



KENYA ELECTRICITY GENERATING COMPANY PLC

KGN-HYD-004-2024

RFx: 5000014464

**TENDER FOR DESIGN, MANUFACTURE, DELIVERY, INSTALLATION, TEST AND COMMISSIONING OF TWO FRANCIS TURBINE RUNNERS FOR KAMBURU POWER STATION  
(Open International)**

Date: 5<sup>th</sup> March, 2024

**Addendum No. 2**

In Accordance with the “Tender for Design, Manufacture, Delivery, Installation, Test and Commissioning of Two Francis Turbine Runners for Kamburu Power Station” KenGen hereby issues Addendum No. 2 as follows:

**SECTION III - EVALUATION AND QUALIFICATION CRITERIA**

Revised technical evaluation.

**2.2 Evaluation of Tenders**

**(b) STAGE 2: Evaluation of Technical aspects of the Tender (Technical Capacity to Deliver The Contract)**

The Procuring Entity shall evaluate the Technical aspects of the Tender to determine compliance with the Procuring Entity's requirements under Section V 'Schedule of Requirement' and whether the Tenders are substantially responsive to the Technical Specifications and other Requirements. Technical evaluation shall be carried out only if the tender is determined to be responsive to the preliminary examination. Bidder must demonstrate conformance to the all the technical specifications and requirements as per the tender document, and as tabulated below.

	<b>Evaluation Attribute</b>	<b>Requirement</b>	<b>Applicant's Response</b>	<b>Compliant (Yes/No)</b>
TR2	<b>Qualification of Key Personnel</b> a) Project Manager	Attach CVs showing qualifications of nominated Project Manager with at least 15 years' experience on similar works. Attach proof of supervision of three (3) similar projects in the last ten years.		

	b) Installation Supervisor	Attach CVs showing qualifications of nominated Installation Supervisor with at least 10 years' experience on similar works. Attach proof of supervision of three (3) similar projects in the last ten years.		
	c) Commissioning Engineer	Attach CVs showing qualifications of nominated Commissioning Engineer with at least 10 years' experience on similar works. Attach proof of supervision of three (3) similar projects in the last ten years.		
TR4	Method Statement	Bidder shall submit a comprehensive method statement on how the project shall be implemented and a complete program of works. This shall also include clear quality control /assurances plan that ensures the products and quality of work adhere to the stipulated standards. This shall also include a Risk register, Job safety analysis, and the HSE plan which should be agree with the KenGen safety policy. The applicable standards for all critical areas shall be indicated in this document.		
TR5	Performance of the runners	Performance curves including but not limited to proposed efficiency curves, discharge curves, hydraulic energy or power curves and preliminary drawings must be provided.		
TR6	Manufacturers Authorizations	Provision of manufacturer's authorization for auxiliary equipment to be used in the process. If the supplier is not the manufacturer, provide manufacturer's authorization for the runner.		
TR11	Conformity of the runner	The runner shall conform to most of		

to the technical requirements provided in section V	the requirements of section V chapter 2.3.		
<b>COMPLIANCE</b>			

#### SECTION IV: TENDERING FORMS

#### APPENDIX TO THE TECHNICAL SPECIFICATIONS

#### LIST OF DRAWINGS

In response to the clarification on the provision of documents, The list of drawings provided for this tender shall be amended and issued as follows:

#### TURBINE

No.	DETAILS OF DRAWING	KenGen Dwg No.	Supplier Drawing No.
1.	Draft Tube Details	KAM.M.0005	335626
2.	Draft Tube Details	KAM.M.100046	335627
3.	Spiral casing VI	KAM.M.0009	335710
4.	Top Cover section (Water Box)	KGn-KAM-TUR-3001	1247304
5.	Turbine section	KGn-KAM-TUR-2001	1247267
6.	Runner	KAM.M.00528	335653
7.	Spiral Casing (Complementary Drawing)	KAM.M.00540	335816
8	Turbine Shaft	KAM.M.0010	335891
9	Air Admission Valve (Upper)	KGn-KAM-TUR-3017	1247513
10.	Air Admission Valve (Lower)	KGn-KAM-TUR-3015	1247425
11.	Guide vane profile	KGn-KAM-TUR-3005	1247310
12	Inlet Water quality results		

## SECTION V

The following clauses are amended to read as follows:

### 1.4 EXISTING PLANT/EQUIPMENT DATA

TABLE 1: TURBINE DATA

Turbine type	Vertical Francis
Maximum head	83 m
Rated design head	72 m
Rated output at 72m Head	28.6 MW
Speed	273rpm
Direction of rotation	Anti-Clockwise (viewed from above)
Runaway speed	525 rpm
Max. Guide vane opening	245mm
Spiral inlet diameter	2700mm
Runner inlet diameter	2336mm
Main shaft diameter	570 mm
Discharge at rated load	43.5 m <sup>3</sup> /sec
Runner Weight	7.689tons
Number of runner blades	16
Maximum hydraulic thrust	1.150kN
Maximum overpressure transient behaviour	50%
Tailrace level with zero discharge	923mAsl (Kenya datum)

### 1.11 Test Procedure Instructions

The Contractor shall prepare and execute a testing program that will establish that specified requirements have been met and that the items furnished and installed will perform as specified and required.

The Contractor shall submit to the Client for approval, during or immediately following the submission of drawings, and testing programs describing each test to be performed during factory acceptance tests (FAT), site commissioning, and performance tests. The program shall establish the sequence of the tests, the equipment preparation and operation procedures to be followed, and the detailed procedure for conducting each test. Model tests shall form part of this requirement. The program shall also contain performance guarantees, design values, technical particulars, and applicable standards or other criteria for the evaluation of each test. These programs shall be submitted for approval and distributed in the same manner as the drawings.

During the FAT, workshop tests shall be performed for each runner in accordance with the General Technical Specifications, and the following requirements. Geometric measurements, preferably using coordinate measurement machines, shall be performed on all components. Other tests shall include, but not be limited to:

- Material tests
- Radiographic, ultrasonic, and magnaflux tests, at the foundry and in the supplier's workshop.
- Magnaflux tests after machining and grinding.
- If repair welding will be undertaken, Radiographic, ultrasonic and magnaflux tests after.
- Verification of shapes to templates and other dimensional control.

Protocols and records from all tests shall be kept and provided for approval by the Engineer.

### **1.12 Attendance of Client's Personnel At Factory Tests And Training.**

The Contractor shall arrange for the Client's Engineers or staff members to witness tests of the following processes in the Contractor's manufacturing plant.

- Design reviews
- Factory Acceptance Tests

The contractor shall make necessary arrangements for the visit of three representatives from KenGen for the participation in witnessing the runner design review, CFD analysis, and Model tests and reviews. The representatives from KenGen will be qualified engineers with experience in this particular field. The contractor's test personnel shall give necessary guidance, explanations, and referenced standards during the performance of the different tests. This witnessing is expected to take one week.

The contractor shall also make necessary arrangements for the visit of three representatives from KenGen for the participation in factory acceptance tests for the runner and related equipment in this tender. The representatives from KenGen will be qualified engineers with experience in this field. The contractor's personnel shall give necessary guidance, and explanations, including providing the referenced standards during the different tests and inspections. A total duration of one week is foreseen for the visits.

Necessary expenses including international/internal air ticket costs between the Contractor's manufacturing facilities, and inland travel charges in the Contractor's country shall be included in the Tender.

**The Client will be responsible for the round-trip airfares between Kenya and the Contractor's country, accommodation, and all out-of-pocket expenses.**

### **1.13 Maintenance Equipment**

All maintenance and test equipment required shall be included in the price schedule and will be handed over to the client in good order on completion of the commissioning tests. This shall include but not limited to:-

- One (1) set of Runner coupling bolts tensioning equipment
- Two (2) sets of Special spanners
- 100kg Special welding materials for the runner
- Any other special equipment necessary for the installation and maintenance.

### **2.3 Requirements of the New Runners**

The new runners shall be designed to adapt and fit perfectly in the existing arrangement and for continuous and efficient operation throughout the runners' operating range of 14 to 35MW. They shall be designed to ensure galling resistance, and corrosion resistance, and to eliminate the undesirable cavitation effects. The contractor shall carry out any modification required on the stationary parts to ensure runner blades cracking and cavitation are eliminated. These modifications shall be documented, and their effects demonstrated in the tender.

The New Francis runners supplied shall have the following main features:

- a) The runner shall be made from 13/4 or 16/5 CrNi stainless steel quality or better, well suited for site repairs by welding. The Tender shall contain all relevant information on the make, grade, and properties of the proposed material.
- b) In the case of cast construction, the runner shall have no casting defects exceeding the requirements to be given by the turbine supplier in the quality sheets from the standard CCH 70-3 (specification for inspection of steel castings for hydraulic machines June 1996). All acceptance criteria shall be agreed upon before the award of the contract. Inspections shall be undertaken at the foundry before any repair welding is done.
- c) If a welded construction is proposed, the entire runner, i.e. runner blades/vanes, band, and crown shall be made of the specified material. Sufficient heat treatment methodologies shall be proposed to ensure homogeneity in the runner material.
- d) The runner cone bolted to the runner hub shall also be of stainless-steel quality preferably as the parent material in (a) above.
- e) The upper and lower wearing rings shall be an integral part of the runner. A proposal with wearing rings shrunk on the runner shall not be acceptable.
- f) The existing/spare stationary wearing rings shall be reused. The integral wearing rings shall have a hardness of at least 50 Brinell points higher than the stationary wearing rings.
- g) Blade surface finish shall be  $R_a = 1.6 \mu\text{m}$  or higher.
- h) Runner form and dimensions shall be according to IEC Publication 60193 - International Code for Model Acceptance Tests for Hydraulic Turbines (with amendments).

- i) The proposed runner shall not result with increased hydraulic load.
- j) The runner shall be balanced according to ISO 1940-1973 G 6.3. The updated version of the standard ISO 21940-11:2016 is applicable.
- k) New coupling bolts shall be supplied for the coupling of the runner to the turbine shaft. The new coupling bolts shall be designed for installation using hydraulic tensioning and shall be supplied complete with the tensioning equipment. Tensioning procedure shall be documented and demonstrated.
- l) The runner shall at the rated discharge and net heads be able to produce at least the following power outputs with the related weighted average efficiencies:

Net head (m)	Power output (MW)	Weighted average efficiency
70	27.5	0.91
72	28.6	0.92
74	29.8	0.93
78	32.2	0.93

Where the weighted average efficiency is calculated, for the purpose of evaluation, by:

$$\eta_t (AV) = 0.4\eta_{t100} + 0.4\eta_{t80} + 0.2\eta_{t60}$$

Where  $\eta_t (AV)$  = *Weighted average efficiency*

$\eta_{t 100}$  = *efficiency at 100% of rated output at the design head of ... m*

$\eta_{t 80}$  = *efficiency at 100% of rated output at the design head of ... m*

$\eta_{t 60}$  = *efficiency at 100% of rated output at the design head of ... m*

- m) The runner shall be able to produce a maximum output of 35MW.
- n) The new runner shall not introduce any additional hydraulic thrust to the system.
- o) The discharges at (l) for the proposed runner shall be indicated.
- p) The specific hydraulic energy produced by the runner at different heads and discharges shall be stated.
- q) The air admission system in the new runner supplied shall be appropriately designed for the purpose. Evidence of its operation shall be provided in the tender.

**Other related requirements:**

The tenderer and any of his personnel or agents will be granted permission by the Employer for the purpose of inspection of turbine parts to assist in the design of the new runners. This shall be only upon the express condition that the tenderer, his personnel or agents, will release and indemnify the Employer from and against all liability in respect of personal injury (whether fatal or otherwise), loss of or damage to property and any other loss, damage, costs and expenses however caused, which but for the exercise of such permission, would not have arisen.

The Contractor shall guarantee the turbine runner against excessive metal removal caused by pitting due to cavitation, for a period of two years from the date of issue of the Operational Acceptance Certificate, provided that the turbine during the guarantee period is operated within normal operating range as stated by the Contractor in the Technical Schedules. The guarantee shall be given in accordance with IEC 60609 - *“Cavitation pitting evaluation in hydraulic turbines, storage pumps and pump turbines”*. The runners shall also be guaranteed against cracking during this period.

Under these guarantees the Contractor shall bear the cost of repairing damage caused by cracking or excessive pitting due to cavitation, and of making any modifications required in the turbine parts to prevent recurrence of these defects. If the repair of the cracks or removal of the pitting require dismantling or transporting of the runner, the Contractor shall be responsible for all costs incurred. Damaged areas shall be repaired by welding and grinding as necessary and restored to a smooth surface that will prevent further cracking or pitting. If cracking or excessive pitting recurs after the runner has been repaired/modified, the Contractor shall be obliged to replace the runner with a new redesigned, satisfactory one. If the runner is repaired or replaced, the guarantee period for the repaired or new runner shall be prolonged according to the Conditions of Contract.

**SECTION VII: SPECIAL CONDITIONS OF CONTRACT**

The GCC 16.1, clause on payments in the General conditions of the contract, shall be amended as follows:

No. of GCC Clause	Amendments of, and Supplements to, Clauses in the General Conditions of Contract
16.1	<p>Payment shall be thirty (30) days upon delivery, Inspection, and acceptance. Local suppliers shall be paid through Electronic Funds Transfer (EFT). For international suppliers Letters of credit (LC) shall be applicable.</p> <p>Milestone payments shall be applicable on the following basis:</p> <ul style="list-style-type: none"> <li>a) Milestone 1: Engineering and design – 30%</li> <li>b) Milestone 2: Model tests, Manufacture, and Delivery – 40%</li> <li>c) Milestone 3: Installation, testing and commissioning – 30%</li> </ul> <p><b>Advance Payment</b> Advance payment is not applicable.</p> <p>10% of the contract amount shall be retained.</p>



**BIDDER'S ACKNOWLEDGEMENT OF ADDENDUM NO. 2**

We, the undersigned, hereby certify that the Addendum is an integral part of the document and the alterations set out in Clarification have been incorporated in our tender document.

**Signed** .....

**Tenderer** .....

**Date** .....