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# TECHNICAL SPECIFICATION FOR ENGAGING PROOF CONSULTANCY SERVICES

**PROJECT:** THE ELECTRIFICATION OF RAILWAY LINES OF THE BIRLANAGAR-ETAWAH, BHANDAI-UDI AND FARRUKHABAD-SHIKOHABAD INCLUDING MAINPURI-ETAWAH OF NORTH CENTRAL RAILWAY 386RKM/440TKM

**Revisions:**  
Refer to record of revisions

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**PROJECT ENGINEERING & SYSTEMS DIVISION**  
(Technical Specification For Engaging Proof Consultant)

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## 1.0 INTENT OF SPECIFICATION

Bharat Heavy Electrical Limited (BHEL), a Govt. of India Undertaking, invites proposals for engaging “**Proof Consultant**” for the Electrification of Railway Lines of the sections Birlanagar-Etawah, Bhandai - Udi and Farrukhabad - Shikohabad including Mainpuri - Etawah of North Central Railway 386 RKM/440 TKM.

It is not the intent to specify completely herein all details of the work; nevertheless, the consultant shall work in conformity with the contract and to the highest standard of engineering, design and workmanship.

## 2.0 DEFINITIONS

‘**Purchaser**’ means BHEL.

‘**Consultant**’ means Proof Consultant being appointed under this contract.

‘**Contractor**’ means other sub-contractors being engaged by the Purchaser for execution of this Railway Electrification Project.

‘**Authority**’ means Railway Authorities engaged for execution of project like RE-Lucknow, CORE-Allahabad, RDSO-Lucknow, RITES, Zonal Railway and Railway’s PMC etc.

## 3.0 PROJECT INFORMATION

The Electrification of Railway Lines of Birlanagar - Etawah section (Gr.239), Bhandai - Udi section (Gr.240) & Shikohabad - Farrukhabad and Etawah - Mainpuri section (Gr.241) of Jhansi, Agra & Allahabad Division of North Central Railway under RE Project, Lucknow Total 386 RKM/440 TKM.

### 3.1 CLIMATIC DATA:

<b>Temperature</b>	: Min 4°C, Max 65°C, Mean Temp 35°C (for OHE)
<b>Rainfall</b>	: Approx. 70cm Annually (Monsoon Rain: June to September and Casual Rain: December to January). Thunderstorms during Monsoon.
<b>Humidity</b>	: Maximum is nearly 60% to 80%.
<b>Wind Pressure</b>	: 155 kgf/sqm As per latest IS 875-1987

### 3.2 TRACKS TO BE WIRED:

a) The route and track length of the section to be equipped with overhead equipment are as under:

Type of OHE	Section	Railway Division	RKM	TKM
<b>Conventional OHE &amp; Tramway type OHE</b>	Birlanagar (Excl) - Etawah (Excl) section (Gr.239),	Jhansi, Division	115	128

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<b>with contact wire height 5.80m</b>	Bhandai (Excl) – Udi (Excl) section (Gr.240)	Agra Division	113	123
	Shikohabad (Excl) – Farrukhabad (Excl) and Etawah (Excl) - Mainpuri (Incl) section (Gr.241)	Allahabad Division	158	189

### 3.3 POWER SUPPLY:

Electric Power will be supplied to the Overhead Equipment (OHE) through 06 Traction Sub-Stations (TSS) located at Bhand, Malanpur, Bah, Fatehabad, Bhogaon & Safai (Traction Sub-Stations are to be equipped with Single Transformers at 3 locations and Double Transformers at 3 locations).

### 3.4 SWITCHING STATIONS, AUXILIARY TRANSFORMERS & MODIFICATION OF OVERHEAD LINES:

Tentative number of Switching Stations, Auxiliary Transformer and Overhead Line Modifications are as under:

Sl.No.	Description of Works	Unit	Qty.			Total
			Gr.239	Gr.240	Gr.241	
i.	Feeding Post/TSS	No.	2	2	2	6
ii.	Sectioning post (SP)	No.	3	3	4	10
iii.	Sub - sectioning post (SSP)	No.	7	7	7	21
iv.	Remote Control Centre: - All the switching station will be provided remotely controlled from the Remote Control Centre through SCADA	No.	JHS	AGRA	ALD	3
v.	Auxiliary transformers (5Kva, 10KVA, 25KVA) including cabling to Aux. loads	No.	5kVA (0), 10kVA(14), 25kVA (1)	5kVA (0), 10kVA(13), 25kVA (0)	5kVA (3), 10kVA(17), 25kVA (1)	49
vi.	Modification of HT & LT power lines a) 33KV Modification b) 11Kv Modification c) 440V Modification d) 230V Modification	Location	-	-	-	10 03 18 20

### 3.5 DETAILS OF SIGNAL AND TELECOMMUNICATION WORK

**Signaling:-** Trenching, laying of underground signaling cables/power cables, casting of foundations, supply of certain equipments/materials, erection of apparatus cases and fixing of equipment wiring, testing & commissioning in connection with RE modification at MACLS/PI/RR/IEI stations & LC Gates to suit 25kV AC Traction.

**Telecom:** Trenching, laying, backfilling, jointing, terminating and testing of 6 quad cable and PIJF cable etc., supply, installation, testing and commissioning of way station equipment, HQ control equipments, with power supply and emergency sockets etc., in SP, SSP, TSS & Station. Modification



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to existing PA system, supply, installation, testing and commissioning of STM and other associated equipments.

However, some main associated works pertaining to S&T in narrative form are as under:-

**A. Signalling:-**

Sl.No.	Description of Works	Unit	Qty.			Total
			Gr.239	Gr.240	Gr.241	
1.	Modification to Existing RRI/PI/MACLS/Provision of MACLS at semaphore Stations.	-	-	-	-	-
1.1.	EI/RRI Stations	No.	0	03	0	03
1.2.	PI Stations	No.	01	0	02	03
1.3.	MACLS Stations	No.	05	0	04	09
1.4.	Provision of MACLS at semaphore stations	No.	0	0	0	0
2.	Signaling Cable	Km.	147.5	73.5	103.5	324.5
3.	Modification of Existing MACLS mid-section interlocked LC gate	No.	0	0	0	0
	Provision of MACLS at semaphore LC gates	No.	0	0	03	03
4.	Track Circuit	No.	02	02	02	06
	Track modification	No.	70	52	84	206
5.	Handle type token less Block instrument Diado.	No.	0	0	0	0
	Modification of Token Instt. (NBT)	Pair	06	0	08	14
6.	Integrated Power Supply (IPS)	No.	06	0	07	13
7.	Single section digital axle counter	Set	0	04	0	04
8.	Earthing for signaling and apparatus cases etc.	No.	350	300	200	850
9.	Maintenance free earthing	No.	30	15	30	75
10.	Modification of Data Loggers	No.	01	0	02	03
11.	Electric point operating machine	No.	02	02	0	04
12.	Universal fail safe block interface equipment	Pair	0	04	0	04

**B. Telecommunications:-**

Sl.No.	Description of Works	Unit	Qty.			Total
			Gr.239	Gr.240	Gr.241	
1.	Optic Fiber Cable	Km	125	123	170	418
2.	6 Quad & PIJF Cable	Km	50	55	170	275
3.	C.T. Box 10 pair	Nos.	25	20	60	105
4.	C.T. Box 20 pair	Nos.	25	20	50	95
5.	Emergency socket box	Nos.	35	35	180	250
6.	4 way equipment	Nos.	30	25	35	90
7.	Earthing	Nos.	65	50	85	200
8.	V.F. Transformer	Nos.	60	60	250	370

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9.	Emergency control room equipment	Nos.	0	0	0	0
10.	DTMF head quarter equipment	Nos.	2	2	2	6

### 3.6 DETAILS OF CIVIL ENGINEERING WORK:

Sl.No.	Description of Works	Unit	Qty.			Total
			Gr.239	Gr.240	Gr.241	
1.	Route Kilometer (RKM)	RKM	115	113	158	386
2.	Steepest Gradient		1:100	1:100	1:100	
3.	Sharpest curvature		6°	6°	6°	
4.	<b>Bridges</b>					
4.1	Road Over Bridges	No.	-	-	-	-
4.2	Foot Over Bridges	No.	-	-	-	-
5.	Level Crossings	No.	27	20	22	70
6.	<b>Main Civil Works</b>					
6.1	Foundation for bridge Masts	No.	20	24	24	68
6.2	Height Gauges for level crossing	SET.	55	40	45	140
6.3	Protective screen for FOBs & ROBs	SET	02	0	12	14
6.4	Modification to platform shelters	Meter	231	0	200	431
6.5	Staff Quarters	No.	Type-II 10, Type-III-04, Type-IV-01	Type-II-10, Type-III-06, Type-IV-02	Type-II-16, Type-III-06, Type-IV-02	57
6.6	Permanent Way Siding	No.	01	01	01	03
7.	Electrical Structure	No.				
7.1	OHE & PSI Depot	No	02	02	01	05
7.2	OHE Depot	No	-	-	-	-
7.3	Sub-stations	No	02	02	02	06
7.4	SP/SSPs	No	10	10	10	30
7.5	Office for DEE/TrD. & AEE/TrD.	No	0	0	01	01
7.6	Modification to existing RC Centre	No	01	01	01	03
7.7	RCC Depot and RRD	No	-	-	-	-
7.8	DSK/RE Depot.	No	-	-	-	-
7.9	Tower Wagon Shed	No	02	02	01	05
8.	<b>S&amp;T Structures</b>					
8.1	TCI Office	No.	1	0	0	1
8.2	CSI Office	No.	1	0	0	1
8.3	ASTE Office	No.	0	0	0	0
8.4	Relay Room	No.	0	0	0	0
8.5	Equipment Room	No.	05	0	03	8
8.6	Battery Room	No.	0	0	3	3
8.7	Repeater Room	No.	2	0	1	3

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#### 4.0 SPECIFICATIONS AND STANDARDS

The Purchaser shall provide project specific drawing / documents for review by the consultant; however any standard RDSO/CORE/Railways drawings/guidelines/specification/manual required for review of the drawings / documents shall be arranged by the Consultant on his own risk and cost. The consultant shall not delay review of drawing / documents on-account of non-availability of any such standard documents with them.

#### 4.1 Construction

The Consultant shall comply with the Specifications and Standards as mentioned below for construction of the Railway Project. It includes verification and validation of system installed and independent certification for maintenance and operation system during its life cycle.

##### 4.1.1 For civil works:

- a. Indian Railways Permanent Way Manual
- b. Indian Railway Bridge Manual
- c. Indian Railway Schedule of Dimensions
- d. The relevant IRS Specifications referred to in the above documents listed at (a), (b) and (c)
- e. Specifications of Works of concerned zonal railway
- f. In case of any contradiction in the various codal provisions, the order of precedence shall be as follows:-
  - i. Provisions of this Specification.
  - ii. IRS Codal provisions
  - iii. IRC Codal provisions
  - iv. IS (BIS) Codal provisions

##### 4.1.2 For signalling and telecommunication works:

- a. Indian Railway Signal Engineering Manual for signalling; and
- b. Indian Railway Telecom Manual for telecommunication works.

##### 4.1.3 For electrification works:

- a. Indian Railways Manual AC Traction, Volume-II Part-I and Volume-II Part- II.
- b. Manual of Standards & Specification for Railway Electrification
- c. Indian Railways Schedule of Dimension

##### 4.1.4 Deviations from the Specifications and Standards

Notwithstanding anything to the contrary contained in above clause, the following Specifications and Standards shall apply to the Railway Project, and for purposes of this Agreement, the aforesaid Specifications and Standards shall be deemed to be amended to the extent set forth below: In case of new developments in designs, comments of Research Designs and Standards Organization (hereinafter called RDSO's) and decision of Authority to implement the same basic drawings /designs/employment schedules will be submitted by the contractor to the Authority. If the RDSO's drawings/ designs/employment schedule is not revised, Contractor need not submit drawings/ designs/ employment schedules to the Railway Electrification. In the event of Contractor suggesting any alteration/deviation in standard drawings, he shall submit the retraced drawings with full calculations and justification of the change to the Authority. The Authority if convinced of the need of the alteration shall approach RDSO for necessary approval. In case of any ambiguity in the interpretation of design and drawing, the decision of the Authority shall be final and conclusive. Any software developed for design will be provided to Authority for verification, validation and further use.

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#### 4.2 Design Standards

The Railway Project including Project Facilities shall conform to design requirements set out in the following documents:

Indian Railways Permanent Way Manual, Indian Railway Bridge Manual, Indian Railway Schedule of Dimensions & relevant IRS Specifications referred in the Manual, Indian Railway Signalling Engineering Manual, Indian Railway Telecom Manual, AC Traction Manual, Rules for Opening Railways

#### 4.3 Latest Version

Latest version of the Manuals, Specifications and Standards including the amendments notified/published by 31.10.2018 shall be considered applicable.

#### 4.4 Terms used in Manuals

The terms 'Inspector', 'AEE', 'DE' used in the Manuals shall be deemed to be substituted by the term "Authority's Engineer"; to the extent it is consistent with the provisions of the Agreement.

#### 4.5 Absence of specific provision

In the absence of any specific provision on any particular issue in the aforesaid Manuals, Specifications, or Standards, the following standards shall apply in order of priority

- i. Bureau of Indian Standards (BIS)
- ii. Euro Codes or British Standards or American Standards
- iii. Any other specifications/standards proposed by the Contractor and reviewed by the Authority's Engineer.

#### 4.6 Alternative Specifications and Standards

The requirements specified in the Manuals are the minimum. The Contractor shall, however, be free to adopt international practices, alternative specifications, materials and standards to bring in innovation in the design and construction provided they are better or comparable with the standards prescribed in the Manuals. The specifications and techniques which are not included in the Indian Railway Manuals/ RDSO specifications shall be supported with authentic specifications and standards specified in Cl.No.4.5 above. Such a proposal shall be submitted by the Contractor to the Authority. In case, the Authority is of the opinion that the proposal submitted by the Contractor is not in conformity with any of the international standards or codes, then he shall record his reasons and convey the same to the Contractor for compliance.

### 5.0 GENERAL CONDITIONS OF THIS SPECIFICATIONS

**5.1** All designs and drawings submitted by the contractor shall be reviewed by Proof Consultant based on a thorough study and shall be such that the consultant is satisfied about their suitability. The Purchaser/Authority approval will be based on these considerations, notwithstanding the approval communicated by the Purchaser/Authority, during the progress of the contract for designs and drawings, prototype samples of components, materials and equipment after inspection of materials, after erection and adjustments to installations, the ultimate responsibility for correct design rest with the consultant unless the Purchaser insists on adoption of his own designs in spite of the consultant not being agreeable to it.

**5.2** The consultant shall be responsible for and shall bear and pay the costs for any alteration/re-review of works arising from any discrepancies, errors or omissions in the designs and drawings reviewed by him, whether such designs and drawings have been approved by the Purchaser or not.

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- 5.3** The payment to the Consultant for review of drawings/documents shall be made only after approval of the drawings/documents by the Authority. The payment shall be as Price Format attached along with this specification.
- 5.4** The consultant shall be allowed to claim the payment for review of any drawing/document only once. There shall not be multiple payments for multiple revisions of any drawing/document. Payments shall be as per terms and conditions of NIT.
- 5.5** Process of Drawing/Document Approval
- All the drawings/documents required for construction of Railway Electrification Project shall be prepared by the contractor and shall be submitted to the purchaser for Review.
  - The Purchaser shall review the drawing/document and furnish its observations to the contractor on its own and through the consultant.
  - Upon receipt of the observations, the contractor will rectify the document and discuss with The Purchaser/Consultant, if required, through mutually suitable mode of communication and time.
  - The contractor will submit the documents to concerned Railway Authority and liaison for approval by the Railway Authority.
- 5.6** The Consultant shall extend all the necessary support to the contractor required for approval of drawings/documents by the Authority.
- 5.7** Time Schedule for Drawing review  
For any drawing, the consultant shall furnish his observations within 2 days from the date of submission of drawing/document by The Purchaser.
- 5.8** by submitting the Drawings reviewed by the consultant to the purchaser, the Consultant shall be deemed to have represented that it has determined and verified that the design and engineering, including field construction criteria related thereto, are in conformity with the Scope of the Project, Specifications and Standards, Applicable Laws and Good Industry Practice;
- 5.9** Within 15 (fifteen) days of the receipt of the Drawings, the Authority's Engineer shall review the same and convey its observations to the Contractor with particular reference to their conformity or otherwise with the Scope of the Project and the Specifications and Standards.
- 5.10** If the observations of the purchaser/consultant indicate that the Drawings are not in conformity with the Scope of the Project or the Specifications and Standards, such Drawings shall be revised by the Contractor in conformity with the project requirements and resubmitted to the purchaser for review.
- 5.11** In the event the Consultant fails to review any Drawing/document submitted by the purchaser, the purchaser may cause the payment for the affected works to be withheld under and in accordance with the provisions of this agreement. If the Contractor disputes any decision, direction or determination of the purchaser hereunder, the Dispute shall be resolved in accordance with mutually decided procedure;
- 5.12** No review and/or observation of the consultant and/or its failure to review and/or convey its observations on any Drawings shall relieve the consultant of its obligations and liabilities under this Agreement in any manner nor shall the purchaser or the Authority be liable for the same in any manner; and if errors, omissions, ambiguities, inconsistencies, inadequacies or other Defects are

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found in the Drawings/document, they shall, along with the affected Works, be corrected at the consultant cost, notwithstanding any review;

- 5.13** The Consultant warrants that its reviewers, including any third parties engaged by it, shall have the required experience and capability in accordance with Good Industry Practice and it shall indemnify the purchaser against any damage, expense, liability, loss or claim, which the purchaser/Authority might incur, sustain or be subject to arising from any breach of the Consultant's design review responsibility and/or warranty as set out in this Clause.
- 5.14** The contract period shall be 18(Eighteen) months from the date of commencement of work.
- 5.15** If, because of reasons attributable either to the Consultant and/or the purchaser and/or Force Majeure conditions, the scope of work, as defined elsewhere in the specification are not completed within the contract period, (as defined in clause no. 5.14 above), suitable extension of the contact completion time will be given in the manner prescribed in clause no. 2.11 of "General Conditions of the Contract. During such extended period of the contract, the consultant is bound to complete the balance works left out at the end of the original contract period.
- 5.16** The date of commencement of work shall be mutually agreed date between the Consultant and the Purchaser engineer to start the work. In case of discrepancy, the decision of the Purchaser engineer shall be final and binding.
- 5.17** The Consultant shall extend all the necessary support in case of any conflict due to design during actual erection/construction/installation of the works. In addition, shall review drawing/document immediately so that there is no hold up / delay in erection works.
- 5.18** The Consultant shall visit the Site/the Contractor/the Purchaser/the Authority, as required, in order to facilitate approval of the drawings/documents reviewed by the consultant and not agreeable to the later. However, the cost of travel, lodging, boarding and any other incidental charges shall not be paid separately.
- 5.19** The Consultant shall not have any conflict of interest. The Consultant also agree that any assignments completed at least three years prior to the appointment hereunder shall not be reckoned for the purposes of conflict of interest.
- 5.20** The Consultant shall neither enter into agreement with any of the contractors/sub-contractors/consultants (Including Safety Consultant) nor shall bid for any other consultancy services (Including Safety Consultancy) for this project appointed/being appointed by the Purchaser or its contractors for any designing and engineering related works of this project.  
*(The Consultant shall be required to give an undertaking that the consultant is neither engaged nor shall engage with any of the contractors/sub-contractors/consultants(including safety consultant) for this project appointed by the Purchaser or its contractors for any designing and engineering related works of this project before entering into agreement of this contract.)*

## **6.0 SCOPE OF WORK**

The Proof Consultant shall:

- a. evolve a systems approach with the Purchaser so as to minimize the time required for final designs and construction drawings; and

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- b. Proof check the detailed calculations, drawings and designs, which have been reviewed by the Purchaser.
- c. Ensure the type designs shall be as few as possible to cover the largest field of application consistent with economic consideration.

### 6.1 List of Drawings to be reviewed by Proof Consultant:

The list of drawings mentioned under this clause are minimum, any other drawing / document as required by Purchaser / Authority for Proof Checking is deemed to be included in Proof Consultants scope.

#### 6.1.1 Signal Engineering:

- a. Signal interlocking plan (station/auto huts/gate huts)
- b. Route Control table (station/auto huts/gate huts)
- c. Panel/ VDU diagram (station/ gate huts)
- d. Cable Core Chart
- e. Cable Route Plan (Separate for station & blocks sections)
- f. Power Supply Diagram (station/auto huts/ control)
- g. Equipment sizing (station/ auto huts/gate huts/control)
- h. Equipment lay out and details including cable troughs required(station/ auto huts/gate huts/control)
- i. Track circuit diagram (station/ auto huts/gate huts/control)
- j. Bonding plan (station/ auto huts/gate huts/control)
- k. Circuit Diagrams
- l. Station/Gate working Rule/Rule diagrams
- m. Equipment Rack details
- n. Cable Termination Rack Diagram
- o. Fuse Details
- p. Location/junction boxes lay out & wiring details
- q. Lightning, surge protection & earthing plan.

#### 6.1.2 Telecommunication Engineering:

- a. Location and connectivity of all equipment's and cables
- b. Schematic and wiring diagrams
- c. Cable core plan and numbering scheme
- d. Equipment mounting details
- e. Cable route drawings
- f. Layouts in equipment racks, in equipment rooms, trackside, and all other equipment locations
- g. Channelling plan.

#### 6.1.3 Electrical Engineering (Traction):

- a. General arrangement of the Traction substation for (25 KV) system single transformer and the double transformer with incoming as 220 KV or 132 KV 3 phase. (These substations will be remotely controlled and operated)
- b. General arrangement of SP (Sectioning Post) with the autotransformer. (These substations will be remotely controlled and operated)
- c. General arrangement of the SSP (Sub sectioning post) with the autotransformer. (These substations will be remotely controlled and operated)
- d. Power supply arrangement for (25 KV) AT system and sectioning drawing for the traction arrangement.

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- e. Power supply arrangement for the signals at the stations (Auxiliary transformer and the arrangement of 230 volt supply)
- f. Typical layout of the control room at the traction substation SP, SSP.
- g. Typical layout of the remote control centre.
- h. General arrangement of the implementation of the SCADA system.
- i. Earthing arrangement at the TSS, SP and SSP.
- j. Typical arrangement of the regulated OHE for (25 KV) system with the feeder arrangement.
- k. Power supply arrangement with IR at interface point.

**6.1.4 Electrical Engineer (General power supply):**

- a. General arrangement of the 11/33/66 KV substations for the station and the service buildings.
- b. General arrangement of the distribution of the 415 V 50 Hz supply to various loads

**6.1.5 Brief particular of tractions installations;**

- a. Power supply installation abstract;
- b. Traction maintenance depot abstract;
- c. Restricted overhead equipment clearance abstract; and
- d. Electrical crossing over railway track abstract

**6.1.6 Electrification Works (OHE):**

- a. Layout Plans (LOP)
- b. Cross Sectional Drawings (CSD)
- c. Structural Erection Drawings (SED)
- d. Section Drawings of OHE including study of over line Structures such as FOB, ROB etc. (Profile Diagrams)
- e. Calculations for Bridge Mast
- f. Other Design and Drawings including Small Parts Steel Work.
- g. Bonding Plans
- h. General arrangement, cross section drawing, and cable trench layouts for LT power supply transformers.
- i. Cable trench layout, cross section drawing for power cable crossing along / across the track.
- j. Prepare drawings for Anti-theft charging.
- k. Employment Schedules

**6.1.7 As Erected Drawings:**

After completion of the OHE erection works contractor shall prepare 'As erected drawings' as applicable for the entire stretch of 440Tkm of Railway Track.

***ANNEXURE-1: PRICE FORMAT***

– Refer Annexures

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**RECORD OF REVISIONS**

Rev. No.	Date	Revision Details	Revised By	Approved By
00	17.04.2019	Original Revision	-----	 J. K. Pattanaik