NOTICE INVITING EXPRESSION OF INTEREST FOR TECHNICAL CONSULTANCY FOR DESIGN STANDARDISATION AND DEVELOPMENT OF DRAWOUT TYPE 415V LOW VOLTAGE SWITCHGEAR PANEL

EOI REFERENCE NUMBER BHEL-EPD/CPBG/EOI/2015-16/01, REV 00

BHARAT HEAVY ELECTRICALS LIMITED, ELECTRO PORCELAINS DIVISION, BENGALURU-12

Subject: CONSULTANCY FOR DESIGN STANDARDISATION & DEVELOPMENT OF DRAWOUT TYPE 415V LOW VOLTAGE SWITCHGEAR PANELS WITH DRAWOUT MECHANISM.

1) Introduction:

This Expression of Interest (EOI) seeks response from person /entity, who are willing to be associated with BHEL-EPD, Bangalore to provide consultancy services and enable BHEL to Design, process engineer, Manufacture, quality control, product test and supply LV Switchgear panels with draw out mechanism.

1.1) Bharat Heavy Electricals Limited (BHEL) is a leading government 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.

At present, BHEL manufactures LV switchgear panels at Electro Porcelains Division (EPD) Bangalore for applications in Power plants, Industry sector and Transmission sector. The range includes fixed type panels and integration of Draw-out panels of different designs and constructions. For the year 2014-15 the business volumes for LV Switchgear panels was Rs.128Crs. and is poised to increase in the years to come to meet the growing needs of Indian power sector. BHEL intends to standardize and optimize the draw-out type of LV switchgear design and hence calls for this EOI.

STRATEGIC BUSINESS UNIT for ceramic products and systems of BHEL works under the banner of Ceramic Business Unit (CBU). CBU is dedicated to the enhancement of business in ceramics and its associated systems. This business unit manufactures High tension Insulators, ceramic wear resistant liners, Industrial ceramic products, LT Switchgear panels, composite insulators and associated systems. CBU has its headquarters at Bengaluru, Karnataka, India. At present, BHEL manufactures Porcelain Disc Insulators at two of its manufacturing facilities with "State of Art" technology for Porcelain products and systems at:

Electroporcelain Division (EPD), Bengaluru, Karnataka, India
Insulator Plant (IP), Jagdishpur, Uttar Pradesh, India

Both the units of CBU have well established manufacturing systems and procedures and have requisite skilled and experienced manpower. The Units are certified for the Quality Management System against ISO-9001:2008 and Health, Safety & Environmental Management (HSE) System for ISO-14001:2004 & OHSAS-18001:2007. The financial turnover of CBU for the year 2014-15 was US$ 68 Million and poised to grow further in the years to come. The products of CBU are tested and certified with respect to relevant National & Inter-National standards at reputed laboratories within the country and abroad. The CBU is the major supplier of Insulators to all the power transmission utilities, railways and power equipment manufacturers in the country.

The operations of CBU are supported by Ceramic Technological Institute (CTI), Bengaluru a wing of BHEL R & D arm. CTI was established in 1983 with the aid of UNDP and is working on advanced Research and Development in Ceramics and allied fields.

1.2) About CBU Manufacturing Plants

EPD, Bengaluru: Electro porcelains Division, Bengaluru is one of the oldest and leading manufacturer of Porcelain Insulators for High Tension Power Transmission and Distribution in India. The unit was established in the year 1932 for manufacturing of Porcelain Insulators for Transmission lines. During 1960's and 1980s, the unit had Technology Tie-up with M/s NGK, Japan for manufacturing of higher rating Porcelain Disc Insulators and Hollow Insulators for instrument Transformers & Bushings.

EPD manufacturers full range of insulators for both AC & DC transmission upto 765kV HVAC & ±800 kV HVDC rating. EPD, Bengaluru makes BHEL the only company in the country offering DC transmission insulators upto 420 kN rating for ±800 kV HVDC lines. Further, over the period of time, EPD, Bengaluru has developed in-house, manufactured and supplied Composite Long Rod (CLR) Insulators to major utilities of the country ranging upto 210 kN EMS rating for 400 kV AC Transmission Lines. Recently, CLR's for 765 AC application has been developed and type tested.

In addition to Transmission Line insulators, EPD, Bengaluru also manufactures Hollow Porcelain Insulators for Instrument Transformers & Bushings upto 765 kV rating.

The plant located in Bengaluru city has a total area of 156,000 sq. meters and is easily accessible to National Highways, Rail Road and Airport. The plant has well established built in factory building of about 100,000 sq meters and state of the art industrial infrastructure for manufacture of diverse products enumerated above. Basic utilities like electrical power are from local utility at 11kV with in-house backup generators. Environment friendly Natural Gas is sourced from Dabhol-Bengaluru pipe line for the fuel needs of manufacturing operations.

1.3) IP Jagdishpur:

BHEL Insulator Plant, Jagdishpur is the leading manufacturer of High Tension Porcelain Insulators in India. Established on in the year 1984 with technological tie-up of M/s NGK, Japan, IP Jagdishpur is serving major transmission utilities in the country with Disc Insulators up to 320 kN EMS for transmission lines up to 765 kV HVAC. IP, Jagdishpur also caters Porcelain hollow insulators upto 66 kV and bus bar support upto 24 kV system. Ceramic Liners (Ceralin) for wear resistant applications is another major product of IP, Jagdishpur.

BHEL Insulator Plant, Jagdishpur is spread in about 495,000 sq. meters area, located in Amethi District of Uttar Pradesh, 80 Kms away from Lucknow on Lucknow-Varanasi National high-way and is well connected by railroad and air as well. The plant has well established industrial building and modern infrastructure for manufacture of its products detailed above.

Power is sourced from local state utility at 11kv with in-house backup generation facility and fuel is environment friendly Natural Gas sourced through Hazira–Bijapur–Jagdishpur (HBJ) gas pipeline.

1.4) Experience of BHEL in Control Panel Business :

BHEL has well established manufacturing facility in all the sectors of power generation viz., Thermal, Hydro, Nuclear and Renewables to cater to the upcoming requirements of power generation equipment. LV Switchgear panels forms one of the critical item for the power plants and auxiliaries. EPD is manufacturing LV Switchgear panels for such requirements in the last 5 years and has supplied to various power plants which are being executed by BHEL.

BHEL envisage good potential for LV switchgear panels required for the application areas mentioned above in the Indian Market over the years to come. The ambitious plan drawn by the Govt. of India for power generation capacity in the country from both conventional and renewable sources for 13th plan period i.e., 2017-22 and beyond is given below:

101745 MW in 13th Plan (2017-2022)
222103 MW in 14th Plan (2022-2027)
257153 MW in 15th Plan (2027-2032)

BHEL EPD which is manufacturing these LV switchgear panels is working in close coordination with the central project management group and various sister units to meet the overall system requirement of power plants. BHEL EPD will be the single point source for LV switchgear needs, and is planning to enhance the manufacturing capacity & capability and standardize the design for optimizing the needs.

2) Scope of consultancy :

In order to meet upcoming market requirements and to upgrade to state of the art technology for LV Switchgear panel, BHEL intends to avail the services of a consultant with suitable experience in field of design, manufacturing and testing of draw out LV switchgear panel. The consultant shall enable BHEL to design, Prepare drawings, Identification of sources for procurement of new/special components & establishment of standard systems / procedures for Manufacture of Draw out Type LV switchgear panels. The design developed shall be acceptable to BHEL & be in line with the requirement indicated in the annexure-4. The indicative requirement for the consultancy services are described below:

- Design of LV Switchgear panels of ratings from 630 Amps to 5000 Amps for different types conforming to “Form 3b & 4b as per IEC 60439-1”.
- Provide guidance for preparation of Drawings – Switchgear assembly, sub assembly, Parts, Design Plan.
- Provide guidance for preparation of Bill of Material – Total BOM, sub assembly level BOM, Part level BOM.
- Identification of sources for Proto - type samples.
- Assist in integration of the Proto - type samples in BHEL.
- Assist for Design verifications / approvals.
- Assist for Type testing of Proto-type samples both in-house and in external laboratories.

- Assistance for obtaining design / product approvals from clients.
- Provide guidance for preparation of Design & Product Documentation.
- Provide guidance for establishment of Shop Systems & Procedures and its implementation for quality & operation management.
- Assist in preparation of Product O & M Manuals.
- Technical support for routine product inspection, testing and resolution of internal and customer non-compliances.
- Provide assistance and guidance on issues related to installation, commissioning & maintenance during operation.
- Transfer of technical knowledge and knowhow on the state of the art technology for LV Switchgear panel to BHEL personnel.

The detailed requirements for the above is given in Annexure - 4

3) Prequalification requirements (PQR) :

The Prospective Consultant shall meet the following conditions as on the date of submission of EOI:

3.1) The prospective consultant shall have the experience and credentials for the "Scope of Consultancy" as defined above. The experience could be in the form of being part of design & manufacturing of Draw out type LV Switchgear panel or providing consultancy as per the scope. The prospective consultant shall have a minimum of 10 years of relevant experience as sought above, further the prospective consultant shall have the experience for executing whole project of providing Draw out type LT Switchgear panel for a minimum of 3 major infrastructural projects in the field of Power Plants, Steel, Petrochemical or other such industries wherein the credential quoted shall match the requirements & scope sought through this EOI.

3.2) The consultancy inputs provided shall not be proprietary of any third person and shall not be attributed or of rights conferred to any individual or an organization through patents, copyrights or other intellectual property rights. The consultant shall indemnify and hold BHEL harmless for any losses, damages or claims that BHEL may suffer due to any breach of infringement of proprietary rights due to the use of inputs from consultant by BHEL. In such an event, the consultant shall be solely responsible and liable for the consequences and shall defend BHEL by initiating suitable remedial actions.

Brief Description of EOI Process:

The interested prospective consultant shall ensure that their response along with annexures is received by BHEL on or before 2.30pm **4th Feb-2016** The response shall necessarily be accompanied with details on company/individual background, detailed credential on the experience of Draw out type LV Switchgear Panels, Technical features/product catalogue, reference list as per Annexure-4 and annual audited financial reports for last 3 (three) years including auditor's report for an organization or income tax returns for last 3 years for an individual.

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

The respondent shall submit their offer with all annexures duly signed in two part sealed bid where in Technical bid with unpriced format & price bid shall be separated with each other. The cover shall be super-scribed with Reference number **BHEL-EPD/CPBG/EOI/2015-16/01, REV 00 and the words "EXPRESSION OF INTEREST FOR TECHNICAL CONSULTANCY FOR STANDARDISING & DEVELOPMENT OF DRAWOUT TYPE 415V LOW VOLTAGE SWITCHGEAR PANEL" (**herein called as LV Switchgear) the documents as above should be submitted in a sealed envelope and should bear the name address and telephone number of the Applicant.

Your response may be sent to the following address:

Dy. General Manager - CPBG
Bharat Heavy Electricals Limited
Electroporcelains Division, IISc Post
Bengaluru - 560012
India
Phone: +91 80 22182427/08022182446/08022182458
Email: eoilvsgtech@bhelepd.com

The consultant found technically qualified and selected based on overall L1 method would be issued an Order regarding their appointment as consultant with detailed terms and conditions which would be fully binding on the consultant.

4) Schedule of Events:

Pre-bid Meeting: 18thJanuary 2016
Technical Bid Opening: 4th Feb 2016
Price Bid Opening: will be informed after techno Commercial Evaluation

5) General Conditions:

5.1 The Applicant for EOI may be (i) a single entity; or (ii) a Group of Entities **("GOE")** coming together to meet the scope of the EOI. The GOE shall elect one of their members as the lead member of the GOE. The term Applicant used herein would apply to both a single entity and the GOE. The consultancy agreement would be entered into with the single entity applicant or the lead member of the GOE. The copy of agreement between participants of GOE shall be furnished to BHEL and it should be valid for at least the period mentioned in the agreement of EOI. The lead member of the GOE would be responsible to BHEL for the entire scope of work and shall ensure back to back tie ups with other members of the GOE.

5.2 An Applicant shall not have a conflict of interest that affects the EOI Process. Any Applicant found to have a conflict of interest shall be disqualified. An Applicant shall be deemed to have a conflict of interest if a constituent of such Applicant is also a constituent of another Applicant.

6.1 Right to accept or reject any or all Applications:

6.1.1 Notwithstanding anything contained in this EOI, BHEL reserves the right to accept or reject any Application and to annul the EOI Process and reject all Applications at any time without any liability or any obligation for such acceptance, rejection or annulment and without assigning any reasons therefore. In the event that BHEL rejects or annuls all the Applications, it may, at its discretion, invite all eligible consultants to submit fresh Applications.

6.1.2 BHEL reserves the right to reject any Applicant during or after completion of EOI process, if it is found there was a material misrepresentation by any such Applicant or the Applicant fails to provide, within the specified time, supplemental information sought by BHEL.

6.1.3 BHEL reserves the right to verify all statements, information and documents submitted by the Applicant in response to the EOI. Any such verification or lack of such verification by BHEL shall not relieve the Applicant of his obligations or liabilities hereunder nor will it affect any rights of BHEL.

6.2 Governing Laws & Jurisdiction

The EOI process shall be governed by, and construed in accordance with, the laws of India and any dispute arising hereof would be decided in an arbitration by a sole arbitrator appointed by the parties out of BHEL panel of arbitrators. The Courts at Bengaluru (India) shall have exclusive jurisdiction over any matter, pursuant to and/ or in connection with the EOI process

Annexure -1

Consultancy Experience in the field of Drawout Type LV Switchgear Panel

Sl. No.	Requirement	Consultant response YES/NO and remarks if any
(a)	Whether documentary evidence in support of PQR "prospective consultant shall have a minimum of 10 years of relevant experience as sought above, further the prospective consultant shall have the experience for executing whole project of providing LT Switchgear for a minimum of 3 major infrastructural projects in the field of Power Plants, Steel, Petrochemical or other such industries wherein the credential quoted shall match the requirements & scope sought through this EOI"	
(b)	Whether details of company/individual background, product catalogues & certifications have been enclosed	
(c)	Whether detailed reference list have been enclosed	
(d)	Whether annual audited financial reports for last 3 years have been enclosed or income tax returns for last 3 years for an individual	
(e)	Whether a summary of experience & reference as per Annexure-3 have been enclosed	
(f)	Whether customers (end users) letters / documentary evidence for satisfactory operation of LV Switchgear Panel have been enclosed.	

(SIGNATURE)

Annexure -2

Essential technical features of 415V LV Switchgear

1. LV Switchgear – Drawout type

Sl. No	Technical Feature	Yes or No	Remarks if any
1	Design procedure suitable to rated operating voltages Min. 380V to Max. 690V		
2	Design procedure suitable to rated operating frequencies Min. 50Hz to Max. 60Hz		
3	Design procedure for Rated Current: from 250A to 5000A		
4	Design procedure to suit Ambient Temp.: 50Deg.		
5	Design procedure to withstand a min. of 65KA RMS short circuit for 1sec with Momentary peak of 143KA.		
6	Design procedure which satisfies the temperature rise requirements of relevant standards of the horizontal and vertical bus bars and main bus links including all power draw out contacts. Minimal requirement when carrying 90% of the rated current along the full run shall in no case exceed 55deg C with silver plated joints and 35 deg C with all other types of joints over an outside ambient temperature of 50 deg C. The temperature rise of the accessible parts/external enclosures expected to be touched in normal operation shall not exceed 20deg. C. over ambient. The temperature rise of manual operating means shall not exceed 10deg. C for metallic & 15 deg. C for insulating material over ambient. Temperature rise for the bus bars shall be carried out at 90% of the rated current.		
7	Design procedure the product to successfully perform the type tests as specified • Ist stage - As per IEC 60439 within 12 months from date of entering into agreement with BHEL • IInd stage- As per IEC 61439 within 18 months from date of entering into agreement with BHEL		
8	Design procedure for standard Bus Bar Support Drawings preparation		
9	Design procedure for standard fabrication drawings preparation		
10	Design procedure for standard Horizontal bus bar chamber drawings preparation		
11	Design procedure for standard vertical bus bar chamber drawings preparation		

12	Design procedure for drawing preparation of male & female draw-out power & control contacts for all possible ratings in 3P & 4P on single mould.		
13	Design procedure to check the alignment of draw out contacts		
14	Design procedure for standard documentation and process flow charts for manufacturing.		
15	Design procedure for standard documentation and process flow charts for In-process quality checks & final product Quality inspection.		
16	Design procedure for both welded or bolted panel construction		
17	The construction shall be suitable for IP 54 up to 1600A and IP 42 above 1600A		
18	Design procedure for both Copper and Aluminium bus-bar panels		
19	Design procedure for Form III b & Form IV b Type 7 for cable separation		
20	Develop standard document for bus bar sizing		
21	Design procedure for standard drawings for fabrication of trolley/Modules for various sizes.		
22	Design procedure for Two-tier breaker arrangement system up to 1000A.		
23	Consultant developed Design shall conform to attached Spec. EP-4-TS-ENC-001 Rev 00		
24	Design procedure for Cable alley to accommodate flexible width from 250mm to 300mm		
25	Design procedure standard procedure available to check alignment of power and control contacts.		
26	Design procedure for indication for Service, Test and Isolate positions.		
27	Design procedure for packing, handling during loading and un-loading, transportation methods and storage at site of final product		

(SIGNATURE)

Annexure -3

Reference List: The consultant shall furnish a summary of their competency reference as detailed below for major supplies in last 10 years

Sl. No	Project name / location	Capacity	Year of supply	Year of Commissioning

(SIGNATURE)

Annexure -4

INDICATIVE TECHNICAL SPECIFICATION FOR ENCLOSURE WITH FORM III & IV B TYPES

A. GENERAL FEATURES & CONSTRUCTIONAL DETAILS

1. Enclosure shall be of single & double front draw out floor mounting modular bolted/Welded.
2. The bus bar shall be well supported with non- hygroscopic anti tracking non inflammable high dielectric strength insulating material (SMC/ DMC/ FRP) capable of withstanding high dynamic stresses. Hylam sheet or SRBP support are not acceptable. Only moulded support shall be used.
3. The Enclosure should be designed such that the Main bus-bars is easily approachable.
4. The Enclosure should be designed such that ample working space shall be provided.
5. The cable alley shall be provided adjacent to the module portion and shall have front access. The cable alley shall have doors with concealed hinges and screws/ half turn cams for locking. The screw head shall be slotted or with moulded metal knobs.
6. For each vertical section, separate vertical bus bar compartment shall be provided. Providing common vertical bus bar compartment for two adjacent vertical sections is not acceptable.
7. In the case of double front design, separate vertical bus bar shall be provided for each front. Providing common vertical bus bar compartment for both fronts is not acceptable.
8. In the case of single front design, the rear side shall be provided with removable cover. The cover shall be provided with slotted head screws.
9. The Panel should be provided with the lifting angle throughout the length of panel which shall bear entire weight of the panel.
10. The sheet steel used for Enclosure should be of minimum (2mm) 14 swg CRCA except that the doors and covers may be of (1.6mm) 16 swg CRCA.Stiffeners' should be provided wherever necessary. The gland plate thickness should be at least 3.0 mm for hot / cold-rolled sheet steel and 4.0 mm for non-magnetic material. The Enclosure shall be of dust and vermin proof. All cut-outs should be provided with synthetic rubber gaskets.
11. The Enclosure should be designed such that minimum clearance between phase to phase and phase 25.4mm and phase to Neutral/earth is 19 mm.
12. The Enclosure height shall not be more than 2450 mm
13. The Enclosure should be having separate horizontal chamber separated by perforated sheet for all auxiliary power and control bus. Vertical cable alley covering entire height and min. 250mm and shall have hinged door.
14. The Enclosure shall be designed such that the adjacent switchgear cubicles shall be provided with side sheets on either side to ensure complete isolation. The Enclosure shall be easily extendable on both sides by the addition of vertical sections
16. The bottom of the Enclosure shall be fully covered by sheet steel with opening for fixing gland plates.
17. Removable gland plates shall be provided with power and control cables. The gland plates shall be 3mm thick for all multi core cables. The gland plate for single core cables shall be 4mm non-magnetic material. The gland plate shall be provided with a rubber gasket of at least 4.0 mm.
18. Each panel should be provided with the following

a) Horizontal chamber at top accommodating power & control buses.
b) Vertical bus bar (droppers) to feed functional units.
c) Vertical cable alley to permit cable entry to each compartment for MCC with cable supporting provisions.
d) Possibility of extension on either end of MCCs including BUSBAR extensions.
e) Removable lifting facilities, for each transport unit.

19. Each panel should be fully separated from the adjacent panels by sheet steel partition except for the openings in the horizontal chambers at top and bottom to enable buses and cables/wires to pass through.
20. Panel should be of double front design. All components should be accessible from the front. All wiring shall be from the front.
21. The top and bottom horizontal chambers housing bus bars etc. should be provided with separate, properly secured, removable covers at the front and at the top.
22. Feeder & cable alley doors shall be designed such that ample working space is available.
23. Gaskets should be provided for all doors and covers and for all partitions between adjacent units.
24. Sheet steel surfaces provided should be free from dents and hammer marks. All opening and cut-outs shall be machine made and shall be free from burrs.
25. At least two concealed hinges shall be provided for each module door.

B. Form IVB TYPE 7 REQUIREMENTS:
(For enclosures where there is no requirement of Form IV design this clause will not be applicable)

Additional requirements of MCCs with Form 4b as per IEC 60439 part-I are as under:
1. Separation of Bus bars from all functional units.
2. Separation of all functional units from one another.
3. Separation of Terminals for external conductor associated with a functional unit from those of any other functional units and Bus bars.
4. Outgoing terminals shall not be in the same compartment as associated functional units.
5. It shall be possible to make the cable connections to any module while the other modules are live. In all such cases there shall be a positive interlock to ensure that the module which is being cabled has switch in the off position.In other words it shall not be possible to cable any module while its switch is 'ON' position.
6. There shall be a mechanism to ensure that it shall not be possible to switch onthe module after termination of the cables without covering the terminals.

C. Bus bars

1. The bus bars in LT switchgear panel shall be of Aluminum alloy 63401WP (E91E) as per IS: 5082. Make shall be Hindalco/Jindal.
2. The bus bars shall be provided with close fitting heat shrunk PVC sleeves Red/Yellow/Blue color corresponding to RYB phases. The Neutral bus bar shall be provided with Black colored sleeve. The horizontal bus bars shall have uniform cross section throughout the length of PMCC/MCC. The practice of providing different cross section of bus bars for ACB Panel and MCC panel in the same PMCC is not acceptable. Vertical bus bars of all verticals shall have same cross section.
3. The horizontal bus bars shall run on the top side of the PMCC and shall be fully accessible after opening the bus bar chamber cover from the front and the rear side.
4. The horizontal bus bars shall also be accessible from the top after removing the top plate for periodic maintenance.
5. The practice of running horizontal bus bars behind the vertical bus bars is not acceptable.
6. The horizontal bus bars shall be adequately braced and supported on SMC supports to withstand the stresses arising out of full system fault current as specified for a period of 1 sec.
7. It is preferable that the horizontal bus bars are supported on the SMC supports without being bolted to the supports. The bus bars shall not be drilled for any purpose other than for making Fish plate joints or vertical top offs. The entire tap offs & Fish plate joints (where the sleeves are removed for making the connections) are covered by clip on type epoxy/SMC shrouds.

8. These joints shall be accessible from the front after opening the front/rear cover, when the PMCC is fully cabled with external power & control cables and in service for routine maintenance.
9. The horizontal bus bar chamber shall be fully separated from the module space. There shall not be any access from the module space to horizontal bus bars when the draw out module of the top most compartments has been taken out for maintenance.
10. The vertical bus bars shall run behind the module compartments, the vertical bus bar space will be fully separated from the cable alley such that it will not be possible to access the VBB from the cable alley. The vertical bus bar space will also be fully separated from the feeder compartment except for the openings through which the power draw out contacts will engage.
11. When the feeder module in drawn out for maintenance the opening will automatically are closed through safety shutters.
12. The vertical bus bars shall be supported on SMC supports without having to be bolted to the supports.
13. The vertical bus bars also shall be rated to withstand the system fault level for 1sec. and fully sleeved as applicable for horizontal bus bars.
14. The vertical bus bars of all the vertical sections will have the same shape and same cross section, the material of the vertical bus bar shall be same as that of horizontal bus bars. Copper vertical bus bars are also acceptable if the same is manufacturer's standard. In case of Copper VBB, the tap off joints (HBB-VBB joints) will be provided with bimetallic strips and the copper part of the joint is silver/Tin plated.

D. MODULES, POWER CONTACTS & CONTROL CONTACTS:

1. The modules of the draw out MCC shall move on sliding rails provided with ball bearings.
2. The sizes of the draw out modules will be multiple of basic size. The modules of similar size and rating shall be totally interchangeable.
3. The minimum rating of power draw out contacts shall be 125A. These shall be of Copper and adequately silver plated.
4. The shape of the power contacts shall be such that during the short circuit, the contact pressure shall increase.
5. The power draw out contacts shall be clamped/bolted to the vertical bus bars Vertical bus bars with pre- punched holes at regular intervals for mounting the power draw out contacts are also acceptable.
6. The male-female power connections in the draw out modules will take place in enclosed area, enclosed by epoxy/SMC shrouds. The power draw out contacts of difference phases shall be separated from each other by these epoxy/SMC shrouds so that in case of overheating of the power draw out contacts, arc from one phase does not travel to other phase.
7. The modules shall have 3 distinct positions: service – Test – Isolated.
8. Effective earthing of the modules will be established before the module is taken to Test position from isolated position.
9. Control draw out contacts provided in the draw out modules (wherever required) shall be self-isolating, sliding type. These contacts shall be of copper duly silver plated. Anti-tracking barrier shall be provided between adjacent contacts. The control draw out contacts shall be individually convertible between
a) The contacts which make contact only in Service position.
b) The contacts which make contact both in service & test position.
c) The contacts which make contact only in Test position.
10. To ensure that the control draw out contact alignment is not disturbed during the termination of external control cables, the connection from the control draw out contacts shall be brought to external row of stud type terminals and the external cable will be terminated on this separate row of terminals only. The terminals for external cable termination and control draw out contacts shall be physically separate and shall not be part of common moulding.
11. Manually isolable plug – socket type of control contacts are also acceptable subject to the end customer's approval Rack In/Out Mechanism

12. Rack in/Out mechanism should be accident free. If any tool is used for the same guide should be covered with canopy such that it will not touch any other parts of the module.
Instrument Plate
13. The with drawable modules shall be provided with a swing-out instrument plate at suitable place, It shall hinged to provide access to the components mounted behind it. The plate shall be opened up to an angle of 110 deg. A cut-out shall be provided in the compartment door to enable the operator to read the flush-mounted meters, reset the overload relay,etc Trolley Earthing
14. Phosphor-bronze earthing/ equivalent system shall be used to provide positive double earthing. The contacts shall scrape against the electro-plated earth plate connected to earth bus. The system shall ensure earthing before the main contacts make and breaking after the main contacts break.
15. Adequate area of contact for termination of cables must be designed to terminate higher sizes of cables considering the voltage drop of the cables to carry the rated current of the feeder.

GENERAL SAFETY FEATURES REQUIREMENT IN ENCLOSURE:

1. An earth bus bar of copper or Aluminum or galvanized Mild Steel having a minimum cross-sectional area as specified shall be provided at the bottom for the entire length of the switchboard.
2. Every metal part other than those forming parts of an electrical circuit shall be connected to the earth bus by means of high conductivity copper wire.
3. The cores of transformer (bus potential transformer, control transformer, 24V winding heating transformer etc.) shall also be earthed through copper wire.
4. Metallic cases of instruments, relays, switches and other associated components mounted in the switchboard shall be connected to the earth bus bar by copper conductors of not less than 2.5 sq. mm. cross-sectional area. Instruments having metallic cases shall be fitted with earthing terminals.
5. The metal parts of with-drawable units shall positively & independently get earthed before the primary connections are made. Scraping earth contact shall be fitted on with-drawable equipment and shall be designed to ensure positive earthing. Mere sheet steel contacts between two parts shall not be considered as earthing bondage.
6. The earthing of circuit breaker shall be achieved through a robust spring loaded, tinned copper contact of sliding type. One side of the contact shall be connected to the main earth bus bar.
7. Doors shall have a copper wire for earth connection to fixed unit.
8. Arrangement shall be provided for connecting the internal earth bar to the external earthing station.
9. Switchboard covers (including doors without interlock) shall be bolted on type, shall be designed to give access to individual circuits without exposing other circuits, which may be live. Alternatively, circuits exposed by the removal of the cover shall be individually shrouded.
10. The switchboards shall be designed to prevent contact with live parts both within the modules and in the cable alley.
11. Shrouds shall be provided between vertical bus bars and modules. All live parts shall be shrouded to prevent inadvertent access and accident.
12. Interlock between compartment door and modules shall be provided such that the door cannot be opened without switching off the power supply to the module. Defeat interlock shall be provided for the units comprising of switch or MCCB or MPCB as a means of isolation, such that it is possible to open the door with device ON and the unit in SERVICE position. The following shall apply under these conditions:
a) It shall not be possible to close the door till the interlock has been reinstated.
b) Attempted withdrawal of the unit under such conditions shall be cautioned against by providing Warning Label affixed at an appropriate place.
13. With the draw out module fully removed from its housing, live parts exposed shall either be shrouded by automatic safety shutters or shall have means to shroud them totally to prevent contact. Suitable add-on type shrouds in loose to cover the opening on the compartment door when the module is taken out for maintenance shall be provided where automatic shutters or inbuilt shrouds are not provided.
14. Safety Shutters shall be provided to completely shroud all the fixed isolating contacts of the circuit breaker both on bus bar & circuit sides.

15. Shutters shall be opened and closed automatically by the movement of the circuit breaker carriage and shall prevent access to the fixed isolating contacts when the circuit breaker is withdrawn.
16. Locking facilities shall be provided to prevent the closing of circuit breaker when it is open and from being manually tripped when it is closed. In case it is not possible to provide locking facility to prevent manual tripping suitable shroud or flap shall be provided on the manual trip actuator to prevent its inadvertent operation. Provision shall be made to ensure that when manual operating mechanism for maintenance purpose is being used, it shall not be possible to electrically close the breaker.
17. The fixed contact of SFU shall be so shrouded that maintenance of the unit can be carried out in safety with the bus bars live.
18. Interphase barriers shall be provided to prevent possibilities of phase-to phase fault in the switch. The switch shall also be shrouded from all sides to prevent access to live parts on the switch after opening the unit door. The barriers and shrouding shall extend up to the height of switch to fully enclose both the bus and the load side terminals of the device. The arrangement shall permit easy maintenance.
19. Where one isolating switch is used as the incoming device, the incoming side fixed contacts shall be shrouded to ensure that maintenance can be carried out with the remote fuse and switch closed.
20. MCCB, MPCB terminals shall be shrouded and designed to receive cable lugs for cable sizes relevant to circuit ratings.
21. Live terminals of fuse bases shall be shrouded to prevent contact with personnel where fuse links are not mounted in carriers and are directly plugged into the fuse base. Interphase barriers extending throughout the length of the fuse base shall be provided to prevent interphase short circuit. They shall be shrouded from all sides to prevent accidental contact.

PAINTING
1. All sheet steel works to be painted shall be pretreated in seven – tank process as per IS 6005(Class 'C').
2. Powder coating of shade, as per drawing, shall be applied. A minimum, of 80 Microns thickness shall be uniformly achieved. The painting shall be done by spray/electrostatic painting and shall be stove enabled.
3. All bolts, nuts, and washer shall be cadmium / chromium plated / Zinc plated and di-chromate treated.

PRICE FORMAT FOR EOI

Sl.NO.	Description	Unit Price	Total Price
1.	Consultancy Services Shall be linked to following milestones : A. Successful Completion of Short circuit & Temperature rise Type test for 630,1000 & 1600 amps rating PMCC as per IEC 60439 with design procedure & Documentation B. Successful Completion of Short circuit & Temperature rise Type test for 2500,3200 & 4000 amps rating PMCC as per IEC 60439 with design procedure & Documentation C. Successful Completion of Short circuit & Temperature rise Type test for 5000 amps rating PMCC as per IEC 60439 with design procedure & Documentation. D. Successful Completion of Short circuit & Temperature rise Type test for 630,1000 & 1600 amps rating PMCC as per IEC 61439 with design procedure & Documentation E. Successful Completion of Short circuit & Temperature rise Type test for 2500,3200 & 4000 amps rating PMCC as per IEC 61439 with design procedure & Documentation F. Successful Completion of Short circuit & Temperature rise Type test for 5000 amps rating PMCC as per IEC 61439 with design procedure & Documentation.		
2.	Training of BHEL engineers in the Design & manufacture assemble of 50 PCC verticals of various Type & rating 50 MCC verticals for various types and rating	Lump Sum/month	
3.	Minimum 24 Visits per annum		
4.	Minimum stay of 6 Days per month at EPD per visit.		
	TOTAL		

TERMS AND CONDITIONS:-

i. **The Consultant will not be eligible for any other payment apart from the remuneration agreed by BHEL in its order/agreement.**
ii. **The period of the consultancy shall be for a minimum period of 2(two) years, extendable by 1(one) more year on same terms and condition.**
iii. **The consultant shall be available at the premises of BHEL-EPD manufacturing units for an average period of 6 days in a calendar month. The days present shall be mutually agreeable between the consultant and the authorized representative of BHEL.**
iv. **However, during the execution of certain trails/experimentation and as agreed upon when the presence of the consultant in the premises is warranted and it gets extended beyond average of 6 days in a calendar month, additional man day payment is permissible on pro-rata basis.**
v. **The consultant shall be available in the premises of the manufacturing unit as reasonably required in a day during the days of presence.**
vi. **Consultant shall adhere to the generally acceptable discipline and etiquette of an industry.**
vii. **The payment for the consultant is proposed as follows:-**
    a. **Monthly compensation as per the agreed terms before 5th day of the month for the preceding month**
    b. **Upon milestone completion, as per the agreed terms before 5th day of the next month for the month of achievement.**
    c. **Consultant shall provide his bank account details in BHEL proforma for making all payments online through EFT or RTGS, and BHEL does not agree for any other mode of payments .**
viii. **The consultant shall provide his PAN details and BHEL will deduct all taxes at source as applicable from the periodic payments to the consultant for which TDS certificates will be issued by BHEL.**
ix. **The consultant shall execute a confidentiality agreement with BHEL regarding non-disclosure of the information and data developed and collected. The confidentiality condition would extend 5 years beyond the termination of consultancy for non-disclosure of the information and data.**
x. **The selected consultant shall not have any dual/parallel consultancy with any other LV Switchgear manufacturing company during the currency of the consultancy contract with BHEL.**
xi. **The consultant shall abide by the safety regulations while in the premises of the manufacturing units and will not undertake or indulge in any activity which is detrimental to the safety of the consultant himself, the workmen of BHEL and the plant in general.**
xii. **The consultant shall not visit any other parts/location of the plant where the scope of the consultancy is not warranted. Under all reasonable and permissible conditions, the consultant shall follow and accompany the authorized person of BHEL during the visit to plant including manufacturing shops, laboratory & testing facilities, stores and other locations.**
xiii. **No Advance payments will be made.**
xiv. **The Offer will evaluated on Overall L1 basis**
xv. **The prospective consultant shall successfully complete the type test as per IEC60439 within 12 months from the date of awarding consultancy and successful complete the**

SCOPE OF BHEL FOR CONSULTANCY CONTRACT

TECHNICAL:-

i. **To make arrangements to procure and provide different type of materials and process inputs.**

ii. **To provide opportunity for conducting trials as per the requirement of the consultant (maximum three opportunity at external lab for any type of test).**

iii. **Drafting & manufacturing facility will be in the scope of BHEL.**

ADMINISTRATIVE:-

i. **To Provide free accommodation in our A type quarter and free food in our canteen & Transit flat for the consultant.**

ii. **To provide local conveyance from airport/bus stand/ railway station to BHEL-EPD.**