
BIDDING DOCUMENTS

FOR

**“PROJECT FOR RENOVATION AND MODERNIZATION
OF UMIAM-UMTRU STAGE III HYDROELECTRIC
POWER STATION”**

“Rehabilitation of Electro Mechanical Equipments”

(Package – 1)

VOLUME –II of II



**EMPLOYER: MEGHALAYA POWER GENERATION
CORPORATION LIMITED**

COUNTRY: INDIA

**PROJECT: PROJECT FOR RENOVATION AND
MODERNIZATION OF UMIAM-UMTRU STAGE
III HYDROELECTRIC POWER STATION**

LOAN NO. : ID-P271

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PART 2

SECTION VI. EMPLOYER'S REQUIREMENTS

SECTION VI. EMPLOYER'S REQUIREMENTS

Scope of Supply of Plant and Installation Services by the Contractor

The scope of works under this Contract includes dismantling of existing equipments with all accessories, except those to be overhauled in situ, transporting the dismantled components to store yard, stacking them properly. Design, manufacture, fabrication, shop testing, finishing, painting, packing, transport, supply, insurance, delivery to port of Kolkata wherever required, landing, customs clearing for foreign supply and/or ex-factory and ex-stock for local supply goods, inland transportation to the site, unpacking, storage, local handling, installation(assembling and erection), field testing and commissioning of the equipments and materials including dispatching erection tools and testing instruments for the project and including arrangement for travel, lodging and boarding of representatives of MePGCL and their Consultants for witnessing the Shop tests.

As this is a renovation Project, the Contractor shall carry out the reverse engineering works seriously and meticulously for proper fitting of newly designed components in the existing space and cutouts available for the respective equipments. For proper implementation of reverse engineering, the Contractor shall take accurate measurement of all required dimensions of the Project including various existing cutouts / openings and get all required information related to the Project by visiting the site. Efforts shall be made by the Contractor to utilize the existing cutouts for installation of the new equipments. Enlarging of the existing cutouts or cutting new holes shall be avoided as far as possible. If at all any new cutout will be required, stability analysis of the civil structure, resulting from such new cutout, shall be conducted by the Contractor well in advance. Remedial measures required to retain stability of the structure shall be carried out by the Contractor, without demanding for any extra cost or extra time.

The works shall be executed by the Contractor on a turnkey basis and execute all such works which are necessary for satisfactory operation of the Power Station and ancillary equipments, whether specifically mentioned in the contract or not. All goods and materials to be incorporated in the Facilities shall be new, unused, of the most recent or current models and incorporate all recent improvements in design and materials. The Contractor shall assess all the equipments, materials and services required for completion of the Project, by visiting the site and inspecting various components of the Project, before submitting their bid. The Contractor shall consider the cost of all such equipments, materials and services required for the Project and the bid price shall be calculated taking into account all such factors, so that after award of the Contract the works can be carried out smoothly by the Contractor, without facing any technical or financial problem.

A list of the major equipments is furnished below, against which action to be taken by the Contractor is mentioned.

List of Major Equipments:

Items	Unit 1	Unit 2	Comments
1. Mechanical Equipments			
1.1. Turbine and Its Auxiliaries			Two sets
a) Runner	R	R	Including model test of the newly designed runner as per existing spiral casing, stay vanes & angle at the entry of penstock at MIV
b) Spiral case & stay ring	O	O	Cleaning and repairing as per requirement,



Items	Unit 1	Unit 2	Comments
			testing & painting
c) Guide vanes	R	R	Bushes such as Thorplas-Blue or equivalent.
d) Head cover	R	R	
e) Guide vane servomotors and gate operating mechanism	R	R	Linkage bushes may be of Thorplas-Blue or equivalent.
f) Bottom ring	R	R	
g) Facings and wearing rings	R	R	
h) Guide bearing, cooler and bearing housing	R	R	Water lubricated bearing with suitable material for the bearing pads, such as Thordon SXL or equivalent.
i) Turbine shaft	R	R	
j) Shaft seal and sealing box	R	R	May be of materials such as Thordon SXL/ Carbon seal or equivalent.
k) Upper/ Lower draft tube Cones and draft tube liner	R	R	New upper/lower draft tube cone, including adjustable rings.
l) Through-flow type MIV and its servomotor	R	R	To replace the existing spherical valve with thru-flow type valve including adjusting pipes. Modification work of existing concrete foundation is also to be done.
m) MIV Bypass valve and its servomotor	R	R	
n) Pressure relief valve (PRV)	R	R	Including replacement of the discharge liner.
o) Instruments / devices for measurement of different parameters, cables and piping	R	R	
1.2. Governor and Turbine Control System			Two sets
a) Governor actuator	R	R	Microprocessor based Digital Governor along with its control panel to be installed.
b) Governor regulator	R	R	
c) Turbine control panel	R	R	
d) Speed Signal Generator (SSG)	R	R	
1.3. Oil Pressure Supply System (OPU)			
a) Oil pump-motor sets	R	R	2 sets per unit for MIV control & 2 sets per unit for Guide Apparatus (governing system) & PRV.
b) Oil piping and valves	R	R	
c) Oil Sumps	O	O	2 nos. per Unit. The capacity of MIV sump & Governor sump are 4 M3 & 2.5 M3 respectively.
d) Accumulator for OPU	O	O	2 sets per Unit (one set for MIV and one set for Governor)
1.4. Air Compressed Supply System			
a) Air compressor with motor	R		Three nos. HP and one LP compressor (For Brake and service) to be installed along with Motor and MCC
b) Air piping and valves	R		
c) Main tank, brake and service tank	O		
1.5. Cooling Water Supply			Three sets. In addition to Cooling Water Pumps,



Items	Unit 1	Unit 2	Comments
System			provision for penstock tapping (with gear box operated valves) for the cooling water system is to be incorporated, with required pressure reducing arrangements.
a) Water strainer	R	R	Duplex strainers should be provided
b) Water piping and valves	R	R	
c) Spares & consumables required for penstock tapping	A	A	
1.6. Dewatering & Drainage System			Two Dewatering Pumps and two Drainage Pumps along with one emergency pump.
a) Submersible water pumps with motors	R		Suitable type with better performing Pumps to be selected not for clear water but for water with little debris.
b) Water level switches with accessories	R		Automatic operation of the pumps to be incorporated with reference to the sump water level.
c) Necessary piping and valves	R		
1.7. Auxiliary Machine Control			Two sets
a) Motor Control Center (MCC)	A	A	Including auxiliary/ local control
b) Necessary wiring and cables	R	R	
1.8. EOT Crane	R		One set. The present capacity of 150/30 MT is to be enhanced suitably to match with the weights required to be lifted. The bridge frame structure and rails shall be overhauled & retained.
1.9. Gantry Hoist	R		One set.
1.10. Penstock Valves			Two sets. Including dedicated power supply to valve house from Power house. Dedicated & independent control system for each unit to be provided. Complete replacement is needed to enable SCADA control operation.
a) Penstock valves and by-pass valves	R	R	
b) Control panel and operating system	R	R	
c) Penstock Air Valve	R	R	
1.11. Ventilation System	O		
1.12. Other Items for Mechanical Equipment			
a) Online Vibration monitoring system, with link to control system and display in Main Control Room	A	A	Provision to indicate/ alarm for increased vibration level.
b) Water level measuring system at Main Dam, Fore bay and Tail race with link to control system and display in Main Control Room	A		
c) Discharge measurement system at Tail race, with link to control system and display in Main Control Room	A		
d) Removal of grease supply	X	X	



Items	Unit 1	Unit 2	Comments
system			
e) Spare parts and special tools	A		
2. Electrical Equipment			
2.1. Generator and Its Auxiliaries			Two sets
a) Stator core	R	R	
b) Stator winding with accessories	R	R	
c) Stator winding main leads and neutral leads	R	R	
d) Rotor spoke and rim	R	R	
e) Rotor winding and excitation leads	R	R	
f) Rotor pole piece with damper winding	R	R	
g) Shaft, thrust and guide collars, thrust runner, coupling bolts and coupling cover	R	R	
h) Collector ring and oil cooler	R	R	
i) Thrust bearing system	R	R	
j) Upper bearing bracket	R	R	
k) Lower bearing bracket	R	R	
l) Segment type UGB and oil cooler	R	R	
m) Segment type LGB and oil cooler	R	R	
n) Brake ring & brake / jack system	R	R	
o) Stator Air coolers	R	R	
q) Current transformers	R	R	
r) CO2 Fire protection system for Generators	R		
s) Instruments and relays	R	R	
t) Terminal boxes	R	R	For instruments, control & alarm Cables
u) Neutral grounding system	R	R	
v) Instruments / devices for measurement of different parameters, cables and pipings	R	R	
2.2. Excitation System			Two sets. Static Excitation Equipment system to be incorporated.
a) DC excitation system	R	R	
b) Digital automatic voltage regulator and excitation cubicle	R	R	Alongwith their OC & EF protection.
c) Epoxy resin molded self-cooled Excitation Transformer, equipped with thermal sensing device, alarm contacts and adjustable wheels	A	A	
2.3. Generator Transformer			Two sets



Items	Unit 1	Unit 2	Comments
a) Outdoor type three phase ONAF transformer with terminal boxes and accessories including lightning arrestors.	R	R	
b) Instruments for Generator Transformer	R	R	
c) Mulsifier system	O	O	Including overhead tank and water supply system to this tank.
2.4. 11 kV Metal Enclosed Switchgears & UAT			Two sets including 11KV Circuit breakers, CTs etc. for protection of the generator following any fault in UAT side.
a) Epoxy resin molded self-cooled transformer with accessories (11/0.4 KV, 500 KVA - 2 Nos)	R	R	
b) 11kV Metal-enclosed cubicles with accessories	R	R	Including Circuit Breaker
2.5. Station Service Transformer (SST)			One set
a) Epoxy resin molded self-cooled transformer with accessories (33/0.4KV, 500 KVA - 1 set)	R		
2.6. Station Power Supply Facilities			
a) Battery bank	R		
b) Battery charger	R		
c) AC power supply board/LTAC panel	O		
d) DC power supply board/DCDB	R		
e) Auxiliary AC distribution boards			
2.7. Control and Protection System			
a) Main control desk, meter panel and protection panel for generating units	R	R	Including recording panel and synchronizing panel. Replacement with computerized SCADA control system, with provision of control switches for operation (in case of failure of computerized control system)
b) 132kV feeder and bus coupler panels for outdoor switchyard	R		Including synchronizing panel and protection panels
2.8. Outdoor Switchyard			
a) 132 kv Motor-driven type disconnecting switch (20 Nos)	R		With provision of remote, local and manual operation
b) 132 kv Current transformer (30 Nos)	R		
c) 132 kv Potential transformer (3 Nos)	R		



Items	Unit 1	Unit 2	Comments
d) 132 kv Lightning Arrestors (30 Nos)	R		
e) 33 kv Current transformer (3 Nos)	R		
f) 33 kv Potential transformer (3 Nos)	R		
g) 33 kv Lightning Arrestors (3 Nos)	R		
h) Support structures: As per requirement	R		
i) Conductors and accessories: As per requirement	R		
j) Two-stage Lift (including required lighting) for movement of personnel and equipments to Switchyard	A		This is proposed because the Switchyard is 285 steps away from the Power House, which creates delay in restoration work of switchyard equipment(s).
2.9. Illumination			
a) Illumination in Power House inside & outside premises	R		To improve as per requirement with LED type Tubes/outdoor luminaires
b) Illumination in Switchyard premises	R		To improve as per requirement with LED type Tubes/outdoor luminaires
c) Illumination in the road from Switchyard to Valve House	A		With LED type Tubes/outdoor luminaires
d) Illumination in Valve house premises	R		To improve as per requirement with LED type Tubes/outdoor luminaires
e) Illumination along the steps between Power House & Switchyard	A		To improve as per requirement with LED type Tubes/outdoor luminaires
f) Illumination in Ware House premises and along the road from Ware House to Power House			
2.10. Other Parts, Devices and Their Accessories			
a) 12kV power cables and cable duct	R	R	
b) 600V Power cables for low voltage	R	R	Including common cables
c) Control cables	R	R	Including common cables
d) All paints, sealing materials, bolts and nuts necessary for overhauling works	R	R	
e) Spare parts and special tools	A		Including common use
2.11. Communication facilities:	A		
a) Mobile facility in Power House and Switchyard area	A		
b) Internet facility in Power House and Switchyard area	A		
c) Internal Telephone System	R/A		



MePGCL
Creating Clean and Green Energy

Project for Renovation and Modernization of Umiam-Umtru Stage III Hydroelectric Power Station :
Rehabilitation of Electro Mechanical Equipments (Volume-II of II)

Items	Unit 1	Unit 2	Comments
between Power House, Switchyard, Valve House, Sentry post & Stage IV Dam.			
Legend: A: Addition O: Overhaul R: Replace X: Remove			

Specification

Description of Project

Umiam Stage III Hydroelectric Power Plant is located at Kyrdekulai in Meghalaya State of India, which is 33 km from Shillong, the capital of the State. The project site is at around latitude 25° 47' 5" N, longitude 91° 47' 22" E and is surrounded by hills. The maximum ambient temperature experienced has been 32.5°C and the minimum temperature has been 5°C outdoors and 9°C indoors, respectively.

MePGCL has been controlling following Hydroelectric Power Plants.

Sl. No.	Name of the Project	Installed Capacity	Year of Commissioning	Year of RMU
1	Umiam Stage I Hydroelectric Power Plant	4 x 9 MW	1965	2002
2	Umiam Stage II Hydroelectric Power Plant	2 x 9 MW	1970	2011-12
3	Umiam Stage III Hydroelectric Power Plant	2 x 30 MW	1979	
4	Umiam Stage IV Hydroelectric Power Plant	2 x 30 MW	1992	
5	Umtru Hydroelectric Power Plant	4 x 2.8 MW	1957 (3 Units) 1968 (1 Unit)	
6	Sonapani Mini Hydro Electric Project	1 x 1.5 MW	2009	
7	MyntduLeshka Hydro Electric Project	3 x 42 MW	2012	
8	New Umtru Hydro Electric Project	2 x 20 MW	2017	
9	Lakroh Mini Hydro Electric Project	1 x 1.5 MW	2019	
Total installed capacity of the system		354.2 MW		

The Umiam Stage III Hydroelectric Power Plant was commissioned in 1979 with both the two hydro turbines and generators, OEM for which is BHEL. After operation of approximately 41 years, some problems have occurred in the generating units. Because of the importance of Umiam Stage III Hydroelectric Power Plant for coordinated economic operation of the above-mentioned Power Stations of MePGCL located at the downstream cannot be ignored in the context of draw down water from Umiam reservoir for running the downstream power stations.

S1. Functional Guarantee Parameters

Functional Guarantee	Minimum Requirement	Acceptable Requirement
1. Efficiency of Turbines at rated head	93%	92%
2. Efficiency of Generators at rated conditions	98%	97%
3. Efficiency of Power Transformers	99%	98%

The minimum and accepted requirement of the functional guarantee parameters are mentioned in the above table. The Contractors shall design / procure the equipments carefully with suitable efficiency and mention the values of these parameters for the said equipments to be installed by them. These

parameters provided by the Contractors shall be used for evaluation of the bids, pursuant to clause 1.2.2(c) of Section III (Evaluation and Qualification Criteria).

S.2. Turbines and their Auxiliaries

After dismantling of the different components of the existing Turbines and accessories of the Project, the new Turbines shall be designed as per relevant standards and latest technology, to utilize the available power potential of the site to the maximum extent, have a maximum output with the maximum discharge at the design net head and a full gate position. The output capacity of the Turbines shall be calculated considering the dimensions of the existing Spiral Case and Stay Ring and hydrological data of the site. The newly designed turbines, with all components and accessories shall give satisfactory, quiet and smooth operation, free from excessive noise, vibrations, pressure pulsations, power swings, hunting etc. in the required range of operation of heads and outputs including standard overload output. The turbine runner shall be designed with suitable material and profile so that it can operate without significant damage.

The contractor is required to conduct the hydraulic study of the existing parameters and Power House cut outs and offer maximum output (with at least 10% overload), at rated head and above with available discharge. The offer with maximum output matching to existing structure shall be given due consideration during evaluation.

S.2.1. The details of major components of Turbine and works to be done by the Contractor are mentioned below. However, the Contractor shall carry out the renovation, modernization and upgradation works for all the components of the two Turbines, whether those are specifically mentioned or not.

- (1) Runner
 - Replacement of runner Two sets
 - (Including model test of the newly designed runner as per existing spiral casing, stay vanes & angle at the entry of penstock at MIV)
- (2) Spiral Case and Stay Ring
 - Cleaning and repairing as per requirement, testing & painting of spiral case and stay ring Two sets
- (3) Guide vane Operating Mechanism
 - Replacement of guide vanes Two sets
 - (With Bushes such as Thorplas-Blue or equivalent)
 - Replacement of guide vane servomotor Two sets
 - Replacement of gate operating mechanism Two sets
 - (With Linkage bushes such as of Thorplas-Blue or equivalent)
- (4) Head Cover and Bottom Ring

- | | |
|---|----------|
| - Replacement of head cover | Two sets |
| - Repairing of bottom ring | Two sets |
| - Replacement with self-lubricated bearings | Two sets |
| (5) Facing Plates and Wearing Rings | |
| - Replacement of facing plates and wearing rings on head cover | Two sets |
| - Replacement of facing plates and wearing rings on bottom ring | Two sets |
| (6) Guide Bearing, Oil Cooler and Bearing Housing | |
| - Replacement of guide bearings | Two sets |
| (Water lubricated bearing with suitable material for the bearing pads, such as Thordon SXL or equivalent) | |
| - Replacement of oil cooler | Two sets |
| - Replacement of bearing housing | Two sets |
| (7) Shaft Seal and Sealing Box | |
| (May be materials such as Thordon SXL/Carbon seal or equivalent) | |
| - Replacement of shaft seal | Two sets |
| - Replacement of sealing box | Two sets |
| (8) Turbine Shaft | |
| - Replacement of turbine shaft | Two sets |
| - Replacement of shaft sleeve | Two sets |
| (9) Upper / Lower Draft Tube Cone and Draft Tube Liner | |
| (including adjustable rings) | |
| - Replacement of Upper Draft Tube | Two sets |
| - Replacement of Lower Draft Tube | Two sets |
| - Replacement of Draft Tube Liner | Two sets |
| (10) Thru-flow Type Inlet Valve and By-pass Valve | |
| - Replacement of inlet valve | Two sets |

- Replacement of inlet valve servomotor Two sets

- Replacement of by-pass valve Two sets

(11) Pressure Relief Valve (PRV)

- Replacement of PRV Two sets

- Replacement of the discharge liner Two sets

- Repairing and painting of embedded parts for PRV Two sets

- Replacement of distributing valve, under body, dash pot, link mechanism, piston rod, bushings and valve seal ring Two sets

(12) Instruments, Devices, Cables and Piping

- Replacement of measuring instruments and devices Two sets

- Replacement of electrical cables and piping Two sets

S.2.2. Design Data of Existing Turbines

The design data of existing Turbines are mentioned below for information of the Contractor. However, they shall collect all informations required from site and design the new Turbines accordingly.

(1) Number installed Two sets

(2) Type Vertical shaft, Francis turbine

(3) Elevation

a) Reservoir water level

- Maximum EL. 673.6 m

- Minimum EL. 667.5 m

b) Tailrace water level

- Maximum (2 units operation 60 MW) EL. 506.025 m

- Minimum (1 unit operation, 30 MW) EL. 505.475 m

c) Center line of turbine distributor EL. 500.973 m

(4) Net Head

- Maximum 162 m

- Design/Rated 150 m

- Minimum 146 m

(5a) Rated turbine output at rated head	30800 kW
(5b) Overload capacity at rated head and above	10% above rated output
(5c) Capability to give minimum continuous output	
at any head without any adversity	40% of rated output
(6) Rated discharge	23.4 m ³ /s (per unit),(may vary - - as per new design)
(7) Rated speed	428.6 min-1

S.2.3. Guarantee regarding breakage of Runner Blades

The Contractor shall guarantee against the breakage with runner blades, which has been experienced by MePGCL since commissioning of this Power Station till date, after operation of the unit(s) for the period from 6 months to 1 year approximately.

S.2.4. Cavitation guarantee

When operating under all specified operating conditions, the plant sigma shall have a sufficient margin above the sigma zero, (called “Thoma number sigma zero” and defined in IEC 60193) based on maximum water temperature of 25°C.

The Contractor shall guarantee the new runner against excessive pitting caused by cavitation during a period of 8,000 operating hours in generating mode but not exceeding 2 years from the date of Commercial Operation.

All operating conditions mean unrestricted operation between P_{CU} and P_{CL} under the specified net head range as defined in Figure 2 of IEC 60609-1, and temporary operation for not more than 500 hours at less than the minimum continuous output (P_{CL}) and for not more than 100 hours at more than the maximum continuous output (P_{CU}) per 8,000 hours. The turbine output of minimum continuous operation (P_{CL}) shall be defined as 40% maximum output at respective net head.

Excessive pitting of the turbine runner caused by cavitation is defined as that which entails the removal of $0.5 \times D^2/8000$ kilogram of metal per operating hour, where D is the outlet diameter of the runner in meter after 8,000 hours of operation in generating mode, regardless of the area. Amount of pitting shall be determined in accordance with IEC 60609-1. Metal removal exceeding the criteria shall be regarded as failure to meet the pitting guarantee.

The inspection of the runner subject to cavitation shall be carried out by the Contractor at the end of the guarantee period under the presence of the Employer. If the turbine runner becomes excessively pitted within the guarantee period stated above and under all operating conditions, the Contractor shall modify the runner profile in manner satisfactory to the Employer. In this case, a new cavitation guarantee period for 8,000 hours shall be applied to the modified runner(s). The cavitation pitting on the runner(s) shall be verified repeatedly with the same manner until fulfillment of the pitting guarantee. If the Employer judges that the cavitation performance on the modified runner(s) is not improved by modification, the Employer shall have a right to reject the modified runner(s), and require the Contractor to provide a new designed runner(s).

All costs for the runner inspection shall be included in the scope of work under this Contract.

Any erosion or damage caused by suspended matters in the water or corrosion caused by chemical composition of the water shall not be covered with the cavitation pitting guarantee.

S.2.5. Runaway speed

The turbine shall withstand safely the maximum runaway speed which may occur under the maximum reservoir water level. The maximum runaway speed shall not exceed the original figure (min^{-1}) for the existing turbine.

S.2.6. Critical speed

The first critical speed of the rotating parts of the turbine generator unit shall be higher than 25 percent above the guaranteed maximum runaway speed.

S.2.7. Speed rise and Pressure rise

The Contractors shall compute the maximum momentary pressure, and speed rise using the parameters of the existing plant, and the operating conditions and furnish the design computations of pressure rise and speed rise worked out in their bids. When the maximum turbine output is suddenly rejected, the maximum hydraulic pressure shall not exceed the original figure (m) of the existing unit at the elevation of the turbine center, and the momentary speed rise shall not be more than the original figure above the rated speed (%) of the existing unit under any conditions.

S.2.7. Turbine Model Test

Before the contractor takes up the manufacture of the prototype turbine, homologous scale model of the prototype turbine shall be carried out to demonstrate that the prototype turbine will meet the guaranteed performance in respect of efficiency, output, smooth operation, pressure pulsations, and other guarantees as stipulated in the specifications.

S.2.7.1. Model Details, Drawings and Homology

Before taking up the manufacture of the model turbine, the Contractor shall submit to the purchaser in a sequential manner, within 60 days after award of contract, drawings and description covering details of the proposed model, testing equipment to be used, instrumentation, testing procedure, method of interpretation and computation of test results for the approval of the Employer. The Corporation will convey his approval or comments within 45 days after receipt of the information/data/drawings.

The turbine model shall be homologous to the prototype in all respects. The water passage of the model turbine shall be homologous with those of prototype right from the scroll case inlet to the draft tube exit point. The draft tube cone shall be made transparent to permit observation of the vortex flow pattern and cavitation phenomenon and to take photographs of the same.

The model scale, minimum size and homology similarity to the prototype turbine shall be in conformity with the IEC code 60193-1. The model size shall not be less than 300 mm, and the test head shall not be less than 40 m.

S.2.7.2. Conducting of Model Test, Test Code, Submission of Report

The test shall be conducted in accordance with the IEC publications 60193-1. The test shall be completed and comprehensive test reports submitted for approval of the Corporation within six (6) months after the award of contract.

The detailed programme of carrying out the comprehensive model test shall be intimated to the Employer/consultant in advance of the start of the test for the Employer/consultant to depute their representatives for observation of the comprehensive tests.

S.2.7.3. Tests on Turbine Model

The test shall include

- a) Turbine performance (efficiency) tests.
- b) Cavitation tests.
- c) Runaway speed test.
- d) Pressure pulsation (fluctuation) tests for the draft tube frequency at half, full and overload.

- e) Hydraulic thrust.
- f) Wicket gate torque.
- h) Air admission test for the full sigma range.
- i) Measurement of nuclei and air content in water during cavitation.
- j) To determine best location of the Winter Kennedy taps and to determine the exponent co-efficient for the flow calculation on prototype. The model test shall simulate all possible normal operating conditions of the prototype for the entire range of reservoir and tail water levels, wicket gate openings, overload etc.

S.2.7.4. Step-up Formulae

The prototype efficiencies shall be calculated and derived from the model efficiencies as per the IEC-995 Code or equivalent.

S.2.7.5. Presentation of Model Test Report

After the completion of the model test, the Contractor shall submit to the Employer, 6 copies of complete report, which shall include but shall not necessarily be limited to the followings.

- a) Introduction, dates of test, by whom conducted
- b) Description of test equipment and test procedures
- c) Drawings showing plan and cross section of the model turbine as well as the prototype turbine giving all principle dimensions and profile.
- d) Detailed drawings showing the complete set up of the test
- e) Records of calibration of all test instruments and equipment
- f) Record of all actual measurements made during the test viz. manometer readings, torque, speed, etc. which are used in the calculation of Head (H), Discharge (D), Speed (N), Power Output (P) etc.
- g) Comprehensive & complete sample calculation for each computation
- h) Model hill curves & universal characteristics
- i) Model efficiency curves
- j) Curves showing sigma vs efficiency and sigma vs unit power and unit discharge for specified head with envelope curves drawn.
- k) Curves showing relationship between wicket gate angle and also wicket gate opening in mm vs servomotor stroke related to maximum opening of guide vane and clear opening between two adjacent wicket gates
- l) Prototype performance curves, hill charts and performance in tabular form for various operating conditions
- m) Photographs and sketches of the cavitation phenomenon and vortex phenomenon with corresponding operating conditions
- n) Pressure pulsation curves for various conditions of operation including air admission test
- o) Establishment of hydraulic similarity of the model turbine to the prototype
- p) Statements as to inaccuracy of each class of measurement and inaccuracy on combined measurement shall be indicated
- q) A table showing the comparison of the test results with the guaranteed data, followed by technical conclusions.

S.2.7.6. Field acceptance tests

All field acceptance tests in accordance with provision in IEC 60041-1991 shall be conducted at site before acceptance of the turbine by the employer. Output and efficiency test shall be conducted at different heads and guide vane openings on any one turbine, chosen by the employer to determine guaranteed efficiency parameters.

Efficiency shall be measured by ultrasonic or other acceptable methods prescribed in IEC. The contractor shall furnish details of tests methods, agency which will conduct tests, provision for field testing, calibration of instruments, for purposes of test and all other relevant details for approval.

The employer reserves the right to appoint an independent agency for repeating these tests at his own costs. The contractor shall be under obligation to accept these tests for purposes of liquidated damages.

S.3. Governor and Turbine Control System

The existing mechanical type governor actuator and regulator panels for each unit shall be removed and shall be replaced with a new designed micro-processor based Digital Electro-hydraulic type Governor, as per relevant standards, for smooth control of the newly designed Turbines.

The governor shall be designed to have stable and accurate operation characteristics with high sensitivity and high response by using the control oil with ISO VG-57 characteristics or equivalent and shall be constructed to enable ease of operation, inspection and maintenance under running condition. The governor and turbine shall keep running without trouble under normal operating conditions and stop during fault conditions.

S.3.1. Major components

Speed governor –To be replaced	Two sets
turbine control system – To be replaced	Two sets
Speed sensing device – To be replaced	Two sets

S.4. Oil Pressure Supply System (OPU)

There are 2 sets of OPU per unit, one for MIV control & one for Guide Apparatus (governing system) & PRV. Each set consists of two oil pumping units, one oil pressure tank (Accumulator), one sump tank, un-loader valves, operation control devices, piping and valves.

The Contractor shall replace the existing system with new ones, except the Accumulators and oil Sump Tanks, which shall be overhauled as per standards. The new oil pressure supply system shall be designed by the Contractor with latest technology as per relevant standards. However, the new components shall be designed in such a manner that those will be installed in the space provided for the old ones, without any modification of existing cutouts.

S.5. Air Compressed Supply System

The existing air compressed supply system consists of three HP compressors and one LP compressor (for Brake and Servicing), along with air tank, air piping, valves and accessories commonly used for both units. After dismantling of the existing equipments and accessories, all the Compressors (3 HP and 1 LP) along with Motor and MCC, accessories, piping and valves etc. shall be completely replaced with new ones, designed by the Contractor with latest technology and as per relevant standards. However, the new components shall be designed in such a manner that those will be installed in the space provided for the old ones, without any modification of existing cutouts.

S.6. Cooling Water Supply System

The Contractor shall dismantle the existing three Cooling Water Pumps, along with the Strainers, pipelines and valves and replace them with new ones designed as per relevant standards and latest technology.

In addition, penstock tapping system is to be incorporated with required pressure reducers, as a standby source of water supply to the Cooling Water System.

S.7. Dewatering & Drainage System

The existing two Dewatering Pumps ,two Drainage Pumps & one emergency pump along with pipings and accessories shall be replaced by the Contractor with new ones designed as per relevant standards and latest technology. However, the new components shall be designed in such a manner that those will be installed in the space provided for the old ones, without any modification of existing cutouts.

The new Pumps shall be selected not for clear water but for water with some debris. Installation of the new Pumps shall be planned by the Contractor in such a manner that drainage and dewatering of the Power House does not Hamper.

S.8. Auxiliary Machine Control

The existing local motor control panels, along with the wiring and cables, is to be dismantled and replaced by a new set. The new integrated MCC(Motor Control Centre) shall be designed as per relevant standard and shall be installed to supply low voltage power source from the AC distribution board to auxiliary equipment for the generating units. Each circuit for auxiliary equipment in the MCC shall be equipped with an individual breaker with an adequate frame and over-current trip circuit.

The MCC shall also be equipped with automatic start & stop functions (sequence) for the auxiliary equipment. The MCC shall be completely wired and equipped with sequential controllers, starters, instruments, protective relays, switches, lamps, indications and so on required for automatic sequential controlling and for manual operating the auxiliary equipment to be installed in the power station.

S.9. EOT Crane

At present the capacity of main hoist of the EOT Crane is 150 MT and that of the auxiliary hoist is 30 MT in Umiam Umtru Stage-III HEPP. This is operated with certain constraints. Hence it is intended to replace it with a new one, along-with with all its ancillary components, except the bridge frame structure and rails which shall be overhauled by the Contractor, as per requirement.

The Contractor shall design the components of the EOT Crane, as per relevant standards, with latest technologies and good materials to sustain the load these are required to take. The capacity of the hoists shall be designed by the Contractor keeping in view the equipment to be lifted, which can be arrived at after design of the different components of Turbine and Generator. Soon after design is completed, steps for manufacturing / procurement of the components of EOT Crane shall be taken up by the Contractor at the earliest, so that the existing EOT Crane can be replaced by the new one, before starting the works in Power House.

Till the new EOT Crane is installed, the Contractor can take up dismantling works etc. in the Power House with the existing Crane, subject to condition that necessary repair of the existing Crane shall be carried out by the Contractor at their cost, to make it fully functional, before using it. In any case, efforts shall be made by the Contractor to replace the existing EOT Crane at the earliest, so that the new EOT Crane will be used for erection works. Problems arising out of delay in replacement of the EOT Crane and overhauling of its components (as mentioned above), will be solely to the account of the Contractor.

The details of the existing installation are as follows.

Sl. No.	Description	Comments
1	Make: Chitram & Co.Pvt.Ltd Chennai Capacity - Main hoist: 150 Tonnes	Commissioned in the year 1977

	<p>Auxiliary hoist: 30 Tonnes</p> <p>Lift - Main hoist: 22.5 meters Aux hoist: 23.5 meters</p> <p>Class II Control: Drum & Master Controller</p> <p>Wire Rope Main hoist: 55 mm dia Aux hoist: 22 mm dia</p> <p>Operating speed - Main hoist: 1.0 m / min Aux hoist: 2.0 m / min Cross travel: 5.0 m / min Long travel: 6.0 m / min Self-weight: 75 Tonnes</p>	
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S.10. Gantry Hoist

The existing Gantry hoist has been used since inception of the Project to raise and lower the Draft tube gates and PRV gates. The Contractor shall design a Gantry Hoist as per relevant standards and latest technology to replace the existing Gantry hoist. During site visit, prior to submission of bid, the Contractor shall take measurement of all dimensions required for design of a new Gantry hoist.

S.11. Penstock Valves

The different components of the Penstock valves are placed in the two chambers at the starting points of the Penstocks of Unit-1 & 2. These are operated with certain constraints. There is heavy leakage of water from the valves in closed condition, due to which complete dewatering of Penstocks is not possible. As a result, maintenance works in Turbine is hampered. Hence it is intended to replace the two Penstock valves with all ancillary components like By-pass valves, Control panel & Operating system etc. with new ones. Contractor shall design the new components as per relevant standards with latest technologies and good materials to sustain the pressure these are applied. The Contractor shall provide dedicated & independent control system for the Penstock valves of each unit and arrangements for dedicated power supply from Power House to Valve House.

Major components:

- (a) Penstock valves and by-pass valves – To be replaced completely with new ones with all the associated accessories.
- (b) Control panel and operating system – To be replaced completely.
- (c) Penstock Air Valve. - To be replaced by new ones.

S.12. Ventilation System

The various components of the Ventilation System installed in different floors of the Power House of Umiam Umtru Stage- III Hydroelectric Power Plant are mentioned below. At present it is operated with certain constraints. To make it fully functional, overhauling of the existing Ventilating system is required.

Two motor-pump sets are installed to run alternatively, with ducts at Generator Floor, Turbine Floor & MIV Gallery. Though the motor-pump sets are operating satisfactorily, there is some problem in getting fresh air in some outlet ducts. Hence a thorough overhauling, including supply of minor spares / consumable materials, is required to be taken up by the Contractor. The Contractor shall inspect the system before submitting their bid, to assess the exact condition & works / materials required for the present system, to make it fully functional.

S.12.1. Existing components:

Sl. No.	Description	Quantity
1	Squirrel Cage Induction Motors, AC, 415 V, 50 c/s	2 Nos.
2	Starter	2 Nos.
3	Centrifugal Fans, 24000 cmH with static pressure of 50 mm	2 Nos.
4	Exhaust Fan	3 Nos.
5	Control Dampers at outlet (Butterfly Dampers)	2 Nos.
6	Flexible connection at Blowers	2 Nos.
7	Filters	2 Nos.
8	Transitional Elbows	2 Nos.
9	GI / Aluminum Duct (Laid in different floors)	

S. 13. Other Items for Mechanical Equipment

S.13.1. Online Vibration Monitoring System

The Contractor shall design and install Online Vibration monitoring system as per relevant standards, to monitor the vibration of the Generating Units, while running. The monitoring system shall be linked to the control system and displayed in Main Control Room.

S.13.2. Water Level Measuring System

The Contractor shall design and install Water Level Measuring System at Main Dam, Forebay and Tail race as per relevant standards. The said water levels shall be displayed in Main Control Room and shall be linked to the control system for optimizing the output of Generating Units.

S.13.3. Discharge Measurement System

The Contractor shall design and install Discharge Measurement System at Tail race, as per relevant standards. The said discharge figure shall be displayed in Main Control Room and the measurement system shall be linked to control system.

S.13.4. Removal of grease supply system

The grease supply system is used for bearing lubrication of the existing turbines, inlet valves and PRVs. All the grease type bearings shall be replaced with self-lubricated bearings. The existing equipment, piping, valves and accessories for the grease supply system shall be removed by the Contractor.

S.13.5. Spare parts and special tools

The Contractor shall provide the spare parts and special tools required for installation of the equipments.

S.14. Generator

The different components of existing Generators shall be dismantled by the Contractor and transported to the Store premises, in a systematic manner. The copper parts shall be kept in a closed and secured place.

The new Generators shall be designed by the Contractor, as per relevant standards and latest technology, to utilize the available power potential of the site to the maximum extent, have a maximum output with the maximum discharge at the design net head and a full gate position of the

newly designed Turbines.

While designing the bearings for the Generators, the Contractor shall explore possibilities of combining the chamber of Thrust bearing with that of Upper Guide Bearing or Lower Guide Bearing and select suitable bearing system in such a manner that the stability and performance of the generating Unit is not compromised.

The fly-wheel effect (GD^2) of the generator required for turbine shall be made as small as possible under the above-mentioned conditions. The GD^2 of generator shall not less than the original figure (ton-m^2) of the existing generator.

S.14.1. Reference Technical Data of Existing Generator

(1) Number installed: Two (2) sets

(2) Type: Three phases, alternating current synchronous generator, vertical shaft, rotating field, enclosed hood, air-cooled type

(3) Nameplate data:

(a)	Phase	3
(b)	Number of poles	14
(c)	Output capacity	33340 kVA
(d)	Rotating speed	428.5 min-1
(e)	Voltage	11,000 V
(f)	Current	1750 A
(g)	Frequency	50 Hz
(h)	Power Factor	0.9 lagging
(i)	Rating	Continuous
(j)	Excitation voltage	220 V
(k)	Field current	240 A
(l)	Temperature rise: Stator winding	65 °C
	Field winding	60 °C
(m)	Ambient temperature	40 °C
(n)	Armature connection	Y

S.15. Generator Transformer

The Generator transformers shall be designed, keeping in view the rated output and overload ratings of the newly designed Generators for this Project and to comply with the requirements of the latest

edition of the IEC 60076 standard or equivalent.

The Contractor shall design the transformers without changing the major important relative dimensions such as the dimensions of existing rails, the distance between the existing rails provided for leading the transformer on the exact location, the heights between the ground level and 132-KV bus and the distance between centre lines of 132KV buses, the location of transformers installed and the location and dimensions of the grounding leads.

The requirements in this item shall be applied for both transformers.

The transformers shall be designed to comply with the requirements of the latest edition of the IEC 60076 standards “Power Transformer” or equivalent.

S.15.1. Type of Transformer:

Three phase, Outdoor, Two winding, Step-up, Oil-immersed-type, ONAF cooled

S.15.2. Ratings of Existing Generator Transformers

(1) Operating Duty	Continuous
(2) Rated Capacity	
(a) High Voltage Winding	37500 kVA
(b) Low Voltage Winding	37500 kVA
(3) Rated Frequency	50 Hz
(4) Rated Voltage	
(a) High Voltage	132 KV
(b) Low Voltage	11 kV

S.16. 11 KV Metal Enclosed Switchgears & UAT

11 KV metal enclosed switchgears and Unit Auxiliary Transformers (2 sets) shall be replaced with new ones, which will be designed as per relevant standards, with latest technology and for enhanced capacity as per requirement of the Project, to match with the capacity of newly designed Generators. The Contractor shall design the 11KV metal enclosed switchgears and accessories in such a manner that there will not be any change in the major important relative locations and spaces for the existing 11KV metal enclosed switchgears and the location and dimensions of the existing grounding leads and the existing cable pits located below the switchgears. 11 KV Circuit Breaker should be incorporated in between 11 KV Bus and 11 KV power Cables going to UAT.

Unit Auxiliary Transformer (UAT): Epoxy resin moulded self-cooled transformer with accessories (11/0.4 KV, 500 KVA- 2 Nos.), as per relevant standards.

S.17. 33 KV Station Service Transformer (SST)

33 KV Station Service Transformer shall be replaced with a new one, which will be designed as per relevant standards, with latest technology and for enhanced capacity as per requirement of the Project, which can be arrived at after design of the Generators.

Station Service Transformer (SST): Epoxy resin moulded self-cooled transformer with accessories (33/0.4 KV, 500 KVA, 1 No), as per relevant standards.

S.18. Station Power Supply Facilities

The followings are items for station power supply facilities, which shall be replaced with new ones in the Project, except item-3, which shall be overhauled. The Contractor shall design the facilities as per relevant standards and latest technology, without modification of the relative locations and spaces for the existing station service switch boards, distribution boards, batteries, battery charger and cable trenches located below the boards.

Sl. No.	Description	Quantity
(1)	Battery bank	Two sets – to be replaced
(2)	Battery charger	Two sets – to be replaced
(3)	AC power supply board/ LTAC panel	One set – to be overhauled
(4)	DC power supply board/ DCDB	One set – to be replaced
(5)	Spare parts	One set – to be supplied
(6)	Maintenance devices and tools	One set – to be supplied

S.19. Control and Protection System

The existing Control and Protection System consisting of Main control desk, meter panel and protection panel for generating units, including recording panel and synchronizing panel shall be completely replaced by the contractor with computerized SCADA control system, designed as per relevant standards and latest technology with provision of discrete control switches for operation (in case of failure of computerized control system).

The existing Control and Protection System for 132KV feeders and bus coupler shall be completely replaced by the contractor with newly designed system as per relevant standards and latest technology with provision of local control switches for operation at Switchyard Control Room.

S.20. Outdoor Switchyard

S.20.1. Isolators:

At present, the 132 KV isolators (20 Nos.) installed in 132 KV Switchyard of the Project are operated manually. It is proposed to replace the existing isolators with new ones, which will be of motorized type. The Contractor shall design the new motorized isolators as per relevant standards with latest technology and these shall have provision to be operated remotely from Main Control Room, locally from Switchyard Control Room and manually, in case the first two options do not work.

During site visit, the Contractor shall get detail information required and design these facilities in such a manner that those can be fitted in the existing locations.

S.20.2. CT, PT, LA:

The following equipments shall be replaced in the open switchyard. The Contractor shall design the new equipments as per relevant standards with latest technology, which shall be installed in the location of existing ones.

a) Current transformer: 132 KV- 30 nos., 33 KV- 3 nos.

b) Potential transformer: 132 KV- 3 nos., 33 KV- 3 nos.

c) Lightening Arrestors: 132 KV- 30 nos., 33 KV- 3 nos.

d) Support structures: As per requirement

e) Conductors and accessories: As per requirement

S.20.3. Two-stage Lift:

The open switchyard of the Project is at a considerably higher level than the Power House premises. For movement of personnel and equipment to the Switchyard 285 steps are being used. To attend emergency works at the Switchyard, it is required to reach there within a short time. But it takes considerable time to climb up the existing 285 steps, which creates delay in restoration work of switchyard equipments. Hence provision of lift is essential. Considering the level difference between Power House and Switchyard, it is proposed to install two Lifts, with horizontal metallic pathway between the two Lifts, with proper illumination for smooth movement of personnel and equipments, to attend the Switchyard works.

The Contractor, during site visit before submitting their bid, shall obtain the required information including measurements etc. to assess the works required and design the Lift way as per relevant standards and latest technology.

S.21. Illumination

At present, the illumination facilities in different places of the Project are not adequate. The Contractor shall design the illumination of the following places, as per the relevant standards, to provide for proper illumination of these areas. The Contractor shall visit the site, get detailed information about the requirements before submitting their bid.

Illumination in Power House inside & outside premises

Illumination in Switchyard premises

Illumination in the road from Switchyard to Valve House

Illumination in Valve house premises

Illumination along the steps between Power House & Switchyard

Illumination in Ware House premises and along the road from Ware House to Power House

S.22. Other Parts, Devices and their Accessories

The Contractor shall provide the following materials and services, as per requirements at various locations of the Project. The Contractor shall assess the requirements and arrange for providing the same as per relevant standards.

12KV power cables and cable duct

600V Power cables for low voltage

Control cables

All paints, sealing materials, bolts and nuts necessary for overhauling works

Spare parts and special tools

S.23. Communication facilities

At present there are no facilities for communication such as mobile and internet in the Project site. The Contractor shall install suitable devices as per relevant standards, for establishing mobile and internet connectivity in the Power House and Switchyard area.

The Contractor shall replace the existing internal telephone system, with a new set, as per latest technology and relevant standards. The internal telephone system shall be connected between Power House, Switchyard, Valve House and Stage IV Dam. The Contractor shall assess the requirements of number of telephones to be connected, during their site visit.

General Requirements

This clause specifies the general requirements for electrical and mechanical Equipment. Except as specified in other clauses and approved by the MePGCL, the requirements in this clause will govern the whole Specifications of the Project.

G.1. Responsibility for the Works

The Contractor shall be solely responsible for ensuring that the works throughout the project is executed in the most substantial, proper and good workmanship, with the best quality materials, latest technology and conforming to the best engineering practice. Quality control shall be performed at each stage of execution of the Contract.

The Contractor shall handle and manage the works systematically in a well-coordinated and organized manners during the whole period of the works from the beginning of the designing stage, till the end of the commissioning and handover to MePGCL.

The Contractor shall furnish all materials and services for satisfactory completion of the Project, including such materials and services which are not specifically mentioned in the contract, but are required for completion of the Project. The Contractor shall make thorough assessment of requirement of the Project by visiting the site, before submitting their bidding.

G.2. Transportation Limitations

The Contractor shall abide by all limitations on the law and regulations in using the public transportation route and shall make any necessary repair or replacement as the case may be, to any structure on the route which has been damaged by the Contractor. Such repair or replacement shall be satisfactory to MePGCL or the appropriate government authorities.

For the purpose of transporting the Equipment from any part of the country to the Site, both railway (upto the nearest railway station of Guwahati) and road link (up to site location) are available. However, the Contractor shall visit Site to ascertain the conditions in detail.

G.3. Port facilities

The services of seaport Kolkata can be available for the Project. Kolkata port has the facilities for handling packages of any size.

G.4. Program and Progress

G.4.1. Key Dates in the Time Schedule

The Contractor shall prepare a detailed Time Schedule for the entire Project showing the key dates when the works shall be ready to receive/deliver the related equipment and/or to commence/complete the works. The dates corresponding to the time periods shall be considered critical and shall be met in all programs prepared by the Contractor.

G.4.2. Progress Report

The Contractor shall submit reports on the physical progress of the works to MePGCL and the Consultant at site daily, weekly and monthly. The monthly progress reports shall be submitted on or before the seventh (7th) Day of every month. If the progress of the works falls behind the approved Time Schedule, the Contractor shall submit to MePGCL and the Consultant modified schedule in which they shall state the reasons for the delay and the measures they shall take to recover lost time. Important events of the works shall be recorded by photographs and videos, which should be attached with the progress reports.

G.5. Consultant's Authority

The consultant shall perform technical assessment of the works in accordance with the contract agreement. The consultant shall have the authority, in coordination with MePGCL, to reject all of the works and materials which do not conform to the contract and to decide questions which arise in the execution of the Works.

The Consultant shall, within thirty (30) Days after their presentation in writing to them by the Contractor, make decisions in writing on all matters relating to the execution and progress of the Works or the interpretation of the Contract Documents.

The Contractor shall comply with and adhere strictly to, the Consultant's instructions and directions on any matter concerning the works and he shall cooperate to the fullest extent with the Consultant in the performance of the works.

G.6. Drawings Provided by MePGCL

The Drawings included in the Bidding Documents are representative of the scope of the works to be done under this Contract but are not necessarily complete in detail or to scale.

The dimensions and the quality of existing materials described in the Drawings of the Bidding Documents are for reference only. Therefore, the Contractor shall confirm actual dimensions and the existing design for materials, etc. by visiting the site. To check the actual dimensions and design, all necessary works such as head cover removal, if required, shall be carried out by the Contractor, which is subject to MePGCL's prior approval. The time period for checking shall be kept minimum by the Contractor. All cost of dimension check and other investigations for design shall be borne by the Contractor.

G.7. Submission of Drawings, Documents, Data etc. by the Contractor

G.7.1.

The Contractor shall submit to MePGCL's Consultant for approval of drawings, plans, design data, dismantling and erection, operating and maintenance instructions, catalogs and any other documents necessary to demonstrate fully that all parts will conform with the provisions and intent of the Contract Documents and with the requirements of their operation and maintenance. The drawings shall show all the necessary dimensions, tolerances, list of components, weights, materials, field joints, sub-assemblies in which the Contractor proposes to ship the Equipment, locations and sizes of

auxiliary connections for hydraulic circuits and the terminal boxes and wire sizes for electric circuits.

The Contractor shall, in addition to the documents specified in the Contract, furnish without delay any calculation, documents, drawings and other information, which though not specified in the Contract, may be required by MePGCL or their Consultant from time to time during the period of the Contract.

Unless otherwise specially provided, all expenses required by the Contractor to submit the documents, drawings and other information in compliance with the Contract shall be borne by the Contractor.

In case of any minor deviations from the Specifications and matters accepted and confirmed by the minutes of meeting, the Contractor shall clearly indicate it on the approval of drawing and submit the drawings together with the reasons for such deviations. MePGCL reserves the right to reject the deviations and ask the Contractor to follow MePGCL's Specifications, if any deviation is submitted without clear indication and is not studied during approval procedure.

G.7.2. Identification of Drawings

All documents supplied by the Contractor shall include in the drawing title as the following indications:

REPUBLIC OF INDIA

MEGHALAYA POWER GENERATION CORPORATION LTD.

RENOVATION, MODERNIZATION AND UPGRADATION WORKS

FOR UMIAM UMTRU STAGE III HEPP, KYRDEMKULAI

CONTRACT NO. MePGCL

and each document shall be properly identified as to:

- (a) Name of the Contractor and manufacturer
- (b) The structure which it belongs to
- (c) An identification of the contents of the document
- (d) Issue date
- (e) Number and date of each revision

All drawings shall be prepared as per ISO standards or equivalent. Each drawing shall be provided on the external frame line with letters and numbers for an easy identification of any part of the drawing. The Contractor before starting with the design shall submit for approval a drawing specimen.

G.7.3. Work Prior to Approval

Any Work, including the manufacturing and the order to subsidiary, carried out without the approval of drawing shall be at the Contractor's risk. The Contractor shall carry out all the changes, which are necessary to make the Equipment conform to the provisions and intent on the Contract Documents without additional cost to MePGCL.

G.7.4. Documents, Drawings and Data for Submittal

Each transmittal of documents (design, drawing, instruction, etc.) shall be accompanied by a list of documents in continuous sequence, containing the precise designation, number and/or other identification of document.

MePGCL reserves the right to hold any payment due to the Contractor in case the drawings and data are not be submitted in time.

G.7.5. Drawings for Approval, Final Drawings and As-built Drawings

(1) Prior to fabrication of the Equipment, the Contractor shall submit drawings for approval. Should direct modifications to be made in order to satisfy the requirements of the Specifications, the Contractor shall submit modified drawings for approval. Alterations in the Contract Prices shall not be made by reason of the modifications in the drawings for approval. In the event the Contractor proceeds with fabrication without approval of drawings, he shall make the necessary changes at his own costs, expense and charges. Approval of drawings shall in no way release the Contractor from his obligation to satisfy the requirements of the Specifications or the responsibility of making corrections in his drawings.

(2) The final drawings shall include the final correct assembly-drawings, erection-drawing, design calculations, parts/component-lists and such details of all replaceable parts as, in the opinion of MePGCL, may be required for completing the design of the erection and for maintenance and repair, or for identification of parts to other replacements.

The drawings shall show all changes and revisions, with revision dates, updated to the time of installation & commissioning of the Equipment(s).

(3) Within 30 days after the certificate for provisional acceptance tests, the Contractor shall correct and submit the as-built drawings, both in hard and soft copies, according to the actual modification made during the erection.

G.7.6. Operation and Maintenance Manuals

(1) The Contractor shall provide operation and maintenance manuals, the scope of which shall be suitable for fully informing the MePGCL's staff on all aspects of the operation and maintenance of the Equipment.

The manuals shall be provided in draft and final forms. If the need to modify the final manuals arises, the Contractor shall provide the necessary modified content as soon as possible after the need for modification arises.

The manuals shall be bound in some hard-covered files separately considering the contents.

(2) The contents of the manuals shall be directly applicable to the Equipment. Typical manuals will not be accepted. Standard manuals covering a number of sizes and/or models of proprietary equipment will be accepted provided they cover the items supplied and these items are clearly identified throughout the manuals.

(3) The manuals shall be subdivided on an equipment-by-equipment basis, with the content for anyone equipment self-contained, complete and separate in all respects from the content for other equipment.

G.8. Applicable Standards

Except as provided in the Specifications, all materials and equipment furnished by the Contractor shall be designed, manufactured, tested and erected in accordance with the following standards and codes. Standards shall conform to the latest applicable versions.

- | | |
|-----------|--|
| (1) IS | Indian Standard Institution |
| (2) IEC | International Electro technical Commission |
| (3) ANSI | American National Standards of Institute |
| (4) NEMA | National Electrical Manufacturers Association |
| (5) ASTM | American Society for Testing and Materials |
| (6) ASME | American Society of Mechanical Engineers |
| (7) AWS | American Welding Society |
| (8) IEEE | Institute of Electrical and Electronic Engineers |
| (9) ICEA | Insulated Cable Engineers Association |
| (10) JIS | Japanese Industrial Standards |
| (11) JEC | Japanese Electro Technical Committee |
| (12) JEMA | The Japan Electrical Manufacturers' Association |
| (13) BS | British Standards Institution |
| (14) SSPC | Steel Structures Painting Council |

All threaded parts shall conform to the Standards of the International Organization for Standardization (ISO).

The Contractor shall furnish MePGCL with numbers of printed Standards and/or Codes including Indian Standards applied to equipment and materials, design, manufacture, inspection, erection and operation, etc.

Reference to standards or to materials and equipment of a particular manufacturer shall be regarded as followed by the words "or equivalent". The Contractor may propose alternative standards, materials or equipment that shall be equivalent to those specified. If for any reason the Contractor proposes alternatives to or deviations from the above standards or desires to use materials or equipment not covered by the above standards, the Contractor shall state the exact nature of the change, the reason for making the change and shall submit relevant Specifications of the materials and equipment in the original language for approval. In case these specifications are written in languages other than English, English version shall be attached. The decision of MePGCL in the matter of equivalency will be final.

G.9. Units of Measurement

Units of measurements shall be in the metric system with SI units and Celsius for temperature.

G.10. Station Service

The service power for use in Umiam Umtru Stage III HEPP shall be supplied with 3-phase, 4-wire, 50 Hz AC 415/230 V. All electrical equipment and apparatus which will receive power from station service circuit/LTAC panel shall withstand standard fluctuation of voltage and frequency.

G.11. Materials

The materials composing the Equipment, unless otherwise provided for in the Specifications, shall be those selected, by thoroughly scrutinizing the properties thereof, from among the materials of good quality usually used for the equipment of the same kind.

All the materials used for the Equipment will be new and will conform to the latest editions of JIS, ASTM Specifications or approved equivalent.

The materials used for renovation of the Component of the turbines and generators shall be, in principle, of the same kind and the same grade or better grade.

The grade and standard number of the materials shall be submitted for approval in the corresponding Contractor's drawings.

(1) Castings

All casting shall be true to pattern, of workman like finish and of uniform quality and condition, free from blowholes, porosity, hard spots, shrinkage defects, cracks or other injurious defects and shall be satisfactorily cleaned for their intended purpose. The largest fillets compatible with the design shall be incorporated wherever a change in section occurs. The surface of castings, which do not undergo machining, shall be free from foundry irregularities, such as projections, ridges, hollows, honeycombing.

The structure of the casting shall be homogeneous and free from excessive non metallic inclusions. An excessive segregation of impurities or alloys at critical points in a casting will be cause for its rejection.

The materials for each kind of casting shall be in accordance with the relevant standards or equivalent.

G.12. Design Stress

(1) Liberal factor of safety shall be used throughout the design, especially in the design of all parts subject to alternating stresses or shock.

(2) Steel castings and welds, shall be stress-relieved by heat treatment before machining and castings shall be repeatedly stress relieved after repair work by welding.

G.13. Welding

(1) The welding shall be done by appropriate arc welding process and the work shall be free from pinholes, cracks and any other visible defects. The qualification test of welding operation and welders shall be in accordance with the latest edition of Section IX of the ASME Boiler and Pressure Vessel Code or approved equivalent standards.

Welding rods to be used in hand welding shall be a heavy coated type suitable for welding of all sections and positions.

(2) Plates to be joined by welding shall be accurately cut to size and rolled by pressure to the proper curvature that shall be continuous from the edge. Flattening in the curvature along the edges with correction by blows shall not be allowed. The dimensions and shape of the edges to be joined shall be thorough fusion and complete penetration and the edges of plates shall be properly formed to accommodate the various welding conditions.

(3) The Contractor shall submit the documents or the drawings of the welding procedure, base materials, welding rods and non-destructive tests of welding for approval.

G.14. Painting

(1) All the Equipment shall be painted as per relevant standards. The painting of metal work shall include the preparation of the metal surfaces, paint application, protection and drying of the paint coating as well as the supplying of materials necessary for the entire painting work.

Paints shall be the products of recognized and reputable manufacturers and proposed paints shall be approved by MePGCL. Paints, only within their valid self-life, shall be used for painting of the equipment/ materials of the Project.

No painting is required on bronze or corrosion-resisting steel, on rolling or sliding surfaces or on metal surfaces to be embedded in concrete.

All finished mating surfaces of ferrous metal, including gear teeth, screw threads, bores of servomotor cylinders, pistons, stems, etc., shall be protected with a heavy coating of rust preventative compound which shall be readily removable with mineral spirits or safety solvents.

(2) All metal surfaces to be painted shall be properly treated or cleaned and methods of surface preparation shall conform to the prescribed standards of the latest edition of the Steel Structures Painting Manual, Volume 2, "Systems and Specifications" as issued by SSPC, or equivalent.

(3) Synthetic resin paint shall be used for the finish paint of the exposed portion of all the equipment except for the portion embedded in concrete and the mechanical finished surface thereof.

The primary coat shall be of the kind matching the finish paint mentioned above and shall have a rust preventive effect.

(4) The exposed portion of all the equipment except portion embedded in concrete and the mechanical finished surface thereof shall be shop-coated with primary paint. The finish coat of the equipment shall be applied by the Contractor after the equipment has been installed at the Site. Paint needed for the finishing coat shall be furnished by the Contractor together with the equipment.

(5) Control cabinets, control boards, motor control centers, metal-enclosed cubicles and switch boxes for auxiliary equipment, motors, pumps and other shop-finished manufacturer's standard products shall be shop-finished with spray painting and shall not undergo painting at the site. However, the Contractor shall furnish paint for touch up in required quantity and shall apply the touch up paint coat, at site, wherever required.

(6) The color schedule for the Equipment will be decided after award of the Contract.

(7) Surfaces exposed to water for the new pressure relief valve and new inlet valve shall be sand blasted or ground to SSPC Specification SP10, or equivalent, in the shop and shop coated with one coat of coal-tar-epoxy to a minimum dry film thickness of 30 microns.

In the field, these surfaces shall be cleaned by power tool or hand tool as per relevant standards, to

remove rust around welded parts and parts damaged during transportation and erection. One coat of coal-tar-epoxy resin paint or equivalent shall be applied to all welded and damaged areas to a minimum dry film thickness of 30 microns.

After completion of installation, the Contractor shall apply two or three coats of coal-tar-epoxy resin paint or equivalent to a minimum dry film thickness of 300 microns.

Paint needed for the repair and finishing coat shall be furnished by the Contractor together with the Equipment in required quantity.

(8) Surfaces exposed to oil, such as the interiors of bearing oil reservoirs, shall be sand blasted to SSPC Specification SP 10 or equivalent and coated with four coats of oil resistant paint to a minimum dry film thickness of 60 microns at the Site.

(9) All exterior surfaces of non-embedded piping shall be solvent cleaned and shall be given a field-applied prime coat followed by a coat of finish paint to be selected. The Contractor shall furnish the prime coat paint and finished paint as required.

The piping and valves shall be coated with appropriate color paint in compliance with color schedule.

G.15. Packing

(1) All the Equipment shall be carefully packed to withstand transportation by sea and land in tropical moist climate. The electrical equipment shall be completely protected against moisture and rust from salt water and rain. The same precaution and care shall be taken for the Equipment and Components that cannot be packed or crated. Machine finished surfaces of the Equipment shall be adequately protected by rust preventive means.

(2) The spare parts shall be packed and crated firmly to withstand storage for a long time and those in need of rust preventive treatment shall be so treated. The spare parts shall be packed separately from other articles and absolute care shall be taken to prevent spare parts being packed or crated in the same box or crated with the Equipment or the installation materials. Packages of spare parts shall carry with notation, which clearly indicates that the contents are spare parts and shall be accompanied by a list of contents, which sets forth instruction for handling and storing.

G.16. Piping

(1) The Contractor shall furnish all necessary pipes and valves required for the Project including pipe supports necessary for installation of pipes and all anchor bolts necessary for fixing pipe supports and also the required packings and other materials for connection, in required quantity. At crossing points between pipes and electrical cables, the Contractor shall furnish required materials for smooth cross over, without any damage.

(2) Piping for pressure equipment shall be seamless steel tube or seamless copper tube. A flange shall be fitted to one end of pipe in the manufacturer's shop and another flange will be fitted to the other end of pipe at the site. Flanges attached to pressure pipes shall be welded from both inside and outside. Ream joint for the connection of copper tube will be applied at the site.

(3) All valves for governor oil lines shall be of the cast steel, extra heavy, rising stem, solid-wedge or needle type, with close guide clearance to minimize vibration of the gates when operating under pressure and at partial opening. Valves for use on lines other than governor oil lines shall be of the rising stem, steel body and bronze-mounted type. All valves shall be suitably designed for the intended service.

(4) Connection of pipes mounted on the equipment shall be supported so as not to transfer the weight of pipes to the equipment. The Contractor shall design the position of all pipe fittings to permit maintenance work with minimum disconnection of pipes.

(5) The Contractor shall furnish drain cocks and air vent valves, etc. at necessary positions in the piping system.

G.17. Terminal Blocks and Wiring

(1) All wires to be used for the Project shall be as per the relevant standard.

The individual temperature detector leads shall be oil, moisture and heat resistant. The cables shall have armor protection against mechanical damage.

The leads from speed signal devices to governor through terminal boxes and from temperature detectors to thermometers and/or temperature recorders through terminal boxes shall be shielded. Outlet leads from transducers shall also be shielded. In addition, any other outlet cables that would be subject to induced signals should be shielded.

(2) Both ends of low voltage wires shall be terminated by crimp-type terminals with insulated colored sleeve and provided with the terminal number rings and the number shall be recorded in the wiring diagram.

(3) DC circuit shall be separated by a terminal block provided on each control board, cubicle, motor control center, control cabinet and control box for easy detection of grounding fault.

(4) The terminal blocks shall be of molded block type with insulating barrier between terminals. The terminal block for current transformer secondary circuit shall be of short-circuit type.

(5) The terminal blocks shall be provided with not less than 10 additional terminals as spares for each control boards, cubicle and cabinet besides the necessary number. Two or more external wires shall not be connected at one terminal.

(6) The terminals of motors or other equipment shall have pressure compression type terminal lugs with which outgoing cables are to be connected.

(7) Test terminals shall be provided on all electrical enclosures.

G.18. Cables and Electrical Conduit

(1) The cables shall conform to IEC, ICEA or JIS standards specified in the relevant clause.

(2) The Contractor shall furnish all cables that will be used for controlling, operating and supplying power for the Equipment of the Project, in required quantity.

(3) The cables shall not have cut or scratches in the insulation or protective covering or in the conductors. No splices shall be made in the conductors except at the terminal blocks of the Equipment. All cables shall be marked by the Contractor at each end with mark bands attached by the cable code numbers. Drawings indicating the cable routes and cable codes shall be submitted by the Contractor before installation.

(4) The electrical conduits and the accessories shall conform to ANSI C80-1, JIS or equivalent standards.

(5) The Contractor shall furnish all conduits, accessories and fittings which will be required for laying the cables in required quantity.

(6) All bends of conduits shall be gradual and smooth to permit the pulling of insulated electrical wires and cables without undue stress or damage of the insulation covering or sheath. Ends of conduit shall be fitted with bushing in order not to injure sheath of cables or insulation coverings.

G.19. Name Plates and Marking

Name plates, card-plates, instruction plates, warning signs and any markings on the Equipment, parts and accessories thereof shall be in the English language.

The name plates provided on the surfaces of the turbines and generators shall be made of stainless steel or bronze and the name plates of other equipments shall be preferably made of stainless steel.

The details to be shown on the nameplates, etc. shall be indicated on the relevant drawings for approval.

G.20. Inspection

G.20.1. Quality Assurance

The Contractor shall plan, establish, implement and maintain a documented quality assurance program that utilizes those organizational and functional disciplines necessary to furnish objective evidence of required quality throughout all phases of Contract performance. The program shall emphasize the prevention of conditions adverse to quality and assure prompt detection and correction of deficiencies. The Contractor shall be responsible for conducting at his own expense all activities affecting quality, in accordance with applicable criteria, codes, standards, and recognized practices.

The quality assurance program of the Contractor and of their Subcontractors shall be subject to approval of MePGCL and the Consultant and/or their designated representative at any time during the course of the program. Such actions by or on behalf of MePGCL shall not release the Contractor from his responsibility for compliance with requirements of the Contract.

G.20.2. Inspections during Manufacturing

MePGCL and/or his designated representative(s) shall have access to the Contractor's factory, facilities and equipment at facilities for such access, and shall furnish promptly, materials reasonably needed for safe and convenient inspection by MePGCL and/or by his designated representative(s).

In case that a part of the machinery is being manufactured in the workshops of a third party, the Contractor shall arrange that MePGCL and/or his designated representative(s) may freely and without hindrance inspect and examine materials and witness tests, just as if these were in the Contractor's workshops. Upon request, the Contractor shall furnish or provide access to documents, records, material samples, information and other items required by MePGCL and/or his designated representative(s) to furnish objective evidence that the Works will comply in all respects with the standards and requirements set forth in the Contract Documents.

All the charges related to the above inspection by MePGCL and/or his designated representative(s) shall be borne and paid by the contractor.

In particular, the Contractor shall furnish or provide access to:

(1) A list of the workshops in which the different parts of the Equipment are manufactured;

(2) A detailed list of all sub-orders placed with sufficient information to enable the inspectorate to function properly, including order number, supplier's identity, equipment specifications, delivery and dispatch dates, etc.;

(3) A list of Contractor's drawings, updating at regular monthly intervals and indicating the status of approval or revision and the corresponding schedule of tests of the Equipment mentioned in such drawings.

The list shall also indicate the drawing numbers and dates, revision numbers and revision dates, and date of approval of each drawing.

At the same time of inspection, an evidence of drawing approval for the Equipment to be inspected shall be presented to MePGCL and/or to his designated representative(s).

G.21.Tests

The Contractor shall execute all shop tests and field tests as per relevant standards.

G.21.1. Shop Test

Unless otherwise approved, the shop tests shall be conducted in the presence of MePGCL's representative and/or their Consultant. The Contractor shall submit all shop test results to MePGCL for approval.

G.21.2. Field Tests

(1) The field tests shall be performed by the Contractor, under the witness of representatives of MePGCL and their Consultant.

(2) Equipment, tools, instruments and materials

The Contractor shall arrange all the equipment, tools, measuring instruments and materials required for field testing.

G.22. Spare Parts

All spare parts shall be interchangeable with and of same quality and dimensions as the corresponding part of the Equipment. All spare parts shall be properly treated and packed for a prolonged storage, considering the ambient conditions prevailing at the Site.

The Contractor shall deliver the spare parts at the site, prior to the date on which erection of the corresponding equipment will start.

The Contractor shall submit Price List of recommended spare parts for all Equipment. The recommended spare parts shall be in addition to those required for erection.

G.23.Working in different fronts

The Contractor shall carry out works in different fronts simultaneously, for timely completion of works.

G.24. Cleanliness

The Contractor shall maintain cleanliness in the work area, particularly in the Power House premises.

G.25. Safety

The safety norms of JICA, Government of India/ Meghalaya shall be scrupulously followed by the Contractor and their personnel working at site.

The safety requirements in accordance with the laws and regulations in the country of the Borrower, relevant international standards (including guidelines of international organization), if any, and also in consideration of "the Guidance for the Management of Safety for Construction Works in Japanese ODA Projects of JICA" and shall be followed. Such requirements shall be in accordance with the laws and regulations on the occupational safety and health in the country of India and contain additional safety requirements as needed.

The personnel for key positions having adequate experience in the field of safety to be proposed by bidders shall include as accident prevention officer/safety officer. This officer shall be engaged at site by the Contractor to look after implementation of safety norms, who shall submit reports concerning safety to MePGCL, with copy to the Consultant.

Contractor shall submit method statements of safety to MePGCL and the consultants at the commencement stage of the project.

Bidders shall furnish a safety plan in their bid to meet the safety requirements.

G.26. COVID-19 Prevention

The Contractor shall be responsible for implementing COVID-19 prevention program at site in accordance with the guidelines of the state of Meghalaya/Government of India as issued from time to time.

G.27. Environmental and Social Consideration

The contractor is to comply JICA Guidelines for environmental and social considerations (April 2010) (hereinafter referred to as "JICA Environmental Guidelines)

Forms and Procedures

Form of Completion Certificate

Date: *[insert date]*

Loan Agreement No: *[insert number]*

IFB No: *[insert number]*

[Name of Contract]

To: *[Name and address of Contractor]*

Dear Sirs,

Pursuant to GC Clause 24 (Completion of the Facilities) of the General Conditions of the Contract entered into between yourselves and the Employer dated *[insert date]* , relating to the *[brief description of the Facilities]* , we hereby notify you that the following part(s) of the Facilities was(were) complete on the date specified below, in accordance with the terms of the Contract.

1. Description of the Facilities or part thereof: *[insert description]*
2. Date of Completion: *[insert date]*

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

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

Very truly yours,

Title

(Project Manager)

Form of Operational Acceptance Certificate

Date: *[insert date]*

Loan Agreement No: *[insert number]*

IFB No: *[insert number]*

[Name of Contract]

To: *[Name and address of Contractor]*

Dear Sirs,

Pursuant to GC Sub-Clause 25.3 (Operational Acceptance) of the General Conditions of the Contract entered into between yourselves and the Employer dated *[insert date]*, relating to the *[brief description of the Facilities]*, we hereby notify you that the Functional Guarantees of the following part(s) of the Facilities were satisfactorily attained on the date specified below.

1. Description of the Facilities or part thereof: *[insert description]*
2. Date of Operational Acceptance: *[insert date]*

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

Very truly yours,

Title

(Project Manager)

Change Order Procedure and Forms

Date: [*insert date*]

Loan Agreement No: [*insert number*]

IFB No: [*insert number*]

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3. References for Changes

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- Annex 2 Estimate for Change Proposal
- Annex 3 Acceptance of Estimate
- Annex 4 Change Proposal
- Annex 5 Change Order
- Annex 6 Pending Agreement Change Order
- Annex 7 Application for Change Proposal
- Annex 8 Change Order log

Change Order Procedure

1. General

This section provides samples of procedures and forms for implementing changes in the Facilities during the performance of the Contract in accordance with GC Clause 39 (Change in the Facilities) of the General Conditions of the Contract.

2. Change Order Log

The Contractor shall keep an up-to-date Change Order log to show the current status of Requests for Change and Changes authorized or pending, as Annex 8. Entries of the Changes in the Change Order log shall be made to ensure that the log is up-to-date. The Contractor shall attach a copy of the current Change Order Log in the monthly progress report to be submitted to the Employer.

3. References for Changes

- (1) Request for Change as referred to in GC Clause 39 shall be serially numbered CR-X-nnn.
- (2) Estimate for Change Proposal as referred to in GC Clause 39 shall be serially numbered CN-X-nnn.
- (3) Acceptance of Estimate as referred to in GC Clause 39 shall be serially numbered CA-X-nnn.
- (4) Change Proposal as referred to in GC Clause 39 shall be serially numbered CP-X-nnn.
- (5) Change Order as referred to in GC Clause 39 shall be serially numbered CO-X-nnn.

Note: (a) Requests for Change issued from the Employer's Home Office and the Site representatives of the Employer shall have the following respective references:

Home Office CR-H-nnn

Site CR-S-nnn

- (b) The above number "nnn" is the same for Request for Change, Estimate for Change Proposal, Acceptance of Estimate, Change Proposal and Change Order.

Annex 1. Request for Change Proposal

(Employer's Letterhead)

To: *[insert Contractor's name and address]*

Date: *[insert date]*

Attention: *[insert name and title]*

Contract Name: *[insert Contract name]*

Contract Number: *[insert Contract number]*

Dear Sirs,

With reference to the captioned Contract, you are requested to prepare and submit a Change Proposal for the Change noted below in accordance with the following instructions within *[insert number of days]* days of the date of this letter *[or on or before (date)]*.

1. Title of Change: *[insert title]* _____
2. Change Request No.: *[insert number]* _____
3. Originator of Change: Employer: *[insert name of Employer]* _____
Contractor (by Application for Change Proposal No. *[insert number]*) _____
4. Brief Description of Change: *[insert description]* _____
5. Facilities and/or Item No. of equipment related to the requested Change: *[insert description]* _____
6. Reference drawings and/or technical documents for the request of Change:

<u>Drawing No./Document No.</u>	<u>Description</u>
7. Detailed conditions or special requirements on the requested Change: _____
8. General Terms and Conditions:
 - (a) Please submit your estimate to us showing what effect the requested Change will have on the Contract Price.
 - (b) Your estimate shall include your claim for the additional time, if any, for completion of the requested Change.
 - (c) If you have any opinion negative to the adoption of the requested Change in connection with the conformability to the other provisions of the Contract or the safety of the Plant or Facilities, please inform us of your opinion in your proposal of revised provisions.
 - (d) Any increase or decrease in the work of the Contractor relating to the services of its personnel shall be calculated.
 - (e) You shall not proceed with the execution of the work for the requested Change until we

have accepted and confirmed the amount and nature in writing.

(Employer's Name)

(Signature)

(Name of signatory)

(Title of signatory)

Annex 2. Estimate for Change Proposal

(Contractor's Letterhead)

To: *[insert Employer's Name and address]*

Date: *[insert date]*

Attention: *[insert name and title]*

Contract Name: *[insert Contract name]*

Contract Number: *[insert Contract number]*

Dear Sirs,

With reference to your Request for Change Proposal, we are pleased to notify you of the approximate cost of preparing the below-referenced Change Proposal in accordance with GC Sub-Clause 39.2.1 of the General Conditions of the Contract. We acknowledge that your agreement to the cost of preparing the Change Proposal, in accordance with GC Sub-Clause 39.2.2 of the General Conditions of the Contract, is required before estimating the cost for change work.

1. Title of Change: *[insert title]* _____
2. Change Request No./Rev.: *[insert number]* _____
3. Brief Description of Change: *[insert description]* _____
4. Scheduled Impact of Change: *[insert description]* _____
5. Cost for Preparation of Change Proposal: *[insert cost]* _____¹

(a)	Engineering	(Amount)
(i)	Engineer	_____ hrs x _____ rate/hr = _____
(ii)	Draftsperson	_____ hrs x _____ rate/hr = _____
	Sub-total	_____ hrs _____
	Total Engineering Cost	_____
(b)	Other Cost	_____
	Total Cost (a) + (b)	_____

(Contractor's Name)

¹ Cost shall be in the currencies of the Contract.

(Signature)

(Name of signatory)

(Title of signatory)

Annex 3. Acceptance of Estimate

(Employer's Letterhead)

To: *[insert Contractor's name and address]*

Date: *[insert date]*

Attention: *[insert name and title]*

Contract Name: *[insert Contract name]*

Contract Number: *[insert Contract number]*

Dear Sirs,

We hereby accept your Estimate for Change Proposal and agree that you should proceed with the preparation of the Change Proposal.

1. Title of Change: *[insert title]* _____
2. Change Request No./Rev.: *[insert number]* _____
3. Estimate for Change Proposal No./Rev.: *[insert number]* _____
4. Acceptance of Estimate No./Rev.: *[insert number]* _____
5. Brief Description of Change: *[insert description]* _____
6. Other Terms and Conditions: In the event that we decide not to order the Change accepted, you shall be entitled to compensation for the cost of preparation of Change Proposal described in your Estimate for Change Proposal mentioned in 3 above, in accordance with GC Clause 39 of the General Conditions of the Contract.

(Employer's Name)

(Signature)

(Name and Title of signatory)

Annex 4. Change Proposal

(Contractor's Letterhead)

To: *[insert Employer's Name and address]*

Date: *[insert date]*

Attention: *[insert name and title]*

Contract Name: *[insert Contract name]*

Contract Number: *[insert Contract number]*

Dear Sirs,

In response to your Request for Change Proposal No. *[insert number]*, we hereby submit our proposal as follows:

1. Title of Change: *[insert title]* _____
2. Change Proposal No./Rev.: *[insert number]* _____
3. Originator of Change: Employer: *[insert name of Employer]* _____
Contractor: *[insert name of Contractor]* _____
4. Brief Description of Change: *[insert description]* _____
5. Reasons for Change: *[insert reason]* _____
6. Facilities and/or Item No. of Equipment related to the requested Change: *[insert description]*

7. Reference drawings and/or technical documents for the requested Change:

<u>Drawing/Document No.</u>	<u>Description</u>
8. Estimate of increase/decrease to the Contract Price resulting from Change Proposal:1	
	<u>(Amount)</u>
(a) Direct material	_____
(b) Major construction equipment	_____
(c) Direct field labor (Total _____ hrs)	_____
(d) Subcontracts	_____
(e) Indirect material and labor	_____

1 Increase and/or decrease to the Contract Price shall be in the currencies of the Contract.

(f) Site supervision _____

(g) Head office technical staff salaries

Process engineer _____ hrs @ _____ rate/hr _____

Project engineer _____ hrs @ _____ rate/hr _____

Equipment engineer _____ hrs @ _____ rate/hr _____

Procurement _____ hrs @ _____ rate/hr _____

Draftsperson _____ hrs @ _____ rate/hr _____

Total _____ hrs _____

(h) Extraordinary costs (computer, travel, etc.) _____

(i) Fee for general administration, _____ % of Items _____

(j) Taxes and customs duties _____

Total lump sum cost of Change Proposal _____

(Sum of items (a) to (j))

Cost to prepare Estimate for Change Proposal _____

(Amount payable if Change is not accepted)

9. Additional time for Completion required due to Change Proposal

10. Effect on the Functional Guarantees

11. Effect on the other terms and conditions of the Contract

12. Validity of this Proposal: within [number] days after receipt of this Proposal by the Employer

13. Other terms and conditions of this Change Proposal:

(a) You are requested to notify us of your acceptance, comments or rejection of this detailed Change Proposal within [number] days from your receipt of this Proposal.

(b) The amount of any increase and/or decrease shall be taken into account in the adjustment of the Contract Price.

(c) Contractor's cost for preparation of this Change Proposal:

[Note: This cost shall be reimbursed by the Employer in case of Employer's withdrawal or rejection of this Change Proposal without default of the Contractor in accordance with GC 39 of the General Conditions of the Contract.]

(Contractor's Name)

(Signature)

(Name of signatory)

(Title of signatory)

Annex 5. Change Order

(Employer's Letterhead)

To: *[insert Contractor's name and address]*

Date: *[insert date]*

Attention: *[insert name and title]*

Contract Name: *[insert Contract name]*

Contract Number: *[insert Contract number]*

Dear Sirs,

We approve the Change Order for the Facilities specified in the Change Proposal (No. *[insert number]*), and agree to adjust the Contract Price, Time for Completion and/or other conditions of the Contract in accordance with GC Clause 39 of the General Conditions of the Contract.

1. Title of Change: *[insert title]* _____
2. Change Request No./Rev.: *[insert number]* _____
3. Change Order No./Rev.: *[insert number]* _____
4. Originator of Change: Employer: *[insert name of Employer]* _____
Contractor: *[insert name of Contractor]* _____

5. Authorized Price:

Ref. No.: *[insert number]* _____ Date: _____ *[insert date]*

Foreign currency portion: *[insert amount]* _____ plus Local currency portion: *[insert amount]* _____

6. Adjustment of Time for Completion

None Increase *[insert number]* days Decrease *[insert number]* days

7. Other effects, if any

Authorized by: _____ Date: _____

(Employer)

Accepted by: _____ Date: _____

(Contractor)

Annex 6. Pending Agreement Change Order

(Employer's Letterhead)

To: *[insert Contractor's name and address]*

Date: *[insert date]*

Attention: *[insert name and title]*

Contract Name: *[insert Contract name]*

Contract Number: *[insert Contract number]*

Dear Sirs,

We instruct you to carry out the work in the Change Order detailed below in accordance with Clause 39 of the General Conditions.

1. Title of Change: *[insert title]* _____
2. Employer's Request for Change Proposal No./Rev.: *[insert number]* _____
dated: *[insert date]* _____
3. Contractor's Change Proposal No./Rev.: *[insert number]* _____
dated: *[insert date]* _____
4. Brief Description of Change: *[insert description]* _____
5. Facilities and/or Item No. of equipment related to the requested Change: *[insert description]*

6. Reference Drawings and/or technical documents for the requested Change:

<u>Drawing/Document No.</u>	<u>Description</u>
-----------------------------	--------------------
7. Adjustment of Time for Completion:
8. Other change in the Contract terms:
9. Other terms and conditions:

(Employer's Name)

(Signature)

(Name of signatory)

(Title of signatory)

Annex 7. Application for Change Proposal

(Contractor's Letterhead)

To: *[insert Employer's Name and address]*

Date: *[insert date]*

Attention: *[insert name and title]*

Contract Name: *[insert Contract name]*

Contract Number: *[insert Contract number]*

Dear Sirs,

We hereby propose that the below-mentioned work be treated as a Change in the Facilities.

1. Title of Change: *[insert title]* _____
2. Application for Change Proposal No./Rev.: *[insert number]* _____ dated: *[insert date]*

3. Brief Description of Change: *[insert description]* _____
4. Reasons for Change: *[insert reason]* _____
5. Order of Magnitude Estimation (in the currencies of the Contract): *[insert amount]* ____
6. Scheduled Impact of Change: *[insert scheduled impact]* _____
7. Effect on Functional Guarantees, if any: *[insert effect, if any]* _____
8. Appendix:

(Contractor's Name)

(Signature)

(Name of signatory)

(Title of signatory)

Annex 8. Change Order log

[The Contractor shall prepare an up-to-date Change Order log, in accordance with Clause 2 of the Change Order Procedure, and attach a copy of it to the monthly progress report to be submitted to the Employer.]

Specification

[It is customary to bind the drawings in a separate volume, which is often larger than other volumes of the Contract documents. The size will be dictated by the scale of the drawings, which must not be reduced to the extent that details are rendered illegible.]

A simplified map showing the location of the Site in relation to the local geography, including major roads, posts, airports, and railroads, is helpful.

The drawings, even if not fully developed, must show sufficient details to enable Bidders to understand the type and complexity of the work involved.]

Supplementary Information

SI.1. Site Conditions

All the Equipment shall be designed and manufactured for satisfactory operation at the following conditions:-

(1) Ambient temperature and humidity

(1-1) Maximum ambient temperature 35 °C

(1-2) Minimum ambient temperature

(a) Outdoor 5 °C

(b) Indoor 9 °C

(1-3) Maximum relative humidity 95 %

(2) Maximum cooling water temperature 25 °C