



Department of Alternative
Energy Development and Efficiency
MINISTRY OF ENERGY

LAM PHRA PHLOENG HYDROPOWER PROJECT
AMPHOE PAK THONG CHAI CHANGWAT NAKHON RATCHASIMA

ELECTRO-MECHANICAL EQUIPMENT

VOLUME 3

BID FORMS, SCHEDULES OF QUANTITIES



FRONTIER ENGINEERING CONSULTANTS CO., LTD.

JANUARY 2019

LAM PHRA PHLOENG HYDROPOWER PROJECT

SCHEDULE 1 - GUARANTEED PERIODS

The work listed below and described in the clause references shown shall be completed within the stated guaranteed periods in days from the Date of Acceptance.

Each item below marked '*' is subject to liquidated damages as provided for in Clause C6.07

The guaranteed period shall be accomplished by program of work (Clause C6.05)

Clause	Work	Guaranteed Period
C6.06 (4) (a) C6.06 (4) (b) C6.06 (4) (c) C6.06 (4) (d)	Supply of Drawings and Information Supply of Drawings and Information Supply of Drawings and Information Supply of Drawings and Information	
C6.05 (3)	Installation and handing over of pipe-work and anchor bolts for draft tubes to be embedded in first stage concrete Installation and handing over of anchor bolts for powerhouse crane Installation and handing over of spiral casing, spiral casing anchor bolts and inlet valve anchor bolts Installation and handing over of generator anchor bolts and baseplate	
C6.05 (4)	* Delivery to Site	18 months
	* Taking Over	24 months

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SCHEDULE 2 - Summary of Prices

Item No.	Details	Total Price (Baht)
1	Total Price of Equipment	
2	Total Price of Spare Parts	
3	Total Price of Maintenance Tools and Instruments*	
4	Price of Factory Tests	
5	Price of Erection	
6	Price of Field Performance Tests	
	SUB - TOTAL	
	VAT 7%	
GRAND TOTAL BID PRICE		

Note : * The Bidder shall breakdown the price of Maintenance Tools and Instruments as specified in Clause S 1.04 of Volume 2 in Schedule 5

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SCHEDULE 3 - SUMMARY PRICES OF EQUIPMENT

Item No.	Details	Total Price (Baht)
1	Turbine and Governor	
2	Inlet Valve	
3	Mechanical Auxiliary Equipment	
4	Generator and Auxiliaries	
5	Switchboards	
6	Generator Terminal Cubicles, Bus Ducts and Neutral Cubicles	
7	DC Station Services	
8	Control, Protection and Alarm System	
9	Main Transformer	
10	Line Protection and Switchyard Equipment	
11	Communication System	
12	Grounding System	
13	Electrical Auxiliary Equipment	
SUB - TOTAL		

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SCHEDULE 3 - PRICES OF EQUIPMENT

Item No.	Details	Quantity	Unit	Unit Rate Baht/Unit	Total (Baht)
1	Turbine and Governor				
	(1) Vertical Kaplan Turbine	2	Set		
	(2) Hydraulic Governing System	2	Set		
	(3) PLC Governor Cubicle	2	Set		
	Sub - Total				
2	Inlet Valve				
	(1) Inlet Valve and Bypass Valve	2	Set		
	(2) Gate Valve 1.35 m and Auxilliaries	1	Set		
	Sub - Total				
3	Mechanical Auxiliary Equipment				
	(1) Unit Cooling Water System	2	Set		
	(2) Air conditioning and Ventilation System	1	LS		
	(3) Water Drainage System	1	LS		
	(4) Portable Fire Extinguishers	1	LS		
	(5) Overhead Traveling Crane	1	Set		
	(6) Diesel-driven Standby Electric Power System	1	Set		
	Sub - Total				
4	Generator and Auxiliaries				
	(1) Generator with Flywheel	2	Set		
	(2) Oil Lubrication System	2	Set		
	(3) Excitation System	2	Set		
	Sub - Total				
5	AC Station Service Transformers and AC Switch Board				
	(1) Station Service Transformer	1	Set		
	(2) AC Switch Board	1	Set		
	Sub - Total				

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SCHEDULE 3 - PRICES OF EQUIPMENT

Item No.	Details	Quantity	Unit	Unit Rate Baht/Unit	Total (Baht)
6	Generator Terminal Cubicles, Bus Ducts and Neutral Cubicles				
	(1) Generator CB Cubicle	2	Set		
	(2) Generator CT, PT Cubicle	2	Set		
	(3) Excitation Transformer Cubicle	2	Set		
	(4) Generator Neutral Cubicles	2	Set		
	(5) Station Service Transformer Cubicle	1	Set		
	(6) Station Service DS Cubicle	1	Set		
	Sub - Total				
7	DC Station Services				
	(1) Battery Cells with Rack	1	Set		
	(2) Battery Charger	1	Set		
	(3) DC Distribution Panel Board	1	Set		
	Sub - Total				
8	Control, Protection and Alarm System				
	(1) Control, Protection and Alarm Equipment	1	Lot		
	Sub - Total				
9	Main Transformer				
	(1) Main Transformer	2	Set		
	Sub - Total				
10	Line Protection				
	(1) Recloser with Electronic controls	1	Set		
	(2) Vacuum Circuit Breaker	1	Set		
	(3) 22 kV Drop Out fuse	9	Set		
	(4) 22 kV Lightning Arrester	6	Set		
	(5) 22 kV Voltage Transformer	3	Set		
	(6) 22 kV Current Transformer	3	Set		
	(7) 22 kV Disconnecting Switch	1	Set		
	(8) 22 kV Protection Cubicle	1	Set		
	(9) HV Switch gear 22 kV (indoor type)	4	Set		
	(10) Electrical concrete pole and others	4	Set		
	(11) HDPE conduit 5"	54	m.		
	(12) Switchyard and Fence	1	LS		
	Sub - Total				

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SCHEDULE 3 - PRICES OF EQUIPMENT

Item No.	Details	Quantity	Unit	Unit Rate Baht/Unit	Total (Baht)
11	<u>Communication System</u>				
	(1) Communication System	1	Set		
	(2) CCTV System	1	LS		
	Sub - Total				
12	Ground System				
	(1) Ground System	1	LS		
	Sub - Total				
13	Electrical Auxiliary Equipment				
	(1) Cable Trays and Support	1	Lot		
	(2) Conduit, Boxes and Fitting	1	Lot		
	(3) CU/XLPE/PVC 12/20 (24) Kv Cable	1	Lot		
	(4) SAC 25 kV Cable	1	Lot		
	(5) 750 V Wire and Cable	1	Lot		
	(6) Control Cable	1	Lot		
	(7) Station Clocks	4	Set		
	(8) Water Level Transmitter	1	Set		
	(9) Motor Control Center Panels	1	Lot		
	Sub - Total				

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SCHEDULE 4 - PRICES FOR SPARE PARTS

The spare parts for the Plant shall include those specified below plus the additional recommended spare parts which shall be listed individually for each item.

The spare parts listed below shall be supplied in accordance with Clause S1.05.

The prices for recommended spare parts shall not be included in the prices stated in Schedule 3.

Item No.	Details	Quantity	Unit	Unit Rate Baht/Unit	Total (Baht)
	<u>Specified Spare Part for Item 1(a)</u>				
	<u>Turbines and Governors</u>				
1.1	Shear pin	2	sets		
1.2	Rotating runner seals	2	sets		
1.3	Fixed runner seals	2	sets		
1.4	Wearing plates for turbine	2	sets		
1.5	Guide vane bushes and sleeves	2	sets		
1.6	Guide vane	2	pieces		
1.7	Shaft sleeves and seals Set	2	sets		
1.8	Complete set of governor actuator (If required)	1	set		
1.9	Governor regulating valves or pilot valve	1	set		

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SCHEDULE 4 - PRICES FOR SPARE PARTS

Item No.	Details	Quantity	Unit	Unit Rate Baht/Unit	Total (Baht)
1.10	Unloader valve or directional valve	1	set		
1.11	Governor oil pump and motor (AC+DC)	1	set		
1.12	Piston and gland packings for guide vane servomotor	2	sets		
1.13	Packing seals and gaskets for the turbines, governors	1	set		
1.14	Solenoid for each type and size of electrically operated valve	1	set		
1.15	Limit switch of each type	1	set		
1.16	Temperature, level, pressure, and flow relays of each type	1	set		
1.17	Valves, complete of each size and type used of 50 mm nominal bore and below including control valves and their actuators	2	sets		
1.18	Governor PLC modules used (CPU, Comm module, etc.)	1	set		
1.19	1 auxiliary relay of each kind	1	set		
1.20	Speed Monitoring Relay	2	Sets		
Total for Item 1 (a)					

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SCHEDULE 4 - PRICES FOR SPARE PARTS

Item No.	Details	Quantity	Unit	Unit Rate Baht/Unit	Total (Baht)
	<u>Additional Recommended Spare Parts for</u> <u>Item 1(b) Turbines and Governors</u> (To be Completed by Bidder)				
Total for Item 1 (b)					

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SCHEDULE 4 - PRICES FOR SPARE PARTS

Item No.	Details	Quantity	Unit	Unit Rate Baht/Unit	Total (Baht)
	<u>Specified Spare Part for Item 2(a)</u>				
	<u>Inlet Valve</u>				
2.1	Packing seals and gaskets	2	sets		
2.2	Motor bypass valve	2	sets		
2.3	Limit switch of each type	2	sets		
Total for Item 2 (a)					

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SCHEDULE 4 - PRICES FOR SPARE PARTS

Item No.	Details	Quantity	Unit	Unit Rate Baht/Unit	Total (Baht)
	<u>Additional Recommended Spare Parts for Item 2(b) Inlet Valve</u> (To be Completed by Bidder)				
Total for Item 2 (b)					

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SCHEDULE 4 - PRICES FOR SPARE PARTS

Item No.	Details	Quantity	Unit	Unit Rate Baht/Unit	Total (Baht)
	<u>Specified Spare Parts for Item 3(a)</u> <u>Mechanical Auxiliary Equipment</u>				
3.1	Cooling water strainer	1	set		
3.2	Replaceable parts for reducing valve and relief valve (if fitted)	1	set		
3.3	Air compressor valves	1	set		
3.4	Air compressor piston rings and bearings	1	set		
3.5	Air compressor gaskets	1	set		
3.6	Air filters for air conditioning plant	1	set		
3.7	1 set of lined shoes for each brake crane	1	lot		
3.8	1 set of crane motor	1	lot		
3.9	Crane Control pad	1	set		

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SCHEDULE 4 - PRICES FOR SPARE PARTS

Item No.	Details	Quantity	Unit	Unit Rate Baht/Unit	Total (Baht)
3.10	1 complete contactor of each size and type	1	lot		
3.11	1 limit switch of each type	1	lot		
3.12	1 set of piston ring, oil ring	1	lot		
3.13	1 set of fuel injection valve	1	lot		
3.14	Diesel engine packing and spring	1	Set		
3.15	DieselEngine bearing metal	1	Set		
3.16	Alternator Brush	1	Set		
3.17	Control pads of generator	1	Set		
3.18	Fuel filling kit	1	Set		
Total for Item 3 (a)					

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SCHEDULE 4 - PRICES FOR SPARE PARTS

Item No.	Details	Quantity	Unit	Unit Rate Baht/Unit	Total (Baht)
	<u>Additional Recommended Spare Parts for Item 3(b) Mechanical Auxiliary Equipment</u> (To be completed by Bidder)				
Total for Item 3 (b)					

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SCHEDULE 4 - PRICES FOR SPARE PARTS

Item No.	Details	Quantity	Unit	Unit Rate Baht/Unit	Total (Baht)
	<u>Spare Spart for Item 4(a)</u>				
	<u>Generators and Auxiliaries</u>				
4.1	Generator bearing metals of each type	1	set		
4.2	Temperature relay, vapor pressure type	1	set		
4.3	thermometer and other relays	1	set		
4.4	Valves of each kind	1	set		
4.5	Speed monitoring relay	2	sets		
4.6	Limit switch of each type	1	set		
4.7	1 current transformer of each type and rating	1	set		
4.8	Vibration sensor	1	set		

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SCHEDULE 4 - PRICES FOR SPARE PARTS

Item No.	Details	Quantity	Unit	Unit Rate Baht/Unit	Total (Baht)
4.10	<u>Excitation System (all of each kind)</u>				
	- Breakers	1	set		
	- Silicon diode	6	set		
	- Thyristor	6	set		
	- printed circuit cards of each type	2	set		
	- Current transformers	1	set		
	- Relays	2	set		
	- Control motor	1	set		
4.11	<u>Miscellaneous Items</u>				
	- Auxiliary relays of each kind	1	lot		
Total for Item 4 (a)					

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SCHEDULE 4 - PRICES FOR SPARE PARTS

Item No.	Details	Quantity	Unit	Unit Rate Baht/Unit	Total (Baht)
	<u>Additional Recommended Spare Parts for</u> <u>Item 4(b) Generators and Auxiliaries</u> (To be completed by Bidder)				
Total for Item 4 (b)					

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SCHEDULE 4 - PRICES FOR SPARE PARTS

Item No.	Details	Quantity	Unit	Unit Rate Baht/Unit	Total (Baht)
	<u>Specified Spare Part for Item 5(a)</u> <u>Switchboard</u>				
5.1	22 kV fuse	1	set		
5.2	1 main and auxiliary contacts for air circuit breaker of each type	1	lot		
5.3	1 coils or motors for air circuit breaker of each type (closing and tripping)	1	lot		
5.4	1 current transformer of each type and rating	1	lot		
5.5	1 voltage transformer of each type and rating	1	lot		
5.6	2 fuse carriers of each type and size	1	lot		
5.7	1 protection relay of each type	1	lot		

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SCHEDULE 4 - PRICES FOR SPARE PARTS

Item No.	Details	Quantity	Unit	Unit Rate Baht/Unit	Total (Baht)
5.10	1 auxiliary relay of each type	1	lot		
5.11	50 pieces of indicating lamp	1	lot		
5.12	1 no fuse breaker of each type	1	lot		
Total for Item 5 (a)					

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SCHEDULE 4 - PRICES FOR SPARE PARTS

Item No.	Details	Quantity	Unit	Unit Rate Baht/Unit	Total (Baht)
	<u>Additional Recommended Spare Parts for</u> <u>Item 5(b) Switchboard</u> (To be completed by Bidder)				
Total for Item 5 (b)					

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SCHEDULE 4 - PRICES FOR SPARE PARTS

Item No.	Details	Quantity	Unit	Unit Rate Baht/Unit	Total (Baht)
	<u>Specified Spare Part for Item 6(a)</u>				
	<u>Transformer Terminal Cubicles, Generator</u>				
	<u>Terminal Cubicles, Bus Ducts, and Neutral Cubicles</u>				
6.1	Generator circuit breaker	1	set		
6.2	1 coil or motor for generator circuit breaker (closing and tripping)	1	lot		
6.3	1 current transformer of each type	1	lot		
6.4	1 voltage transformer of each type	1	lot		
6.5	3 insulator for bus duct of each type	1	lot		
6.6	1 no fuse breaker of each type	1	lot		
6.7	2 fuse carriers of each type and size with replacement fuse	1	lot		
6.8	50 pieces of indicating lamp	1	lot		
Total for Item 6 (a)					

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SCHEDULE 4 - PRICES FOR SPARE PARTS

Item No.	Details	Quantity	Unit	Unit Rate Baht/Unit	Total (Baht)
	<u>Additional Recommended Spare Parts for Item 6(b)</u> <u>Transformer Terminal Cubicles, Generator</u> <u>Terminal Cubicles, Bus Ducts, and Neutral Cubicles</u> (To be completed by Bidder)				
Total for Item 6 (b)					

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SCHEDULE 4 - PRICES FOR SPARE PARTS

Item No.	Details	Quantity	Unit	Unit Rate Baht/Unit	Total (Baht)
	<u>Specified Spare Part for Item 7(a)</u>				
	<u>DC Station Services</u>				
7.1	1 battery charger rectifier of each type	1	lot		
7.2	Battery Cells	5	sets		
7.3	1 no fuse breaker of each type	1	lot		
7.4	2 fuse carriers of each type and size	1	lot		
7.5	2 replacement fuse cartridge for every fuse	1	lot		
7.6	20 pieces of indicating lamp	1	lot		
Total for Item 7 (a)					

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SCHEDULE 4 - PRICES FOR SPARE PARTS

Item No.	Details	Quantity	Unit	Unit Rate Baht/Unit	Total (Baht)
	<u>Additional Recommended Spare Parts for Item 7(b) DC Station Services</u> (To be completed by Bidder)				
Total for Item 7 (b)					

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SCHEDULE 4 - PRICES FOR SPARE PARTS

Item No.	Details	Quantity	Unit	Unit Rate Baht/Unit	Total (Baht)
	<u>Specified Spare Parts for Item 8(a)</u> <u>Control, Protection and Alarm System</u>				
8.1	Each type of CPU module used	2	sets		
8.2	Each type of power supply module used	2	sets		
8.3	Each communication cards used	2	sets		
8.4	Each type of I/O cards used	2	sets		
8.5	Each type of AVR set used	1	sets		
8.6	Each type of auxiliary relay used	1	sets		
Total for Item 8 (a)					

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SCHEDULE 4 - PRICES FOR SPARE PARTS

Item No.	Details	Quantity	Unit	Unit Rate Baht/Unit	Total (Baht)
	<u>Additional Recommended Spare Parts for</u> <u>Item 8(b) Control, Protection and Alarm</u> <u>System</u> (To be completed by Bidder)				
Total for Item 8 (b)					

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SCHEDULE 4 - PRICES FOR SPARE PARTS

Item No.	Details	Quantity	Unit	Unit Rate Baht/Unit	Total (Baht)
	<u>Specified Spare Parts for Item 9(a)</u>				
	<u>Main Transformers</u>				
9.1	Gaskets	1	set		
9.2	1 temperature relay of each type	1	set		
9.3	Breathing device	1	set		
Total for Item 9 (a)					

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SCHEDULE 4 - PRICES FOR SPARE PARTS

Item No.	Details	Quantity	Unit	Unit Rate Baht/Unit	Total (Baht)
	<u>Additional Recommended Spare Parts for Item</u> <u>9(b) Main Transformers</u> (To be completed by Bidder)				
Total for Item 9 (b)					

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SCHEDULE 4 - PRICES FOR SPARE PARTS

Item No.	Details	Quantity	Unit	Unit Rate Baht/Unit	Total (Baht)
	<u>Specified Spare Parts for Item 10(a)</u>				
	<u>Line Protection Equipment and Switchyard</u>				
10.1	2 lightning arrester	2	sets		
10.2	Drop Out Fuse 100A	2	sets		
10.3	22kV Current Transformer	1	set		
10.4	22kV Voltage Transformer	1	set		
10.5	GCB Closing Coils	2	sets		
10.6	GCB Tripping Coils	2	sets		
10.7	20 pieces of indicating lamp	1	lot		
Total for Item 10 (a)					

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SCHEDULE 4 - PRICES FOR SPARE PARTS

Item No.	Details	Quantity	Unit	Unit Rate Baht/Unit	Total (Baht)
	<u>Additional Recommended Spare Parts for Item 10(b) Line Protection Equipment and Switchyard</u> (To be completed by Bidder)				
Total for Item 10 (b)					

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SCHEDULE 4 - PRICES FOR SPARE PARTS

Item No.	Details	Quantity	Unit	Unit Rate Baht/Unit	Total (Baht)
	<u>Specified Spare Parts for Item 13(a)</u>				
	<u>Electrical Auxiliary Equipment</u>				
13.1	100 meters of spare cable (0.75 kV type)	1	lot		
13.2	Cable terminations of each type	1	lot		
13.3	1 no-fuse breaker of each type	1	lot		
Total for Item 11 (a)					

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SCHEDULE 4 - PRICES FOR SPARE PARTS

Item No.	Details	Quantity	Unit	Unit Rate Baht/Unit	Total (Baht)
	<u>Additional Recommended Spare Parts for Item 13(b) Miscellaneous Electrical Equipments</u> (To be completed by Bidder)				
Total for Item 11 (b)					

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SCHEDULE 5 – PRICES OF MAINTENANCE TOOLS AND INSTRUMENTS

Maintenance tools and instruments for all Plant shall be provided in accordance with Clause S1.04.

The individual tools and appliances provided for each Item shall be listed below with the corresponding prices stated for each and the total prices shall be included against Item 3 in Schedule 1.

Item No.	Details	Quantity	Unit	Unit Rate Baht/Unit	Total (Baht)
1	<u>Maintenance Tools and Instruments for all Items</u>				
1.1	Portable oil centrifuge unit (list to be provided below)				

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SCHEDULE 5 – PRICES OF MAINTENANCE TOOLS AND INSTRUMENTS

Maintenance tools and instruments for all Plant shall be provided in accordance with Clause S1.04.

The additional recommended of maintenance tools and instruments shall be listed below and shall not be included in the prices stated in Schedule 1.

Item No.	Details	Quantity	Unit	Unit Rate Baht/Unit	Total (Baht)
2	<u>Additional Recommended of Maintenance Tools and Instruments for all Items</u> (list to be provided below)				
Total for Schedule 5					

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SCHEDULE 6 - DRAWINGS, ILLUSTRATIONS, TECHNICAL AND OTHER INFORMATION

REF. NO.	SPEC. CLAUSE NO.	PARTICULARS OF DRAWINGS, ETC. REQUIRED	TITLES OF DESCRIPTIONS OF DRAWINGS, ETC. SUBMITTED BY BIDDER	REFERENCE
		<u>Item 1 - Turbine, Governor, Inlet Valve and Ancillaries</u>		
1.1		Reference list of Vertical Kaplan turbines, governors and inlet valves recently supplied.		
1.2		General and Sectional arrangement of turbine, governor, generator, inlet valve, and ancillaries relative to the station.		
1.3	S2.01	Performance Curves of turbine output, efficiency and discharge at net head and discharge		
1.4	S2.02	Model Test Report		
1.5	S2.02	Pressure and Speed rise calculation		
1.6	S2.03	Description of governor including Panel Layout with components		
1.7	S2.03	P & I Diagram and Layout of Hydraulic Pressure Unit		
1.8	S2.03	Manufacturer catalogs and information of Governor PLC modules		
1.9	S2.03	Manufacturer catalogs and information of HMI touch screen		
1.10		Turbine Site Efficiency Test Methods and Procedures		
1.11		GD ² Calculation and Dummy Load Test Information		

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SCHEDULE 6 - DRAWINGS, ILLUSTRATIONS, TECHNICAL AND OTHER INFORMATION

REF. NO.	SPEC. CLAUSE NO.	PARTICULARS OF DRAWINGS, ETC. REQUIRED	TITLES OF DESCRIPTIONS OF DRAWINGS, ETC. SUBMITTED BY BIDDER	REFERENCE
		<u>Item 3 - Mechanical Auxiliary Equipment</u>		
3.1	S2.5.01	Drawings and description of unit cooling water system		
3.2	S2.5.06	Drawings and description of overhead traveling crane		
3.3	S2.5.07	Description of diesel-driven standby electric power system.		

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SCHEDULE 6 - DRAWINGS, ILLUSTRATIONS, TECHNICAL AND OTHER INFORMATION

REF. NO.	SPEC. CLAUSE NO.	PARTICULARS OF DRAWINGS, ETC. REQUIRED	TITLES OF DESCRIPTIONS OF DRAWINGS, ETC. SUBMITTED BY BIDDER	REFERENCE
		<u>Item 4 - Generator and Auxiliaries</u>		
4.1		Reference list of hydro-generators recently supplied.		
4.2		General and sectional arrangement of turbine runner mounted directly on generator shaft		
4.3		Generator dimensional layout drawing from manufacturer		
4.4		Capability Curves and Performance Curves of Generator		
4.5		Bearing Selection and Calculation		
4.6		Lubrication Oil Supply System Drawings and information		
4.7		AVR manufacturer's catalogs and information		
4.8		VPI Insulation evidence in Manufacturer's catalogs		
4.9		Generator Factory Performance Test items and procedures		

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SCHEDULE 6 - DRAWINGS, ILLUSTRATIONS, TECHNICAL AND OTHER INFORMATION

REF. NO.	SPEC. CLAUSE NO.	PARICULARS OF DRAWINGS, ETC. REQUIRED	TITLES OF DESCRIPTIONS OF DRAWINGS, ETC. SUBMITTED BY BIDDER	REFERENCE
5.1		<u>Item 5 - AC Station Service Transformers and AC Switchboard</u> Manufacturer's literature describing of the following equipment offered : (1) Protection relays (2) Digital Power Meter		
5.2	S8.03	Description of station service transformer		

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SCHEDULE 6 - DRAWINGS, ILLUSTRATIONS, TECHNICAL AND OTHER INFORMATION

REF. NO.	SPEC. CLAUSE NO.	PARTICULARS OF DRAWINGS, ETC. REQUIRED	TITLES OF DESCRIPTIONS OF DRAWINGS, ETC. SUBMITTED BY BIDDER	REFERENCE
6.1		<u>Item 6 - Generator Terminal Cubicles, Bus Ducts, and Neutral Cubicles</u> Catalogs of VCB		
6.2		Catalogs of Current Transformer		
6.3		Catalogs of Voltage Transformer		
6.4		Catalogs of MV Switchgear		

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SCHEDULE 6 - DRAWINGS, ILLUSTRATIONS, TECHNICAL AND OTHER INFORMATION

REF. NO.	SPEC. CLAUSE NO.	PARTICULARS OF DRAWINGS, ETC. REQUIRED	TITLES OF DESCRIPTIONS OF DRAWINGS, ETC. SUBMITTED BY BIDDER	REFERENCE
		<u>Item 7 - DC Station Services</u>		
7.1	S2.10.03	Description of batteries.		
7.2	S2.10.06	Description of battery chargers.		

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SCHEDULE 6 - DRAWINGS, ILLUSTRATIONS, TECHNICAL AND OTHER INFORMATION

REF. NO.	SPEC. CLAUSE NO.	PARTICULARS OF DRAWINGS, ETC. REQUIRED	TITLES OF DESCRIPTIONS OF DRAWINGS, ETC. SUBMITTED BY BIDDER	REFERENCE
8.1		<u>Item 8 - Control, Protection and Alarm System</u> Manufacturer's literature describing each type of the following equipment offered : (1) PLC Modules catalogs and manufacturer's letters (2) Protection Relay catalog for Generator Protection (3) Protection Relay catalog for Line Protection (4) Overall Main Single Line Diagram with protection functions (5) Communication modules of SCADA		

LAM PHRA PHLOENG HYDROPOWER PROJECT

SCHEDULE 6 - DRAWINGS, ILLUSTRATIONS, TECHNICAL AND OTHER INFORMATION

REF. NO.	SPEC. CLAUSE NO.	PARTICULARS OF DRAWINGS, ETC. REQUIRED	TITLES OF DESCRIPTIONS OF DRAWINGS, ETC. SUBMITTED BY BIDDER	REFERENCE
9.1	S2.12.02	<u>Item 9 - MainTransformers</u> General arrangement and description of main transformers		

LAM PHRA PHLOENG HYDROPOWER PROJECT

SCHEDULE 6 - DRAWINGS, ILLUSTRATIONS, TECHNICAL AND OTHER INFORMATION

REF. NO.	SPEC. CLAUSE NO.	PARTICULARS OF DRAWINGS, ETC. REQUIRED	TITLES OF DESCRIPTIONS OF DRAWINGS, ETC. SUBMITTED BY BIDDER	REFERENCE
		<u>Item 10 - Line Protection Equipment</u>		
10.1	S13.04	Catalogs of 22kV Circuit Breaker		
10.2	S13.04	Catalogs of 22kV Recloser		
10.3	S13.04	Catalogs of 22kV DS		
10.4	S13.04	Catalogs of 22kV Current Transformer		
10.5	S13.04	Catalogs of 22kV Voltage Transformer		
10.6	S13.04	Catalogs of 22kV Drop out fuse		
10.7	S13.04	Catalogs of 22kV Line Protection Relay		

LAM PHRA PHLOENG HYDROPOWER PROJECT

SCHEDULE 6 - DRAWINGS, ILLUSTRATIONS, TECHNICAL AND OTHER INFORMATION

REF. NO.	SPEC. CLAUSE NO.	PARTICULARS OF DRAWINGS, ETC. REQUIRED	TITLES OF DESCRIPTIONS OF DRAWINGS, ETC. SUBMITTED BY BIDDER	REFERENCE
		<u>Item 13 - Electrical Auxiliary Equipment</u>		
13.1	S16.06	Drawings and description of cables.		
13.2	S16.13	Description of HV cable end treating material.		

SCHEDULE 7 - GUARANTEED AND INFORMATIVE DATA

The Bidder shall fill in all the following lists of Guaranteed and Informative Data.

The Department reserves the right to reject any Bid which does not include all the pertinent lists duly filled by Bidder and all technical specifications mentioned here shall comply with Volume - 2 of Bid Documents.

The following Guaranteed Data shall conform to the Technical Specifications and, when accepted by the Department shall prevail over the Technical Specifications.

The Department reserves the right to reject any Bid which include guaranteed Data not in accordance with Volume 2 of Technical Specifications.

1. TURBINE, GOVERNOR, INLET VALVE AND MECHANICAL AUXILIARY EQUIPMENT

(1) Turbines

-	Type/ Model	_____	
-	Manufacturer	_____	
-	Country of Origin of Manufacturer's Factory	_____	
-	Rated Net Head	_____	m
-	Operating Head Range (min. - max.)	_____	m
-	Design Discharge (At Rated)	_____	m ³ /sec
-	Design Discharge Range (min. - max.)	_____	m ³ /sec
-	Rated Synchronous Speed	_____	rpm
-	Maximum runaway speed	_____	rpm
-	Maximum momentary speed rise on load rejection	_____	rpm
-	Maximum momentary pressure rise on load rejection	_____	%/ bar
-	Reated Turbine Output at rated head	_____	kW
-	Efficiency at rated output	_____	%
-	Number of Runner Blades	_____	
-	Maximum Suction Head	_____	m
-	Runner directly mounted on generator shaft	_____	(Yes/ No)
-	Isolated operation mode	_____	(Yes/ No)
-	Acceptable instantanous load change	_____	kW

Load	100%	90%	80%	70%	60%
Turbine Efficiency					

-	Turbine Performance Curve/ Hill Curve submitted	_____	(Yes/ No)
-	Turbine CAM Relation Curve submitted	_____	(Yes/ No)
-	Maximum runaway speed	_____	rpm
-	Maximum momentary speed rise on load rejection	_____	rpm

-	Maximum momentary pressure rise on load rejection	_____ %/ bar
-	Runner	_____
	Runner hub Material	_____
	Runner hub diameter	_____ mm
	Runner hub cast and forged in one piece	_____
	Runner blade material	_____
	Runner blade cast in one piece	_____
	Runner blade (fix/ adjustable)	_____
	Runner blade position feedback sensor type	_____
	Total number of runner blades	_____
	Overall runner diameter with blades	_____ mm
-	GD ² of rotating parts (Runner+Generator Rotor+Flywheel)	_____ kg-m ²
-	GD ² of rotating parts (Generator Rotor+Flywheel)	_____ kg-m ²
-	Flywheel mass	_____ kg
-	Speed rise and pressure rise calculation attached with Bid at 100% load rejection	_____ (Yes/ No)
-	Guide Vane	
	Number of Guide Vane	_____
	Material of Guide Vane	_____
	Material of Guide Vane Stem	_____
-	Material of guide vane bearing bush	_____
	Guide vane position feedback sensor type	_____
	Shear Pin Alarm device included	_____ (Yes/ No)
-	Shaft Sealing type/ material	_____
-	Has the Bidder's manufacturer performed model test for the proposed turbine?	_____ (Yes/ No)
	(if yes, please indicate details of laboratory)	_____
	Place of test performed (country/ city)	_____
	Details Contact information	_____
-	Bidder's manufacturer based the guarantees for this project from the performed model test	_____ (Yes/ No)
	(if yes, please attach Model Test Report)	_____
-	Elevation/ Dimensional drawings of equipment at each floor attached with Bid showing all equipment locations	_____ (Yes/ No)
-	Weight of Kaplan Runner hub with blades	_____ kg
-	Weight of Spiral Casing with Kaplan runner	_____ kg
-	Dummy Load Test methods and procedures submitted	_____ (Yes/ No)
-	Turbine field efficiency test procedures submitted	_____ (Yes/ No)

(2) Governor

Governor PLC Cubicle

- Type/ Model _____
- Manufacturer _____
- Country of Origin _____
- Panel plate thickness _____ mm
- IP Class _____
- Panel layout with components submitted _____ (Yes/ No)

PLC Controller

- Type/ Model _____
- Manufacturer _____
- Country of Origin _____
- Controller Speed _____ bit
- Controller Working Memory _____ MB
- Number of Ethernet Port _____
- Working Temperature (Ambient) _____ °C
- Manufacturer Catalog submitted _____ (Yes/ No)

Power Supply modules

- Type/ Model _____
- Manufacturer _____
- Country of Origin _____
- Operating Voltage _____ Vdc
- Redundant Power _____ (Yes/ No)
- Manufacturer Catalog submitted _____ (Yes/ No)

HMI Touch Screen

- Type/ Model _____
- Manufacturer _____
- Country of Origin _____
- Operating Voltage _____ Vdc
- Display Size _____ inch
- Display resolution _____ x _____ pixel
- Interface Method _____
- IP Protection Class _____
- Manufacturer Catalog submitted _____ (Yes/ No)
- HMI parameter pages submitted _____ (Yes/ No)

Communication Modules

- Type/ Model _____
- Manufacturer _____
- Country of Origin _____
- Interface Method _____
- Working Temperature (Ambient) _____ °C

-	Operating Voltage	_____	Vdc
-	Manufacturer Catalog submitted	_____	(Yes/ No)
Digital/ Analog IO Modules			
-	Type/ Model	_____	
-	Manufacturer	_____	
-	Country of Origin	_____	
-	Interface Method	_____	
-	Operating Voltage	_____	Vdc
-	Manufacturer Catalog submitted	_____	(Yes/ No)
RTD Modules			
-	Type/ Model	_____	
-	Manufacturer	_____	
-	Country of Origin	_____	
-	Manufacturer Catalog submitted	_____	(Yes/ No)
PLC Software			
-	Type/ Model	_____	
-	Manufacturer/ Country of Origin	_____	
-	Country of Origin	_____	
-	Manufacturer Catalog submitted	_____	(Yes/ No)
-	Control system configuration/ Sequence submitted	_____	(Yes/ No)
-	Dummy load (isolated) operation program included	_____	(Yes/ No)
Speed Controller/ Monitoring Relay			
-	Type/ Model	_____	
-	Manufacturer/ Country of Origin	_____	
-	Type of input/ number of channel	_____	
-	Rated Supply Voltage	_____	Vdc
-	Input Signal type	_____	
-	Output signal type	_____	mA
-	Input Frequency (max)	_____	kHz
-	Accuracy for measurement	_____	%
-	Manufacturer Catalog submitted	_____	(Yes/ No)
Digital Power Meter			
-	Type/ Model	_____	
-	Manufacturer/ Country of Origin	_____	
-	Rated Supply Voltage	_____	Vdc
-	Accuracy class	_____	
-	Communication Port type	_____	
-	Manufacturer Catalog submitted	_____	(Yes/ No)
Governor Hydraulic Pressure Unit			
-	Type/ Model	_____	
-	Manufacturer/ Country of Origin	_____	
-	Comply/ applicable standard	_____	

- Location of installation _____
- Number of AC pump and Capacity _____
- Insulation class _____
- Protection class _____
- Total number of accumulator _____
- Operating pressure range _____ bar
- Capacity of pressure tank _____ liter
- Grade of oil and type _____
- External Cooling needed _____ (Yes/ No)
- Hydraulic P& I diagram submitted _____ (Yes/ No)
- Drawing for component and layout arrangement submitted _____ (Yes/ No)

(3) Inlet Valve and Bypass Valve

- Type/ Model _____
- Manufacturer/ Country of Origin _____
- Inlet Valve Diameter _____ mm
- Valve Disc materials _____
- Disc Seat materials _____
- Inlet Valve Opening and Closing Methods
 - a) Opening Method (Remote/ Local) _____
 - b) Closing Method _____
- Bypass Valve diameter _____ mm
- Bypass Valve Opening and Closing Methods
 - a) Opening/ Closing by motor (Remote) _____ Vdc
 - b) Opening/ Closing by valve (Local/ Manual) _____
- Dimensional drawing for layout submitted _____ (Yes/ No)

(4) GENERATOR AND AUXILIARIES

4.1 Generator

- Type _____
- Manufacturer _____
- Country of Origin _____
- Rated Output Capacity at 0.8 p.f. _____ kW
- Synchronous Speed _____ rpm
- Rated Voltage Generator Terminals _____ V
- Rated Current _____ A
- Power Factor _____ p.u.
- Frequency _____ Hz
- Cooling Method _____
- Enclosure Type _____
- Protection Class _____
- Insulation Class (Rotor/ Stator) _____

- Insulation Process for Stator and Rotor _____
- Short Circuit Ratio (not less than) _____ p.u.
- Generator capability curves submitted by manufacturer _____ (Yes/ No)
- Generator dimesional drawings submitted by manufacturer _____ (Yes/ No)
- Noise level, not greater than _____ dB
- Generator Reactances at rated output and voltage
 - a) Direct axis, transient reactance, saturated (X'd) _____
 - b) Direct axis, transient reactance, unsaturated (X'd) _____
 - c) Direct axis, sub-transient reactance, saturated (X''d) _____
 - d) Direct axis, sub-transient reactance, unsaturated (X''d) _____
 - e) Synchronous reactance, saturated (Xd) _____
 - f) Synchronous reactance, unsaturated (Xd) _____
 - g) Negative Sequence reactance, saturated (X2) _____
 - h) Negative Sequence reactance, unsaturated (X2) _____

The efficiency of the Generator at different output loads for 0.8 and 1.0 power factor

<u>Rated Output</u>	<u>At 0.8 P.F.</u>	<u>At 1.0 P.F.</u>
110%		
100%		
75%		
50%		
25%		

Values for 100 % percent rated output and 0.8 p.f. shall be considered as guaranteed rated efficiency.

- Generator Bearing
 - Type of bearing (DE) _____
 - Type of bearing (NDE) _____
 - Bearing Cooling Method _____
 - Bearing Mounted at Generator Housing _____ (Yes/ No)
 - Runner Directly Mounted with Extended Shaft _____ (Yes/ No)
 - Bearing Calculation with loads and forces submitted _____ (Yes/ No)
- Lubricating Oil Supply Unit
 - Number of Lubrication Oil Pump-Motor _____
 - Rating of AC motor _____ V
 - Capacity of AC motor _____
 - Rating of DC motor _____ V
 - Capacity of DC motor _____
 - Protection Class (for both motors) _____
 - Insulation Class (for both motors) _____
 - Lubricating Oil Unit Drawing with components submitted _____ (Yes/ No)
 - P&I diagram for lubrication and cooling water submitted _____ (Yes/ No)
- Flywheel included in generator housing _____ (Yes/ No)
- GD² of rotating parts (Generator Rotor+Exciter+Flywheel) _____ kg-m²

-	GD ² of rotating parts (Runner+Rotor+Exciter+Flywheel)	_____	kg-m ²
-	Weight of generator with Flywheel and Rotor exciter	_____	kg
-	Factory Acceptance Test procedures submitted	_____	(Yes/ No)
-	Compliance standard for FAT	_____	

4.2 Excitation System

Automatic Voltage Regulator (AVR)

-	Type/ Model	_____	
-	Manufacturer/ Country of Origin	_____	
-	Power Supply	_____	V
-	Rated Excitation Voltage	_____	V
-	Rated Excitation Current	_____	Adc
-	Current at rated load and power factor	_____	Adc
-	AVR control loop	_____	(Yes/ No)
-	Temperature Sensing Input	_____	(Yes/ No)
-	Output Relay Contacts	_____	(Yes/ No)
-	3 Phase voltage sensing	_____	(Yes/ No)
-	3 Phase current sensing	_____	(Yes/ No)
-	Communication Port provided for SCADA	_____	(Yes/ No)

Exciter Rotor

-	Type/ Model	_____	
-	Manufacturer/ Country of Origin	_____	
-	Insulation type/ class	_____	
-	Manufacturer of diode/ thyristor	_____	
-	Number of bridge arms and diodes/ thyristor in series	_____	
-	Number of bridge arms in parallel	_____	
-	Exciter rotor assembly on shaft	_____	(Yes/ No)
-	Method of cooling	_____	

Auxiliary Winding for AVR excitation

-	Manufacturer	_____	
-	Type/ Installaion location	_____	
-	Winding rated capacity	_____	VA
-	Winding rated ratio	_____	V
-	Type of conductor	_____	
-	Insulation Class	_____	
-	Accuracy Class	_____	

(5) AC STATION SERVICE TRANSFORMER AND AC SWITCH BOARD

5.1	Station Service Transformer		
-	Type/ Model	_____	
-	Manufacturer/ Country of Origin	_____	
-	Rated Capacity	_____	kVA
-	Impedance based on nominal voltage	_____	%
-	Insulation Class	_____	
-	No load losses at 75°C	_____	Watt
-	Load losses at 75°C	_____	Watt
-	Sound Level	_____	dB(A)
5.2	AC Switchboard		
-	Type/ Model	_____	
-	Manufacturer/ Country of Origin	_____	
-	Country	_____	
-	Rated Capacity	_____	V
-	Protection Class	_____	
-	Control Power Supply	_____	Vdc
5.3	Main Circuit breaker		
-	Type/ Model	_____	
-	Manufacturer/ Country of Origin	_____	
-	Rated Breaking Current	_____	kA
-	Control Power Supply	_____	Vdc
5.4	Current transformers		
-	Type/ Model	_____	
-	Manufacturer/ Country of Origin	_____	
-	Burden/ Accuracy Class	_____	
-	Number of Core	_____	
5.5	Voltage transformers		
-	Type/ Model	_____	
-	Manufacturer	_____	
-	Burden	_____	
-	Number of Core	_____	
5.6	Indicating Instruments		
a)	Ammeter		
-	Type/ Model	_____	
-	Manufacturer	_____	
-	Accuracy Class	_____	
b)	Voltmeters		
-	Type/ Model	_____	
-	Manufacturer	_____	
-	Accuracy Class	_____	

c)	Watt Hour Meter	
-	Type/ Model	_____
-	Manufacturer	_____
-	Accuracy Class	_____
d)	Selector Switch	
-	Type/ Model	_____
-	Manufacturer	_____
e)	Protective relays (27/ 59)	
-	Type/ Model	_____
-	Manufacturer	_____
f)	Protective relays (50/ 51)	
-	Type/ Model	_____
-	Manufacturer	_____
-	Control Power Supply	_____ Vdc
g)	Auxiliary relays	
-	Type/ Model	_____
-	Manufacturer	_____
-	Control Power Supply	_____ Vdc

(6) TRANSFORMER TERMINAL, GENERATOR TERMINAL CUBICLES and NEUTRAL CUBICLES

6.1 MV Switchgear Cubicle for Generator Terminal and Transformer Terminal Cubicles

-	Type/ Model	_____
-	Manufacturer/ Country of Origin	_____
-	Rated Capacity	_____ kV
-	Continuous Current	_____ A
-	Short Time Current	_____ kA
-	Protection Class	_____
-	Control Power Supply	_____ Vdc
-	Type Test submitted (Yes/ No)	_____

a) MV Circuit Breaker

-	Type/ Model	_____
-	Manufacturer/ Country of Origin	_____
-	Rated Capacity	_____ kV
-	Interrupting Medium	_____
-	Continuous Current	_____ A
-	Short Time Current	_____ kA
-	Type of operating mechanism	_____
-	Protection Class	_____
-	Control Power Supply	_____ Vdc

b)	MV Disconnecting Switch		
	- Type/ Model	_____	
	- Manufacturer/ Country of Origin	_____	
	- Rated Capacity	_____	kV
	- Continuous Current	_____	A
	- Control Power Supply	_____	Vdc
c)	MV Current Transformer		
	- Type/ Model	_____	
	- Manufacturer/ Country of Origin	_____	
	- Rated primary current	_____	A
	- Rated secondary current	_____	A
	- Rated CT ratio	_____	
	- Accuracy classes (metering and protection)	_____	
	- Continuous thermal current at ambient temp.	_____	A
d)	MV Voltage Transformer		
	- Type/ Model	_____	
	- Manufacturer/ Country of Origin	_____	
	- Rated primary Voltage	_____	V
	- Rated secondary voltage	_____	V
e)	MV Lightning Arrester		
	- Type/ Model	_____	
	- Manufacturer/ Country of Origin	_____	
	- Residual voltage at 10 kA	_____	(kV)
	- Residual voltage at 20 kA	_____	(kV)
	- Manufacturer	_____	
6.2	Neutral Resistor Cubicles		
	- Type/ Model	_____	
	- Manufacturer/ Country of Origin	_____	
	- Rated Voltage	_____	V
	- Resistance Value	_____	
	- Disconnecting Switch Rating/ No. of Phase	_____	
(7)	CONTROL, PROTECTION AND ALARM SYSTEM		
7.1	Unit Controller (PLC)		
	- Type/ Model	_____	
	- Manufacturer/ Country of Origin	_____	
	- Rated Power Supply	_____	Vdc
	- Maximum processing time	_____	second
	- Degree of protection of system board	_____	
	- Type of CPU	_____	
	- Type of memories and size	_____	Kbytes
	- Interface to field devices	_____	
		(Yes/No)	

	-	Communication port for network connection		
	-	Max. number of I/O modules per CPU		
	-	System Configuration submitted (Yes/ No)		
7.2		Digital input/output module		
	-	Type/ Model		
	-	Manufacturer/ Country of Origin		
	-	Rated Power Supply		Vdc
	-	Maximum processing time		second
7.3		Analog input/output module		
	-	Type/ Model		
	-	Manufacturer/ Country of Origin		
	-	Rated Power Supply		Vdc
	-	Number of input signal available per module		second
7.4		Communication module		
	-	Type/ Model		
	-	Manufacturer/ Country of Origin		
	-	Rated Power Supply		Vdc
	-	Communication Type/ Port		
	-	Communication Protocol		
7.5		Pulse Input Module		
	-	Type/ Model		
	-	Manufacturer/ Country of Origin		
	-	Rated Power Supply		Vdc
	-	Maximum Input available per module		
	-	Input Frequency Range (MW, Mvar)		
	-	Input Frequency Range (rpm)		
7.6		Operator Control Station		
	-	Type/ Model		
	-	Manufacturer/ Country of Origin		
	-	Rated Power Supply		Vac
	-	Operating System Software		
	-	Power Supply Module		Watt
	-	CPU Model/ Type		MHz
	-	CPU microprocessor length		bit
	-	HDD Capacity		Gbyte
	-	RAM Capacity		Gbyte
	-	VGA Card Capacity		Gbyte
	-	LCD Monitor size		inch
7.7		PLC Liscensed Software (For Unit PLC)		
	-	Name/ Descriptions		
	-	Type/ Model		
	-	Manufacturer/ Country of Origin		

7.8 Protection Relay

- | | | |
|----|--|-----------|
| a) | Generator Multifunction Protection Relay | |
| - | Name/ Descriptions | _____ |
| - | Type/ Model | _____ |
| - | Manufacturer/ Country of Origin | _____ |
| b) | Directional O/C and Ground Relay | |
| - | Name/ Descriptions | _____ |
| - | Type/ Model | _____ |
| - | Manufacturer/ Country of Origin | _____ |
| c) | Directional O/C and Ground Relay | |
| - | Name/ Descriptions | _____ |
| - | Type/ Model | _____ |
| - | Manufacturer/ Country of Origin | _____ |
| d) | Lock-Out Relay | |
| - | Name/ Descriptions | _____ |
| - | Type/ Model | _____ |
| - | Manufacturer/ Country of Origin | _____ |
| e) | Auto Sync. Relay | |
| - | Name/ Descriptions | _____ |
| - | Type/ Model | _____ |
| - | Manufacturer/ Country of Origin | _____ |
| f) | Auto Sync. Relay | |
| - | Name/ Descriptions | _____ |
| - | Type/ Model | _____ |
| - | Manufacturer/ Country of Origin | _____ |
| g) | Protection Relay Cubicle | |
| - | Name/ Descriptions | _____ |
| - | Type/ Model | _____ |
| - | Manufacturer/ Country of Origin | _____ |
| - | Degree Of Protection | _____ |
| - | Power Supply for relay | _____ Vdc |
| - | Power Supply for transducer, conditioner, aux. relay | _____ Vdc |

7.9 Metering and Alarm System

- | | | |
|----|---------------------------------|-------|
| a) | Digital Multimeter | |
| - | Name/ Descriptions | _____ |
| - | Type/ Model | _____ |
| - | Manufacturer/ Country of Origin | _____ |

b)	Energy Meter for selling electricity	
-	Name/ Descriptions	_____
-	Type/ Model	_____
-	Manufacturer/ Country of Origin	_____
c)	Frequency Meter	
-	Name/ Descriptions	_____
-	Type/ Model	_____
-	Manufacturer/ Country of Origin	_____
d)	Voltmeter	
-	Name/ Descriptions	_____
-	Type/ Model	_____
-	Manufacturer/ Country of Origin	_____
	Scale Range	_____ V
f)	Ammeter	
-	Name/ Descriptions	_____
-	Type/ Model	_____
-	Manufacturer/ Country of Origin	_____
-	Scale Range	_____ A
g)	Power Factor Meter	
-	Name/ Descriptions	_____
-	Type/ Model	_____
-	Manufacturer/ Country of Origin	_____

(8) MAIN TRANSFORMERS

-	Type/ Model	_____
-	Manufacturer/ Country of Origin	_____
-	Rated Capacity	_____ kVA
-	Impedance at rated voltage	_____ %
-	Vector Group	_____
-	Material of Winding	_____
-	Temperature Rise Avarage	_____ Celsius
-	Temperature at Hottest Spot	_____ Celsius
-	Insulation Class	_____
-	No load losses at 75°C	_____ Watt
-	Load losses at 75°C	_____ Watt
-	Sound Level	_____ dBA
-	Amount of oil required per transformer	_____ Liter
-	Weight of Transformer with oil	_____ kg

(9) LINE PROTECTION AND SWITCHYARD EQUIPMENT

a)	22kV Gas Circuit Breaker		
-	Type/ Model	_____	
-	Manufacturer/ Country of Origin	_____	
-	Rated Capacity	_____	kV
-	Interrupting Medium	_____	
-	Continuous Current	_____	A
-	Short Time Current	_____	kA
-	Control Power Supply	_____	Vdc
b)	22kV Disconnecting Switch		
-	Type/ Model	_____	
-	Manufacturer/ Country of Origin	_____	
-	Rated Capacity	_____	kV
-	Continuous Current	_____	A
-	Short Time Current	_____	kA
-	Control Power Supply	_____	Vdc
c)	22kV Current Transformer		
-	Type/ Model	_____	
-	Manufacturer/ Country of Origin	_____	
-	Rated primary current	_____	A
-	Rated secondary current	_____	A
-	Rated CT ratio	_____	
-	Accuracy class for metering	_____	
-	Accuracy class for relaying	_____	
-	Continuous thermal current at ambient temp.	_____	A
-	Rated thermal burden	_____	VA
d)	22V Voltage Transformer		
-	Type/ Model	_____	
-	Manufacturer/ Country of Origin	_____	
-	Rated primary Voltage	_____	V
-	Rated secondary Voltage	_____	V
-	Rated VT ratio	_____	
-	Rated thermal burden	_____	VA
e)	22kV Lightning Arrester		
-	Type/ Model	_____	
-	Manufacturer/ Country of Origin	_____	
-	Residual voltage at 10 kA	_____	(kV)
-	Residual voltage at 20 kA	_____	(kV)
-	Manufacturer	_____	

- | | | | |
|----|--|-------|-----|
| f) | 22kV Protection Relay Cubicle | | |
| - | Type/ Model | _____ | |
| - | Manufacturer/ Country of Origin | _____ | |
| - | Power Supply for relay | _____ | Vdc |
| - | Power Supply for transducer, conditioner, aux. relay | _____ | Vdc |

(10) DC STATION SERVICE

- | | | | |
|----|--------------------------------------|-------|-----------|
| a) | Battery Cells | | |
| - | Type/ Model | _____ | |
| - | Manufacturer/ Country of Origin | _____ | |
| - | Battery Cell type | | |
| - | Number of Cells | | |
| - | Rated capacity at 10 hr rate | _____ | Ah |
| - | Battery Sizing Calculation submitted | _____ | (Yes/ No) |
| - | Battery Sizing Calculation Standard | _____ | |
| b) | Battery Charger | | |
| - | Type/ Model | _____ | |
| - | Manufacturer/ Country of Origin | _____ | |
| - | Power Supply | _____ | Vac |
| - | Enclosure Type | _____ | |
| - | Protection Class | _____ | |
| - | Nominal Output of Charger | _____ | Vdc |
| - | Output Range of Charger | _____ | Vdc |
| c) | DC Distribution Panel | | |
| - | Type/ Model | _____ | |
| - | Manufacturer/ Country of Origin | _____ | |

(11) ELECTRICAL AUXILIARIES

- | | | | |
|----|---------------------------------|-------|--------------|
| a) | Motor Control Center | | |
| - | Type/ Model | _____ | |
| - | Manufacturer/ Country of Origin | _____ | |
| - | Rated Capacity | _____ | V |
| - | Rated Continuous Current | _____ | A |
| - | Short Time Current | _____ | kA |
| - | Protection Class | _____ | |
| - | Control Power Supply | _____ | Vdc |
| - | Type Test submitted (Yes/ No) | _____ | |
| b) | Forebay Water Level Transmitter | | |
| - | Type/ Model | _____ | |
| - | Manufacturer/ Country of Origin | _____ | |
| - | Sensing Method | _____ | |
| - | Control Power Supply | _____ | Vac (or) Vdc |