**Appendix No.5 to the Supplement No.10 to the Fuel Contract No.08843672/50293-09D 08.08.1995**

**Leak Check of Cladding System in mast of Fuel Handling Machine (FHM LCC SYSTEM)**

1. **Subject of the Appendix**

The subject of the Appendix is the development and supply of the working design documentation and equipment manufacturing and delivery of Leak Check of Cladding System in mast of Fuel Handling Machine (FHM LCC SYSTEM) together with installation, commissioning, Acceptance test and training of the said System to the Principal’s personnel hereinafter referred to as the Equipment.

2: **Scope of the Appendix**

2.1 The FHM LCC SYSTEM is designed to detect ~~of~~ FAs with unsealed fuel rods by the activity of gaseous fission products in the volume of ~~the in~~ working mast of FHM while the reactor stopped during transportation ~~of FAs, including~~ and unloading/shuffling of ~~all~~ FAs.

The Equipment ~~should~~ functionally consist of three main parts:

1. Pipeline (mechanical) part (LCC SYSTEM MP) should be located on the mast of FHM and consist of pipelines, fittings, nozzles, ~~as well as~~ and fastening elements. The pipeline part is intended to perform the following functions:

* supply of bubbling air under the fuel-assembly bottom nozzle;
* bubbling;
* supply of gas samples to the technological equipment.

1. Technological part (LCC SYSTEM TP) should be located on FHM carriage. ~~and consist of:~~ The technological part is intended to perform the following functions:

* Air preparation and supply for bubbling;
* Gas sampling and treatment;
* Gas sample activity check;
* Check results processing;
* Data transmission and reception of commands from the remote control equipment;
* LCC process control;
* LCC preliminary results generation.

1. Operator's terminal / Remote control equipment (LCC SYSTEM RCE) consists of a personal computer and software~~:~~. The operators terminal remote control equipment is intended to perform following functions

* LCC remote control;
* Data reception and transmission of commands to the technological equipment;
* Storage and display of check results
* Control of the remote control equipment;
* Control of the technological equipment;
* Data exchange between the remote control equipment and the technological equipment;
* LCC SYSTEM hardware diagnostics;
* Data processing, storage and displaying;
* Processing of FA sample check results and LCC results presentation.

2.2 The scope of the ~~goods~~ equipment and documentation to be delivered for the LCC SYSTEM ~~\*~~ are presented in table 5.1

Table 5.1: The scope of the equipment and documentation to be delivered for the LCC SYSTEM

|  |  |  |
| --- | --- | --- |
| No. | Name | Quantity |
| 1 | Operator's terminal / Remote control equipment | 1 pcs |
| 2 | The cabinet of control, sample preparation and analysis, and air preparation | 1 pcs |
| 3 | Set of tools and accessories | 1 pcs |
| 4 | Set of mounting parts | 1 pcs |
| 5 | Set of parts, devices and tools | 1 pcs |
| 6 | Set of operational documentation | 1 pcs |
| ~~\* The final scope of delivery shall be specified in the manufacturing of LCC SYSTEM.~~ | | |

~~The picture shows~~ The main principle of work of FHM LCC SYSTEM is presented in figure 5.1



*FA*

*ММ*

*LCC SYSTEM ME*

*LCC SYSTEM TE*

*FHM trolley*

*FHM*

*~~IMSS~~ RCE*

*FHM control room*

1. Sparger block
2. Compressed air supply
3. Gas sampling
4. Sample release
5. Condensate drain-off
6. 220 VAC, 50 Hz power

*Steel Containment*

*(Reactor Hall)*

1. Connection box
2. Control

Figure 5.1 The main principle of work of FHM LCC SYSTEM

2.3 The main activities and stages of FHM LCC SYSTEM development \* are presented in table 5.2

~~The table shows~~ Table 5.2 the main activities and stages of FHM LCC SYSTEM development \*

|  |  |  |  |
| --- | --- | --- | --- |
| No. | Main steps of works | Stages of works | Executor |
| 1 | Technical assignment\*\* | Development, ~~agreement and approval~~ of Technical assignment | ~~JSC «Diakont» \*)~~  JSC «TVEL», |
| 2 | Development of ~~working design~~ Technical documentation\*\* | Development of design documentation, as per Attachment No.1 to this Appendix | ~~JSC «Diakont» \*)~~  JSC «TVEL», |
| Development of software of LCC SYSTEM TP and LCC SYSTEM RCE  as per Attachment No.2 to this Appendix | ~~JSC «Diakont» \*)~~  JSC «TVEL», |
| Development of programs and test procedures  as per Attachment No.3 to this Appendix | ~~JSC «Diakont» \*)~~  JSC «TVEL», |
| Development of operational documentation | ~~JSC «Diakont» \*)~~  JSC «TVEL», |
| 3 | LCC SYSTEM equipment manufacturing | Manufacturing of LCC SYSTEM MP | ~~JSC «Diakont» \*)~~  JSC «TVEL», |
| Manufacturing of LCC SYSTEM TP | ~~JSC «Diakont» \*)~~  JSC «TVEL», |
| Manufacturing of LCC SYSTEM RCE | ~~JSC «Diakont» \*)~~  JSC «TVEL», |
| 4 | LCC SYSTEM equipment mounting | Mounting of LCC system mechanical part in place without removal and dismantling of working mast. ~~The Principal should secure the safe performance of the works.~~  as per Attachment No.4 to this Appendix | ~~JSC «Diakont» \*)~~  JSC «TVEL», |
| Installation of the air supply pipeline and gas sampling pipeline on the external mast section.  as per Attachment No.4 to this Appendix | ~~JSC «Diakont» \*)~~  JSC «TVEL», |
| Installation and connection of LCC system process cabinet on the MPS-V-446 carriage.  as per Attachment No.4 to this Appendix | ~~JSC «Diakont» \*)~~  JSC «TVEL», |
| Installation, cabling between RCE and TP and connection of the control rack in the control room of the FHM control system.  as per Attachment No.4 to this Appendix | ~~JSC «Diakont» \*)~~  JSC «TVEL», |
| Adjustment, trial running and tests of LCC system. | ~~JSC «Diakont» \*)~~  JSC «TVEL», |
| 5 | Equipment testing | Acceptance tests of FHM LCC SYSTEM | ~~JSC «Diakont» \*;~~  JSC «TVEL»,  /BNPP-1 |
| 6 | Commissioning | handling of FHM LCC SYSTEM on BNPP -1 | JSC «TVEL»,  /BNPP-1 |
| Commissioning works on BNPP -1  as per Attachment No.5 to this Appendix | ,  JSC «TVEL»,  ~~JSC «Diakont» \*~~ |
| Final Acceptance tests of FHM LCC SYSTEM  as per Attachment No.6 to this Appendix | BNPP -1,  JSC «TVEL»,  ~~JSC «Diakont» \*~~ |
| ~~\* The executor is specified in the process of development of LCC SYSTEM.~~  \*\* These works should be developed ~~at least 6 months before end of 5~~~~th~~ ~~cycle~~ of BNPP-1.  Note: The above main steps of works comprise all activities associated with the FHM LCC SYSTEM whether explicitly mentioned or not. | | | |

2.4 LCC SYSTEM should detect ~~of~~ both type of FAs including UTVS and TVS-2M simultaneously in the ~~each~~ transient fuel cycles.

2.5 Training of the BNPP-1 personnel on LCC SYSTEM shall be carried out during the Planned Repair and Maintenance before 6th fuel loading ~~The content and schedule of training shall be developed by the contractor and approved by the Principal before the commencement of training.~~

~~2.6 The scope and accestance criteria for equipment and commissioning test shalbe developed the contractor and approved by the Principal before performance of that tests.~~

2.7 **Technical documentation including specifications, drawings and diagrams, calculations and methods, installation instructions and design, repair documentation, operation manuals shall** be delivered in English and Russian copies.

~~As an example: 2.8~~ The FHM trolly shall have following characteristic:

FHM trolly

Technological equipment cabinet:width × depth × height – 835 × 680 × 2290 mm;

weight – 450 kg.

Junction box: width × depth × height – 176 × 90 × 190 mm;

weight – 1.5 kg.

Control room:

Junction box (mounted on the control room wall):width × depth × height – 176 × 90 × 190 mm;

weight – 1.5 kg.

Remote control equipment (process notebook with installed software set + printer): width × depth × height – 308 × 290 × 70 mm;

weight – 4.5 kg.

The technological equipment power supply source shall have the following parameters: 220 V AC supply voltage, frequency of 50 Hz, maximum power consumption of 5 kW.

**(means of the above information shall be clarified)**

~~2.4~~ 2.9 FHM LCC SYSTEM Technical Characteristics

FHM LCC SYSTEM is designed for detection of non-tight FA on the shut-down reactor while transporting the assemblies on the fuel-handling machine. FHM LCC SYSTEM is installed on fuel-handling machines of WCPR (water-cooled power reactors).

1. Technical characteristics

Inspection period for a single fuel assembly, maximum 180 s

Continuous operation time, minimum 720 hours

1. Operation conditions

The FHM LCC SYSTEM mechanical equipment is installed on the mast of the fuel-handling machine and is operated under the same conditions.

1. Working environment water or aqueous process solution

(distilled water containing 16-20 g/dm3 of boric acid)

1. Water temperature, °С, +70 maximum
2. Excessive pressure, MPa 0.2 maximum

The FHM LCC SYSTEM technological equipment is installed on the fuel-handling machine trolley in the reactor hall and is operated under the following conditions:

1. Working environment air
2. Air temperature, °С, from +15 to +40
3. Absolute pressure, MPa from 0.84 to 1.067
4. Relative air humidity, %, maximum 90
5. Detectable radioactivity в – radiation
6. Power range of detectable radioactivity, keV from 80 to 2000
7. Beta-radiating gases detectable radioactivity range, Bq/m3 3.7⋅104 to 3.7⋅109

FHM LCC SYSTEM remote control equipment is installed in the fuel-handling machine control room and is operated under the following conditions:

1. Working environment air
2. Air working temperature, °С, from +10 to +25
3. Pressure atmospheric
4. Relative humidity at temperature of 25 °С, %, maximum 80
5. FHM LCC SYSTEM safety class: 4.

**3. Terms of payment**

3.1 Payments under the Appendix shall be effected in favor of the Contractor from the irrevocable LC opened/increased by the Principal in accordance with ”) the terms and conditions of the present Appendix and on the basis of the latest revision of the Uniform Custom and Practice for Documentary Credits, publication No. 600 of the International Chamber of Commerce (UCP 600) in the amount of prices for FHM LCC SYSTEM reflected in Paragraph 3.1.2 of the Supplement No.10 to the Fuel Contract.

3.2 The nominated bank shall be selected by the Central bank of Iran and the Principal shall notify it to the contractor.

3.3 The Principal shall instruct to Issuing bank to open/increase the LC in compliance with the terms and conditions of the Appendix as well as UCP600 after receiving required Performa Invoice from the Contractor.

3.4 The Nominated bank shall advise the LC opening to the Contractor.

3.5 30 (thirty) calendar days before manufacturing of the FHM LCC SYSTEM, the Principal shall open/increase the LC for 20% of the price of the FHM LCC SYSTEM as advance payment. The initial validity of the LCs shall be 6 (six) months and shall be extended by the Principal in case of necessity. For the benefit of receiving of the Advance Payment, the Contractor shall timely submit an advance payment bank guarantee issued by the Russian bank accepted by the Central Bank of Iran (CBI) as the Issuing Bank of the LC**.** The amount of a bank guarantee for an advance payment is equal to 20% of the price of the FHM LCC SYSTEM.The amount of the advance payment shall be deducted proportionally from each invoice of the Contractor.

The Nominated Bank shall pay the advance payment to the Contractor under the LC in value of 20% of the price of the FHM LCC against the following documents:

- signed Commercial invoice for 100% of the price of the FHM LCC SYSTEM,.reflecting the price for payment under LC equal to 20% of the price of the FHM LCC SYSTEM - one original;

- An advance payment bank guarantee for 20% of the price of the FHM LCC SYSTEM, acceptable to the Principal’s bank (CBI) and forwarded through the SWIFT.

3.6 15 (fifteen) calendar days before delivery of the FHM LCC SYSTEM, the Principal shall increase the LC up to 100% of the price of the FHM LCC SYSTEM.

3.7 The Nominated bank shall effect by at sight the payment of the 80% of the price of the FHM LCC SYSTEM against submission of the following documents by the Contractor to the Nominated bank:

а) signed Commercial invoice for 100 % of price of the FHM LCC SYSTEM reflecting the price for payment under the LC and equal to 80% of the price of the FHM LCC SYSTEM confirming that the delivered LCC System is in strict conformity with the specifications stipulated in the present Appendix– one original and 2 copies.

b) Protocol of the Final Acceptance of the FHM LCC SYSTEM described in the Attachment No.6 to this Appendix signed by the Contractor and the Principal – one original and 2 copies

1. Certificate of origin issued and certified by local Chamber of Commerce (one original and 2copies).
2. Detailed packing list of the goods (one original and 2 copies).
3. clean airway bill of lading marked freight prepaid bearing the flight number.
4. Insurance Policy covering value of the goods plus 10% (ten percent).

The Documents should be provided by the Contractor to the Nominated bank during the LC validity.

3.8 The Contractor is obliged to submit an acceptable Good Performance Bank Guarantee (GPBG) to the Principal equivalent to 10% ( ten percent) of the price of the FHM LCC SYSTEM for the good performance of his obligations under the Appendix.

The Good Performance Bank Guarantee shall be submitted by the Contractor 15 (fifteen) days prior to the opening of the LC for the FHM LCC SYSTEM as per Paragraph 3.5. The Good Performance Bank Guarantee shall be released 18 months after successfully completion of the Warranty period of LCC SYSTEM .

. The cost related to the Good Performance Bank Guarantee will be covered by the Contractor.

3.9 The payments under the Appendix shall be made in the currency of the Contract.

3.10 If the Principal does not increase the LC in compliance with Paragraphs 3.3; 3.4 and 3.5 and not follow the conditions of Article 4 of the Appendix the Contractor shall have the right to shift the date of fabrication start of the FHM LCC SYSTEM under the Appendix for the same period of delay in LC increasing.

3.11 In case the Contractor failed to timely supply the FHM LCC SYSTEM , all evident expenses incurred to the Principal as a results of delay including expenses connected with extension of the LC shall be borne by the Contractor. The Contractor shall pay to the Principal's account against the Principal's invoice through the Nominated bank to Central Bank of Iran.

3.12 All banking charges of Letter of Credit outside of Iran shall be borne by the Contractor and inside Iran shall be borne by the Principal.

**4. Warrantees**

4.1 The warranty period shall be 18 months after testing, handing over and final acceptance of LCC SYSTEM at the BNPP-1.

4.2The Contractor warrants that:

4.2.1 The FHM LCC SYSTEM will be performed with full information and are reliable to be used during operation of Bushehr Unit 1.

4.2.2 The Contractor warrants that the quality and the quantity of LCC System are:

* In accordance with the specifications and nomenclatures presented in the present Appendix and without any non-conformances.

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* Free of defects, failures, faults and/or deficiencies.

4.2.3 FHM LCC SYSTEM transferred within the frames of the Appendix is not encumbered by third party’s rights and is free to be transferred to the Principal.

4.2.4 The Contractor warrants that a FHM LCC SYSTEM provided under the Appendix will be totally acceptable for unit 1 Bushehr NPP operation.

4.5 The Contractor warrants that if up to the end of warranty period failures, faults or deficiencies is detected in any part of the LCC System, the Contractor shall without delay initiate all necessary measures, upon receipt of the Principal's written notice and within a mutually agreed reasonable time, improve, repair or replace the defective part(s) of the LCC System or replace such part(s) by new ones of more suitable design, whenever shall be necessary, at the Contractor’s cost.

In any case, the warranty period of such part(s) shall continue for period at least 6 months from the date of repaired or replaced part(s) is ready to resume operation.

The warranty period of the Contractor shall in no way be reduced by any approval of the Principal or by the test, inspection and controls carried out by the Principal.

4.3 The Principal warrants that:

4.3.1 The FHM LCC SYSTEM transferred by the Contractor to the Principal under the Appendix shall be used for Bushehr NPP Unit 1.

4.3.2 For the purpose of obtaining the license for transfer of the FHM LCC SYSTEM by the Contractor the Principal in reasonable time provide the Contractor with representations of the competent authorities of Iran that the FHM LCC SYSTEM supplied by the Contractor to the Principal under the Appendix:

• Shall not be used for manufacturing nuclear weapons and other nuclear explosive devices or for any other military purpose;

• Shall be under the IAEA safeguards during the period of its presence under the jurisdiction of the receiving country;

• Shall be provided with physical protection not lower than recommended by IAEA;

• Shall be re-exported or transferred from the jurisdiction of receiving country only with prior written consent of the State Corporation for atomic energy “Rosatom” agreed by the Federal Service for technical and export control of Russia

**5. Terms of delivery.**

5.1 The Contractor shall transfer the FHM LCC SYSTEM with the regular fuel delivery on the terms DAP – airport Bushehr (INCOTERMS 2010, ICC, rev. 600) with the aircraft of Volga Dnepr Airlines.

5.2 The delivery date of the Equipment is …………………………….

5.3 The Contractor is obliged to receive necessary export license before shipment of the FHM LCC SYSTEM.

5.4 The Contractor shall initiate the procedure of obtaining the export license right after it receives representations according to paragraph 4 of the Appendix.

5.5 The Contractor through the shipping company, and along with the FHM LCC SYSTEM shall transfer three originals of the Protocol of Acceptance of the FHM LCC SYSTEM signed by the Contractor. The Contractor shall notify the Principal via E-mail upon issuance of the each Air Way Bill of the shipment.

6. Custom Clearance The Principal shall perform Customs clearance activities in Iran and the shipment of the LCC System from the Bushehr Airport to the BNPP-1 shall be carried out by the Principal under supervision of the Contractor.

# 7.   Installation, Erection, Acceptance Test, Commissioning Works

7.1. The Contractor shall erect and completely install the Equipment required for fulfillment of the present Appendix to the Supplement No.10 . Erection and installation of given Equipment is considered complete if Commissioning tests can be administered on the Equipment. Having completed the activities, the Contractor shall submit for the Principal’s approval the relevant completion reports in compliance with the requirements of the present Appendix.

7.2. The Contractor shall execute Commissioning of the system immediately after completion of erection and installation activities.

7.3. The Contractor is fully and solely responsible for Commissioning and shall commission the FHM LCC SYSTEM under its own full responsibility.

7.4. The Contractor shall submit to the Principal for approval, the time schedule related to the installation, erection and Commissioning activities at least ….. day/months prior to start of the commissioning of the Equipment. The Contractor shall submit the list containing the tests required for Commissioning stage and is responsible for performing the said required tests in the specified period of time.

7.5. Having successfully completed all the activities, tests, and adjustments related to the Commissioning, the Contractor shall send to the Principal the protocols, or reports on their fulfillment. The Principal will consider the received documents and approve them in case there is no comment; otherwise, in case of comments, the Principal will send their comments back to the Contractor along with the document, for comments removal. Having received the comments, the Contractor shall implement the comments and return the revised document for the Principal’s approval. . Functionality of FHM LCC SYSTEM shall be considered fulfilled only when the results of the tests executed at Commissioning stage fully comply with the criteria specified in the present Appendix; otherwise the Contractor shall take the required corrective actions.

**8. Training Of The PrincipalS Personnel**

The Contractor shall be fully responsible for comprehensive training of the Principal’s personnel for the purpose of enabling such personnel to fully and safely operate the FHM LCC SYSTEM as per the present Appendix . Training of the BNPP-1 personnel on LCC SYSTEM shall be carried out during the Planned Repair and Maintenance before 6th fuel loading or other agreed period by the Parties. Within ......... days after completion of the commissioning the Contractor the Contractor shall submit to the Principal the program which shows the details and time schedules, the number of trainees, and scope of training, and terms and conditions of training, and obligations of the Contractor and the Principal related to training.

**9. Other conditions**

9.1 The title of property for FHM LCC SYSTEM shall transfer to the Principal from the date of signing the Protocol of Acceptance of the FHM LCC SYSTEM supply (.The title of property for FHM LCC SYSTEM shall transfer to the Principal from the date of issuance of bill of lading or other acceptable shipment document to the Principal marked the Principal’s bank as consignee and the Principal as the applicant (or notify party) confirming actual shipment of the Equipment to the address of the Principal.

The said transfer of title of property shall in no way reduce the obligations of the Contractor and its liabilities as described in the present Appendix.

9.2 This Appendix to the Supplement No 10 is an integral part of the Contract.

9.3 All the changes to this Appendix shall be made in writing and shall be effective only if they are duly signed by the authorized representatives of the Parties.

Lists of the Attachments:

Attachment No.1;

Attachment No.2;

Attachment No.3;

Attachment No.4;

Attachment No.5;

Attachment No.6;