hand rest trip relays – Test plug for each protection relay – All necessary switches, auxiliary relays, interposing relays and transformers, fuse links, test block, MCBs, terminals, wiring, etc., to complete the scheme.	1 set

Item No.	Description	Quantity
A14.2	**Main 2 Protection Panel** – Low impedance biased differential protection relay with over flux and synchro check facility. – Circuit breaker fail 2 protection relay – Over current, earth fault protection relay with neutral E/F facility (from HV NCT). – Selector switch "Protection in Service/out of service", for CBF relay with indicating lamp in case out of service. – Electrically hand rest trip relays – Trip circuit supervision relay – Test plug for each protection relay All necessary switches auxiliary relays interposing transformers MCBs, links (fuse block: link in fuse holder), terminals test blocks for main relays, wiring etc., to compete the scheme.	1 set
A15	**Control panel for 400 kV Bus Section:**	**1 set**
	Mimic diagram with discrepancy type control switches for, circuit breaker, isolators and discrepancy indicator for earth switches with buzzer in panel to indicate a discrepancy condition.	**1 set**
	Multifunction Digital power meters (P ,Q ,I ,V)	**2 sets**
	Transducer for supervisory indications (P, Q, I, V).	**2 sets**
	Lockable control selector switch ("Remote/Supervisory").	**1 set**
	Lockable Off/Synchro selector switch with Indicating lamb for off position.	**1 set**
	Interposing relays for supervisory control of circuit breaker, disconnectors and earth switches etc.… (50vdc)...	**1 set**
	All necessary switches, auxiliary relays, interposing transformers transducers, fuse links, test points, terminals, wiring, etc. to complete the scheme.	**1 set**
	Annunciator with accept, reset and lamp test push buttons with alarms according to Contractor's Design approved by Client (with at least 20% spare),	**1 set**

Item No.	Description	Quantity
A16	**Bus Section protection equipment** to be installed on one separate panel and equipped with the following relays and associated equipment: – Over current and earth fault relay with synchro check facility. – CBF 1 relay – CBF 2 relay – 2 trip circuit supervision relays – Two Selector switch "Protection in Service/out of service", for CBF relays with indicating lamps in case out of service. – Self-reset trip relay – Test plug for each protection relay – All necessary switches auxiliary relays interposing transformers MCBs, links (fuse block: link in fuse holder), terminals, test Blocks for main relays, wiring etc, to compete the scheme.	1 set
A17	**Control panel for 400 kV Bus Coupler:**	**1 set**
	Mimic diagram with discrepancy type control switches for, circuit breaker, isolators and discrepancy indicator with buzzer in panel to indicate a discrepancy condition.	**1 set**
	Multifunction Digital power meter (P ,Q ,I ,V)	**2 sets**
	Transducer for supervisory indications (P, Q, I, V).	**2 sets**
	Lockable control selector switch ("Remote/Supervisory").	**1 set**
	Lockable Off/Synchro selector switch with Indicating lamb off position.	**1 set**
	Interposing relays for supervisory control of circuit breaker, disconnectors and earth switches etc.… (50vdc)...	**1 set**
	All necessary switches, auxiliary relays, interposing transformers transducers, fuse links, test points, terminals, wiring, etc. to complete the scheme.	**1 set**
	Annunciator with accept, reset and lamp test push buttons with alarms according to Contractor's Design approved by Client (with at least 20% spare),	**1 set**

Item No.	Description	Quantity
A.18	**Bus Coupler protection equipment** to be installed on one separate panel and equipped with the following relays and associated equipment: – Over current and earth fault relay with synchro check facility. – CBF 1 relay – CBF 2 relay – 2 trip circuit supervision relays – Two Selector switch “Protection in Service/out of service”, for CBF relays with indicating lamps in case out of service. – Self-reset trip relay – Test plug for each protection relay – All necessary switches auxiliary relays interposing transformers MCBs, links (fuse block: link in fuse holder), terminals, test Blocks for main relays, wiring etc, to compete the scheme	1 set

Item No.	Description	Quantity
A.19	**400 kV High Impedance Busbar Protection (Comprised of two Panels) for indoor installation with IP41 degree of mechanical protection, completely wired, equipped with the following equipment and devices:** • Four (4) High Impedance Busbar protection relays for Main 1, Main 2, Reserve & Check Zones. • Four (4) CT supervision relays. • Electrical/hand reset trip relays for tripping the required circuits (1 trip relay for each circuit + 2 trip relays for Bus Coupler + 2 trip relays for Bus Section + 4 spare trip relays), • Any necessary test blocks for testing the Busbar protection relays and any alarm relays necessary for remote alarms and indications, • Isolation switches (In & Out of service) for the tripping of Busbar protection relays with indicating lamps in case out of service. • Signaling lamps for each Zone (i.e. Busbar protection operated for each Zone, Busbar protection fail for each Zone, DC healthy, Busbar protection in/out of service for each zone…), • Annunciator with accept, reset and lamp test push buttons with alarms according to Contractor's Design approved by Client (with at least 20% spare), • All necessary switches, MCBs, auxiliary relays, interposing transformers, transducers, links (fuse block: link in fuse holder), terminals, labels, test blocks for main relays, wiring, etc. to complete the scheme. –	2 set

Item No.	Description	Quantity
A.20	400 kV Fault Recorder Panel for indoor installation with IP41 degree of mechanical protection, completely wired, equipped with fault recorders arranged to record the waveforms of three (3) phase voltages and three (3) phase and neutral currents: – Eight (8) 400 kV OHTL feeder circuits, – Three (3) 400 kV TR circuits, – One (1) 400 kV bus coupler circuit, – One (1) 400 kV bus section circuit, – Four (4) 400 kV spare (future) circuits, Fault recorders shall be provided to cater for a minimum of 256 event/digital inputs & 128 analogues. The device shall be equipped with distance to fault, time, date, and alarms for "recorder faulty" and "fault recorder triggered". All necessary auxiliary transformers and interposing relays, all necessary wiring and additional relay contacts shall be included in relay panels to enable recorder to be connected. Recorder(s) are to be triggered by the operation of the main, backup protections and trip relays of new substation circuits. Recorder(s) are to produce a record for a period adjustable from 5 to 60 seconds. The record is to include, at least 15 cycles of pre fault conditions. The device shall generally have features as indicated below for all the substation circuits, however the final arrangement shall be agreed with the Client during the design stage of the contract. Waveforms to be captured: – 3 phase currents (for all cct.). – Residual current (for all cct.). – 3 phase voltage (for all cct.). Events/Digital inputs to be captured: – Distance protection/transformer trip relays. – Distance PLC send and receive signals. – Main protection for each feeder. – Back up protection for each feeder. – Tripping of each feeder circuit breaker. – Tripping of bus-section circuit breaker. – Tripping of bus coupler circuit breaker. – All the events/digital input channels in order to comply with NEPCO scheme, with wiring up to recorder panel terminal blocks. In addition, the recorders shall also include: – Inter trigger between recorders. – Time synch module, synchronized either by GPS receiver and antenna or BNC socket for IRIG-B signal (TTL). – At least one Remote connection either by internal modem or Ethernet connection 10BASE-T. – Software packages for configuration and records retrieval, display, analyzing, and printing capabilities. – Non-volatile storage for normal DFR recorders and triggered slow scan records. – Automatic printout for the fault records through external Printer. – Global positioning system	1 set

Item No.	Description	Quantity
	GPS receiver for clock synchronization of numeric protection device's fault recorders complete with antenna and cable.	
A.21	**Global Positioning System (GPS):** GPS receiver for clock synchronization of numeric protection device's and fault recorders complete with antenna and cable.	2 sets
A.22	**System synchronising panel:** one common relay for all feeders in a separate panel - All necessary switches, auxiliary relays, interposing transformers transducers, fuse links, test points, terminals, wiring, etc. to complete the scheme - test plug for system synch relay *Refer to technical specifications for more info.	1 set

Item No.	Description	Quantity
A.23	**Alarm and Control Station Desk:** Alarm and Control Station Desk in 400 kV control room for indoor installation, completely wired, equipped with the following equipment and devices: - Annunciator with accept, reset and lamp test push buttons with station alarms according to Contractor's Design (with at least 20% spare), - Selector switch for "Substation unattended/Substation attended". The selector switch shall disconnect all audible alarms when in the "Unattended" position. Two (2) pairs of potential free contacts, one pair arranged to close in the "Attended" position and the other pair "Unattended position", shall be wired to the remote control and supervisory marshalling cabinet. A further set of two (2) pairs of contacts (closed with the switch in the "Attended" position) shall be provided as well. - For accept / reset command for acceptable and cancellation of alarms should be controllable from NCC. - Common push button to accept all alarms for all annunciators. - Common push button to reset all alarms for all annunciators. - three differentiated audible alarms for trip signal, non-trip signals, and discrepancy alarms. - Temperature and humidity indicator (0-10 mA DC) and range scale for temperature (-20 ºC ÷ 60 ºC) and for humidity (0 ÷ 100%). - A suitable padded, swivel type office chair shall be provided with the work station control desk.	1 set

Item No.	Description	Quantity
A.24	Supervisory Control & Telemetering Marshalling Cabinets: Supervisory Control & Telemetering Marshalling Cabinet for indoor installation with IP41 degree of mechanical protection, completely wired, equipped for the following: – Eight (8) 400 kV OHTL feeder circuits, – Three (3) 400 kV ATR circuits, – One (1) 400 kV Bus coupler circuit, – One (1) 400 kV Bus section circuit, – Four (4) 400 kV spare (future) circuits,	2 sets
A.25	**Neutral CTs:** Single-phase, oil-insulated, post type Current Transformer (CT), for outdoor installation, complete with supporting steel structure, all in accordance with IEC 61869-1&2, with one (1) core with the following characteristics:	
A25.1	- Neutral single-phase current transformer for connection between the transformer neutral bushing and the earth system. CT to contain one CT core ratio 2000/1000/1A for earth fault protection. Class 5P20 and duty to suit the application. To include all connections support steel structure, terminal boxes, clamps, connectors, etc, to inter-connect with auto-transformer neutral bushing and earth system.	2 sets
A25.2	- Neutral single-phase current transformer for connection between the earthing transformer neutral bushing and the earth system. The CT to contain one CT core ratio 750/1A for earth fault and over current protection. Class 5P20 and duty to suit the application. To include all connections support steel structure, terminal boxes, clamps, connectors, etc to inter-connect with earthing-transformer neutral bushing and earth system.	2 sets
A26	**110VDC Equipment for Substation AAWDCP 400/132/33 kV, 400KV GIS building, 110 V DC Equipment, comprising of the following equipment:**	**1 set**
A26.1	**110 V DC Batteries** High-performance, Nickel-Cadmium (Ni-Cd), vented (open) or semi-sealed type, pocket plate or sintered plate, housed in a totally enclosed polystyrene translucent plastic containers. Each battery shall have capacity to meet the total requirements of the actual complete equipment to be supplied for substation, plus 50% spare capacity, but not less than 450 Ah/5 h. Batteries shall be supplied complete with adequate battery racks/stands and accessories stated in Particular Technical Specifications.	2 sets
A26.2	**Fuse Boxes** Wall mounted fuse box with double-pole fuses of adequate rating.	2 sets

Item No.	Description	Quantity
A26.3	**110 V DC Battery Charger – Rectifier** 110 V DC Battery Charger – Rectifier Panel, free-standing type, for indoor installation with IP41 degree of mechanical protection, completely wired, with the following installed equipment per Panel:	2 sets
	110 V Battery Charger – Rectifier, with float & boost charging modes, with rated capacity according to Contractor's calculation. but not less than 150 A.	1 set
	Incoming Circuit Breaker of adequate rating according to the Contractors Design.	1 set
	Voltage dropping diodes of adequate rating.	1 set
	Outgoing Circuit Breaker of adequate rating according to the Contractors Design.	1 set
	Measuring instruments & indicators according to Particular Technical Specifications.	1 set
A26.4	**110 V DC Distribution Board** 110 V DC Distribution Board, free-standing type, for indoor installation with IP41 degree of mechanical protection, completely wired, with the following installed equipment:	1 set
	Incoming Circuit Breaker of adequate rating according to the Contractors Design.	2 sets
	Bus Section Circuit Breaker of adequate rating according to the Contractors Design.	1 set
	Double-pole Miniature Circuit Breakers (MCBs) of adequate ratings with alarm contact for all substation equipment/consumers according to the Contractors Design.	1 set
	Incoming Voltmeter	2 sets
	Incoming Ammeter	2 sets
	Earth fault relay	2 sets
	One (1) spare MCB of each type/rating.	1 set
	Note: interlocking between 110 V DC switchboards shall be provided with electrical type and hard-wired interlocks.	
A 27	**400V AC Equipment for Substation AAWDCP 400/132/11 kV – New substation 400KV GIS building** **400 V AC Equipment, comprising of the following equipment**	**1 set**
A 27.1	400VAC distribution Board/Switchgear	
	400 V AC Distribution Board/Switchgear, metalclad, free-standing type, for indoor installation with IP41 degree of mechanical protection, with two (2) busbar sections for suitable rated current and for 40 kA rated short-time (1 s) withstand current, completely wired, with alarm fascia/display, with all cable glands for cables entering from the bottom side, with interlocking specified in Particular Technical Specifications for and shown on the Tender Drawing , with the following installed equipment:	1 set
A27.1.1	Automatic Transfer Switch (ATS) with all necessary switching and control equipment (incoming supply automatic changeover contactor mechanical and electrical interlock) for quickly and reliably switching between power supply sources from two (2) Earthing & Auxiliary transformers (400/132/33KV TR1) and (400/132/33KV TR2).	1 set

Item No.	Description	Quantity
A27.1.2	Main incoming Circuit Breaker for main incoming power supplies from the Earthing & Auxiliary transformers, for suitable rated current. Main incoming Circuit Breakers shall be mutually interlocked and interlocked with Stand-by incoming Circuit Breaker & Bus section Circuit Breaker as per Tender technical specification and Drawing.	2 sets
	Stand-by incoming Circuit Breaker for stand-by incoming power supply from diesel generator for suitable rated current, interlocked with Main incoming Circuit Breaker & Bus section Circuit Breaker as per Tender technical specification and Drawing.	1 set
	Bus section Circuit Breaker for suitable rated current, interlocked with Main incoming Circuit Breakers & Stand-by incoming Circuit Breaker as per Tender technical specification and Drawing.	1 set
	Incoming ammeter scaled 0 ÷ xx A with phase selector switch.	3 sets
	Bus section ammeter scaled 0 ÷ xx A with phase selector switch	1 set
	Incoming voltmeter scaled 0 ÷ 420 V with selector switch.	3 sets.
	Incoming 3-phase kWh meter.	3 sets
	Moulded Case Circuit Breakers (MCCBs) of adequate ratings for all substation equipment/consumers according to the Contractors Design.	1 set
	Miniature Circuit Breakers (MCBs) of adequate ratings for all substation equipment/consumers according to the Contractors Design.	1 set
	One (1) spare MCCB of each type/rating.	1 set
	One (1) spare MCB of each type/rating.	1 set
	Socket Outlet for Transformer Oil Treatment Plant Socket Outlet for 160 A rated current, for outdoor installation, for transformer oil treatment plant (each socket shall be mounted on the nearest trench transformer area in side separate enclosure).	3 sets
	Note: the rated current for the LVAC SWG shall be determined by the calculations and design of the contractor.	
A28	**Automatic, Mains Failure, Standby Diesel Generator for 400KV GIS building** Complete with all fuel filling facilities, storage tanks, generator circuit breaker, control board, batteries, power cable to connections to the LVAC Services Board, also it shall be under an appropriate enclosure with it is auxiliary equipment keeping protected from the direct sun. Installation will be safe from accidental trips. Generator is to be installed in the dedicated building; however, noise levels will be below those defined OSHA standards. **Note: the rated power for the Diesel Generator shall be determined by the contractor according to actual load (Not less than 630 kVA), with spare of 20%.**	1 set
A29	**Substation Earthing System, comprising of the following equipment and materials:** **this system shall be covered the whole substation (400 KV, 132KV and 33 KV etc.).**	1 set

Item No.	Description	Quantity
	Stranded copper (Cu) conductor for substation earthing grid, with characteristics and quantities according to the Contractors Design.	1 set
	Copper (Cu) earthing rods with preferred dimensions of Ø 15 mm & 3.5 m length, complete with clamps.	1 set
	Joints of stranded Cu conductor of different sizes. The joints shall be exothermic CADWELD. Important notes: – Cad-weld moulds types and quantities are according to the supplier design. – each Cad-weld mould shall be specified for a maximum 20 joints. The Cad-weld moulds are to be supplied by contractor.	1 set
	Earthing pits, mat and operating plat form.	1 set
	Note: The exact quantities and characteristics of substation earthing system equipment & materials shall be determined according to the Contractors Design and earthing system calculation.	
A30	**Lightning protection** system for ALL buildings and including all outdoor equipment Comprising (for whole substation): – Steel supporting masts height of 25m (at least) or Pylons, complete with clamps, jumpers, etc. for supporting overhead steel earth wire line and (where necessary) overhead line earth wire (calculation shall be provided for NEPCO) – Lightning protection rods to protect the control building according to design. – Set of steel earth wires to form Overhead Earthing Screen section area.	1 set
A31	**Set (3 single phase) of the portable Earthing equipment to be suitable for primary conductor and Busbar**	1 set

- The 420kV GIS type surge arrestor shown are the minimum. The contractor shall carry out EMTDC/ insulation coordination study, to establish the adequacy of surge arrestor proposed, for entire GIS based on the study result, if any additional surge arrestors are deemed necessary, additional surge arrestor at suitable location shall be provided.
- Very fast transient overvoltage (VFTO) study shall also be conducted for the entire GIS/GIB and suitable protective measures to be implemented.
- Local Control Cubicles (LCC), one set for each bay.
- Each LCC should be provided with Mimic Board for Local/Maintenance control (of CB, and all disconnector, and grounded switches), complete with bus diagram, auxiliary relays, devices, moulded case circuit breakers, contactors, control switches, semaphore indicators, etc. Each LCC should also be provided with annunciator and nameplate.
- The route, configuration and length of the 400 kV GIB are preliminary and shall be finalized during detailed engineering based on the approved layout, site conditions and interface requirements, including those at the far-end substations. The Contractor shall provide the complete GIB system and all required accessories in accordance with the final approved arrangement, without any additional cost impact to the Employer.