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**Subject: Technology Collaboration for Resin Impregnated Paper (RIP) Bushings**

**1) Introduction:**

This Expression of Interest (EoI) seeks response from Original Equipment Manufacturers (OEMs), who are willing to be associated with BHEL through a license & technology collaboration agreement on long term basis, to enable BHEL to design, engineer, manufacture, assemble, quality control, test, supply, install, erect, commission, repair, service and retrofit state of the art Resin Impregnated Paper (RIP) Bushings to meet market requirements.

1.1) Bharat Heavy Electricals Limited (BHEL) is a leading state owned company, wherein Government of India is holding 63.06% of its equity. BHEL is an integrated power plant equipment manufacturer and one of the largest engineering and manufacturing organization in India, catering to the core infrastructure sectors of Indian economy viz. energy, transportation, heavy engineering industry, defence, renewable and non-conventional energy. The energy sector covers generation, transmission and distribution equipment for hydro, thermal, nuclear and solar photo voltaic. BHEL has been in this business for more than 50 years and BHEL supplied equipment account for more than 57 % of the total thermal generating capacity in India. BHEL is also listed in stock exchanges of India. The company has 17 manufacturing units, 4 power sector regions, 8 service centers, 8 overseas offices and 15 regional offices besides host of project sites spread all over India and abroad. The annual turnover of BHEL for the year 2014-15 was **US\$ 5.04 Billion\***, with profit before tax of **US\$ 349 Million\***. BHEL's highly skilled and committed manpower of approximately **44900** employees, the state of art manufacturing facilities and latest technologies, has helped BHEL to deliver a consistent track record of performance. To position leading state owned companies as Global Industrial giant & as a recognition for their exemplary performance, Government of India categorized BHEL as "Maharatna Company" in 2013, empowering the company with enhanced autonomy in decision making. With the current order book exceeding **US \$ 16.1 Billion\***, BHEL is poised for excellent future growth. Our ongoing major technology tie-ups include agreements with GE, USA (for gas turbines); Siemens, Germany (for steam turbines, generators and condensers); Metso Automation Inc., Finland (for control & instrumentation); Alstom, France (for Super-Critical Boilers & pulverisers); MHI, Japan (for pumps); MHPS, Japan (for Flue Gas Desulfurization Systems); Vogt Power International, USA (for HRSG); GENP, Italy (for compressors); Turbo Lufttechnik, Germany (for fans) and Sheffield Forge masters International, UK (for forgings). More details about the entire range of BHEL's products and operations can be obtained by visiting our web site [www.bhel.com](http://www.bhel.com).

**1.2) About Heavy Electrical Plant (HEP), Bhopal unit of BHEL:**

The Heavy Electrical Plant (HEP) at Bhopal is one of the biggest & oldest units of BHEL which started operations in the year 1960. It is located in the capital city Bhopal of central state of Madhya Pradesh, India. The unit manufactures a wide range of electrical products like switchgears, traction & industrial controls, transformers, capacitors, bushings, rectifiers & power electronics, heat exchangers, thermal sets for power & industrial applications, DG sets, hydro turbines & generators, traction machines, industrial machines etc.

Transformer is one of the major product of this unit. The manufacturing range of transformers includes Generator Transformers upto rating of 765kV/400MVA, Inter-connecting Transformers upto rating of 765kV/500MVA, HVDC Converter Transformers upto rating of 800kV/500MVA, Shunt reactors upto rating of 765kV/125MVA and other special transformers like phase-shifting transformers, controlled shunt reactors etc.

[\*Note: Currency conversion rate considered: 1 US \$=Rs 62.59 as on 31<sup>st</sup> March 2015]

The total installed capacity at Bhopal is 30000MVA/annum. Besides Bhopal unit, another unit at Jhansi, Uttar Pradesh also manufactures smaller rating transformers and is having the installed capacity of 15000MVA/annum. The total bushing requirements of these two plants are partly addressed through manufacturing facility at Bhopal.

### 1.3) Experience of HEP, Bhopal in Bushings:

HEP, Bhopal started manufacturing of Bushings in 1962. The manufacturing range of OIP bushings includes; Oil-to-air, bushings of rating 52 kV to 525 kV /3150 Amps, Air-to-air, wall bushings upto rating of 300kV/2000A. Bushings for miscellaneous applications such as roof bushings, T.G. bushings etc. are also being manufactured to suit various customer requirements. The installed capacity of OIP bushings is 2000 Nos per annum of all ratings. HEP Bhopal has supplied more than 40000 bushings of various rating till date which are in service.

### 1.4) Market in India:

In India, Central utilities i.e. POWERGRID & NTPC Ltd. have recently graduated to Resin Impregnated Paper (RIP) Bushings for all their future requirement from 52 KV to 765 KV Bushings. The present annual average demand from these two Central Transmission and Generation utilities is around 1000 Nos. which translate to US\$ 20 Million (52 KV TO 400 KV voltage class).

As per the industry estimates, India manufactures about 900-950 Nos. of Power Transformers & Shunt Reactors of different voltage class and MVA ratings per year. It is expected that other Indian state utilities would also gradually move towards adoption of RIP Bushings. The future business of RIP Bushings would depend upon level of adoption by other utilities and can be in the range of US\$ 62-65 Million per Annum.

- 1.5) In order to address upcoming market requirements and upgrade to the state of art technology for RIP Bushings, BHEL intends to enter into a Technology Collaboration Agreement (TCA) with a leading Original Equipment Manufacturer (OEM).

### 2) Scope of cooperation :

BHEL seeks a partner for entering into a TCA for state of the art & proven RIP Bushings in the voltage class of 52kV to 765 kV having current rating upto 3150 A. The TCA shall enable BHEL to design, engineer, manufacture, assemble, quality control, test, supply, install, erect, commission, repair, service and retrofit of RIP Bushings. The detailed terms and conditions for such a paid-up license agreement shall be mutually agreed upon. The duration of the TCA shall be around 10 years. Indicative scope of technology transfer for RIP Bushings is given in Annexure-1.

The RIP Bushings being proposed under the TCA should be type tested successfully at reputed and internationally test laboratories as per latest revision of IEC 60137.

**Business sharing option**, during the initial period of technology assimilation by BHEL can also be considered.

3) **Prequalification requirements (PQR):**

The Prospective Collaborator shall meet the following conditions as on the date of submission of Eoi:

- 3.1. Prospective Collaborator should have at least 5 years of experience in design, engineering, manufacturing and supply of state of the art RIP Bushings. (To be substantiated by a documentary evidence.)
- 3.2. The Prospective Collaborator should have designed, engineered, manufactured, type tested and supplied at least 100 nos. of RIP Bushings and out of which at-least 25 nos. should be of 400 kV or above ratings, which should have completed 2 years of satisfactory operation as on the date of closing of this Eoi. The reference projects/list may be furnished as detailed in Annexure-4. (To be substantiated by end user certificate(s) for supply of minimum 25 nos. of RIP Bushings of 400 kV or above ratings only.)

4) **Brief Description of Eoi Process:**

The interested prospective collaborators shall ensure that their response along with annexures is received by BHEL on or before **December 19, 2015**. The response shall necessarily be accompanied with details on company background, technical features/product catalogue, information on market share, reference list as per Annexure-4 and annual audited financial reports for last 3 (three) years including auditor's report.

In case any further information is needed, kindly feel free to contact us.

The respondent shall submit their offer with all annexures duly signed.

**Your response may be sent to the following address:**

General Manager

Technology Licensing & Joint Ventures

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India

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Annexure-1

Indicative Scope of Technology Transfer

a)	Licensing & transfer of state of the art technology relating to the design, engineer, manufacture, assemble, quality control, test, supply, install, erect, commission, repair, operate and retrofit of the RIP Bushings
b)	Transfer of improvements/modifications/developments/up gradations carried out by the Prospective Collaborator over the duration of the technology transfer for taking care of new market requirements and obsolescence.
c)	Transfer of information to enable BHEL to source/procure those items, which the Prospective Collaborator sources from outside (as these are not manufactured by the Prospective Collaborator) for use in the RIP Bushings.
d)	Transfer of site feedback and troubleshooting information
e)	Transfer of applicable computer programs including logics and source code if any
f)	Support through engineering services from Prospective Collaborator's design office / manufacturing facilities for licensed products
g)	Deputation of Prospective Collaborator's experts to assist BHEL in absorbing the technology for licensed products
h)	Training of BHEL engineers in the design, engineer, manufacture, assembly, quality control/quality assurance, testing, installation, erection, commissioning, maintenance & operation of the above RIP Bushings

(SIGNATURE)

Annexure -2

OEM's Confirmation

Sl. No.	Requirement	OEM's response YES/NO and remarks if any
(a)	Whether the prospective collaborator is an Original Equipment Manufacturer (OEM) of RIP Bushings	
(b)	Whether the prospective collaborator agrees for technology transfer as per scope given in Annexure-1	
(c)	Whether the OEM is meeting Prequalification requirements (PQR) mentioned against Clause-3 of this Eoi.	
(d)	Whether customers (end users) letters / documentary evidence for satisfactory operation of RIP Bushings have been enclosed in support of meeting PQR as mentioned in clause 3 of this Eoi.	
(e)	Whether the prospective collaborator's RIP Bushings meet the minimum technical requirements specified in Annexure-3	
(f)	Whether the prospective collaborator's RIP Bushings are successfully type tested for ratings mentioned in Annexure-3 as per latest IEC 60137.	
(g)	Whether details of company background, product catalogues have been enclosed	
(h)	Whether information on market share has been enclosed	
(i)	Whether OEM's detailed reference list has been enclosed	
(j)	Whether OEM's annual audited financial reports for last 3 years have been enclosed	
(k)	Whether a summary of experience & reference as per Annexure-4 has been enclosed	
(l)	Whether the RIP Bushings offered for technology transfer is the latest being marketed by the OEM	
(m)	Whether the prospective collaborator owns the IPRs for the technology being proposed for transfer under the Technology Collaboration Agreement (TCA) or have unencumbered right from the owner of the IPRs to sub-license the technology, if applicable. If yes, list of such IPRs to be enclosed.	

(SIGNATURE)

**Annexure -3**

**General technical specifications of RIP Condenser Bushings proposed for TCA**

Parameters	52 / 72.5 kV	145 / 170 kV	245kV	420kV	765 kV
Rated voltage	52/ 72.5 kV	145/ 170 kV	245 kV	420 kV	765 kV
Rated Current	1250 A to 3150 A	1250 to 3150 A	1250 to 3150 A	1250 to 3150 A	1250 to 2500 A
Creepage	25-35 mm/kV	25-35 mm/kV	25-35 mm/kV	25-35 mm/kV	25-35 mm/kV
Tan delta (max.)	0.4%	0.4 %	0.4 %	0.4 %	0.4 %
Max. PD level	10 pC max.	10 pC max.	10 pC max.	10 pC max.	10 pC max.
Test tap withstand voltage	2 kV rms	2 kV rms	2 kV rms	2 kV rms	2 kV rms
Bushings to comply with	IEC 60137:2008	IEC 60137:2008	IEC 60137:2008	IEC 60137:2008	IEC 60137:2008
CT space	100- 600 mm	100- 600 mm	100-600 mm	Min.400 mm	Min.400 mm
Type of connection	<b>Option-1:</b> Bottom Palm type <b>Option-2:</b> Draw Rod type with half connector at Flange level	<b>Option-1:</b> Bottom Palm type <b>Option-2:</b> Draw Rod type with half connector at Flange level	<b>Option-1:</b> Bottom Palm type <b>Option-2:</b> Draw Rod type with half connector at Flange level	<b>Option-1:</b> Bottom Palm type <b>Option-2:</b> Draw Rod type with half connector at Flange level	Bottom Palm type

Note:

1. The detailed technical specification shall be finalized during discussion stage.
2. There shall be provision of other ratings and parameters within the voltage range of RIP Bushings in the TCA.

(SIGNATURE)

**Annexure -4**

**Reference List:** The OEM shall furnish a summary of their product reference/particularly RIP Bushings meeting PQR as detailed below for major supplies in last 5 years

Sl. No.	RIP Bushings Rating	Contract No. & Date	Number of RIP Bushings	Customer Details			Year Of Delivery	Year of commissioning
				Name	Category - End User/ Equipment supplier	Site Location		
1.								
2.								
3.								
4.								

(SIGNATURE)