SCOPE OF SUPPLY AND WORK FOR RETROFITTING OF THYRISTERISED DIGITAL STATIC DRIVE SYSTEM FOR ROTOR BALANCING BED BLOCK-1

PURPOSE :

1.Two nos. DC motors each having(Power-1.8 MW, Armature voltage-720V, Armature current-2750A, Field voltage-220V,Field current-23/15.5A, 1000RPM) are connected in tandem and are used to drive rotors of TG through a gear box for dynamic balancing in rotor balancing installation. The rotors are run from '0' speed to full speed/ over speed with smooth speed variation through acceleration/ deceleration. Multiple balancing runs are required to be taken depending upon type of rotor. These two DC motors are presently controlled by Motor-Generator Set (One Synchronous motor of Power-5MW, Armature voltage-6.6kV, Armature current-508A, Field voltage-106V, Field current-280A, 1000RPM and Two DC generators of Power-2 MW, Armature voltage-720V, Armature current- 2780A, Field voltage-220V,Field current-19.5A, 1000RPM each). This MG set is energy inefficient and difficult to maintain due to non availability of spare parts. Therefore, the rotor balancing bed needs retrofitting with static drive system.

2. The supplied drive system will also be used for TG excitation. TG excitation system will consume 4000A at 500V(DC).

Note: Manual Changeover of connection from RBS(Rotor balancing station) motor to TG excitation system should be provided by the party.

S.No.	ITEMS	QTY	CONFIRMATION BY VENDOR (YES/NO)	REMARKS
A.	**SCOPE OF SUPPLY:**			
1.0	Total engineering, supply, installation, commissioning & prove out of Thyristorised Digital Static DC drive system of Siemens/ABB make and of suitable capacity to give DC power and run two nos. DC motors each of 1.8 MW, 720V, 2750A, 1000RPM and to accelerate / decelerate electrically. The DC drive motors are run independently or together in tandem as per the type of rotor. Details of drive configuration/ features requirements are as follows.	1 Set		

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1.1	**Drive Configuration & Features Requirements**			
1.1.1	Each motor can be run either independently with its individual drives or in tandem with other motor with their respective drives.			
1.1.2	Drive should essentially to be offered in 12 pulse configuration (both for load & source) to limit the harmonics. 12 pulse configuration is required for both driving motor and TG excitation independently.			
1.1.3	Drive should be suitable for 4 Quadrant operations and shall have dynamic overload capability			
1.1.4	Drive should be suitable & able to function in Indian Tropical weather conditions.			
1.1.5	All power sections shall consist of latest generation thyristor.			
1.1.6	Separate Field controller shall be required.			
1.1.7	Tacho-generator / pulse encoder input should be integral part of drive & should have provisions to accept Zero marker input. The Tacho should be **Huebner make**.			
1.1.8	Gating controller of drive should have synchronization in all 3 phases of power section			
1.1.9	A PLC (Siemens/ABB make, latest version) to be provided in panel/ control desk to give featured benefits like: flexibility in configuring scheme as per requirement of the application, to eliminate control logic using auxiliary contactors by using control disc to reduce the wiring in panel and easy programming without any external hardware. All the Interlocks/ status signals to be incorporated from present system			
1.1.10	Galvanic isolation signal converters/isolators must be provided between drive & external circuit			
1.1.11	Drive shall be equipped with a hand held operator panel for display, loading, editing operational parameters and local control			
1.1.12	Degree of protection for panel should be to IP 42 and paint shade should be RAL 7035 (inside & out side)			
1.1.13	Cable entries for power & auxiliary section from bottom & routing of electronic & signal cables to be separated from power & control cables.			
1.1.14	Equipments to be mounted on galvanized mounting plate of minimum 3mm thickness.			

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1.2	**Digital DC drive must provide following minimum standard functions**			
1.2.1	Fully controlled bridge for armature power section.			
1.2.2	Drive should run on back emf in case of tacho/ encoder failure without manual intervention			
1.2.3	Selection of analog tachometer or pulse encoder should be possible by parameter settings without any modification in hardware to have complete flexibility for selection of speed sensor.			
1.2.4	Close loop function in armature to have both torque & current control with setting/ selection for torque/ current limiting			
1.2.5	Self tuning i.e. measurement of motor resistance & speed loop optimization. (auto optimisation)			
1.2.6	Selection of drive motor direction of rotation to clock wise/ anti clock wise. Provision to be incorporated in control desk/HMI.			
1.2.7	Control stability of ± 3 rpm of rated motor speed for tacho generator operation & digital set point.			
1.2.8	Automatic voltage adjustment for power range ± 10%			
1.2.9	Flash EPROM on control board.			
1.2.10	Two analog inputs: one ± 10 VDC and one 4 -20 mA in each drive.			
1.2.11	Four analog out puts: two ± 10 VDC and two 4 -20 mA in each drive.			
1.2.12	Eight programmable binary inputs & eight out puts.			
1.2.13	Two separately addressable serial interface ports.			
1.2.14	User digital interface panel with backlight LCD display. Stop, start, parameter, speed control and forward/ reverse.			
1.2.15	Warning & fault messages for comprehensive protection and faults are to be shown on digital operator panel.			
1.2.16	Adjustments: i) Controlled access authorization to the individual parameters ii) Operating source (Local, Remote, Serial) iii) Individual adjustment of torque and current limits iv) Parameterization via PC using drive software			

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1.2.17	**<u>Control desk should have following operational features & display</u>** i) Control on off (Display/Indication also) ii) Field on off (Display/Indication also) iii) Selection of motors (Display/Indication also) iv) Selection of direction (Display/Indication also) v) Speed raise/ lower (Display/Indication also) vi) Selection of speed / current control (Display/Indication also) vii) Potentiometer for torque / current limit viii) Separate analog ammeter for armature current display of both DC motors ix) RPM display x) Separate analog voltmeter for armature voltage display of both DC motors xi) Field current display. Control desk should have PC based HMI having minimum 21" display . All the above mentioned features (i to xi) should also be available in PC based HMI (In case PC is provided by BHEL, Please inform system hardware required & mention its price impact) **Note**: System should run without HMI also with the help of push buttons selector switches etc Additional display to be provided on HMI : (a) Line voltage mains (6.6 kv) to rectifier transformers at control panel and in control room CD. 6.6kv / 110v PTs are already installed on incoming feeder. (b) Line current to rectifier transformers (for three phase through selector switch) at control panel and in control room CD. 600/5A CTs are already installed on incoming feeder. (c) Line frequency. (d) Status of binary inputs & out puts at control panel/ cabinet. (e) Thyristor temperature.			

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	(f) Faults/Alarms of Drive & PLC. **Display on panel**: (A1) Line voltage & Line current on Respective ACB section (A2) Armature current& Armature voltage of used drives. (A3) PC based HMI on the control desk along with latest control desk elements in addition to the features available with the offered drive system and PLC.			
1.3	**<u>Protections:</u>** Following minimum protections must be provided			
1.3.1	Armature over voltage.			
1.3.2	Armature over current.			
1.3.3	Armature current ripple.			
1.3.4	Loss of speed feed back/ speed measurement fault.			
1.3.5	Tacho fault.			
1.3.6	Motor over speed.			
1.3.7	Minimum field current / Field failure.			
1.3.8	Field over current.			
1.3.9	Thyristor over temperature.			
1.3.10	Auxiliary/ control supply over voltage/ under voltage/ failure.			
1.3.11	Main supply (6.6kv) over voltage &under voltage. 6.6kv / 110v PTs are already installed on incoming feeder.			
1.3.12	Inbuilt or additional protection in drive against mains power dip for the safety of drive component.			
1.4	**<u>Software functions:</u>** The basic software standard functions should be provided for maximum user friendliness regarding operator control and the highest degree of flexibility.			
2.0	Requisite Feedback sensors for drive controller and its coupling arrangement with DC motor. TACHO analog Hubner make IP65 protection	1 No.		
3.0	Suitable Input converter duty transformers (according to drive configuration) of suitable rating with protection on primary & secondary side along with required complete accessories / switch gear. The bus-bars/ Cables for	2 Nos.		

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	output connection to thyristor bridges. (The Input supply of 6.6 kV, 3 phase, 50 Hz shall be available).Input of the transformer should have the tapping of ± 2.5% and ± 5% of the rated voltage. Input supply cable from 6.6kV source to supplied transformer will be in the scope of the party. Separate VCB (with Over current (O/C), Earth fault (E/F), Short circuit(S/C)) for each transformer to be provided on the input side of transformer. The supply of VCB (with O/C, E/F, S/C) will be in the scope of the party.			
4.0	Switchgear for offered drive system i.e. ACB, Line Fuses, MCCBs, Contactors, Relays, Current relays, DC fuses, Chokes, Filters, Operator panel, control transformers, Power disconnections/ breakers and T-reactors on Drive/Fuses output(Siemens/ABB/L&T make)	1 Set		
5.0	Copper Bus bars/Copper cables along with its ducting & supports to interface drive system. (i) The connection between Drive output and existing terminal plate should be through Copper cable. (ii) The changeover connection from RBS motor to TG excitation system should be provided by the vendor. Output of Drive for TG excitation should be connected through manual change over. The manual change over must have some design interlock to prevent faulty connection (e.g. to prevent connections to motors and TG at same time). Over-voltage protection must be provided for TG excitation. (iii) Copper cable from existing terminal plate to TG exciter **(Approximate Length=60m)**	1 Set		
6.0	Cables for power connections, Signal cables, Control Cables, Panel wiring, Interfacing feedback & control elements, cables for requisite display and controls extension to control room and other wiring material like lugs, ferrules, cable/ wire markers, cable trays etc.	1 Set		
6.1	All the power (HT) cables should be of **TORRENT/ CCI/ CORDS/ UNIVERSAL/ HINDUSTAN VIDYUT Pvt Ltd.** make only.			

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6.2	All the power & signal (LT) cables should be of **LAPP/SAB/IGUS** make only.			
7.0	Sufficient cooling for continuous running of thyristor drive panel enclosure, PLC and ventilation at ambient temperature 0°C to 50°C for other panels, as per requirement must be provided.	1 Set		
8.0	Modular mini PLC make, Siemens /ABB (latest version) with minimum 96 DI/64 DO & 4 Analog input / 8 Analog output (digital & analog) to incorporate the complete logic and controls of the drive system, control desk & motor selection. Comprehensive range of modules for optimum adaptation to automation user friendly handling design, efficient processing speed for short machine cycle time, easily expandable, communication between PLC & Drive via standard and suitable communication cable (Transmission rate should be minimum 2MBPS) & also through Ethernet. In built diagnostic features and display unit for display of operational parameters, faults, alarms of system. PC based HMI for loading of drive data, maintenance and fault diagnostic	1 Set		
9.0	**SPARES:** **(To be compulsorily quoted items wise)**			
9.1	Semiconductor Fuses for armature/ Field for drive	10 Nos. each type		
9.2	Thyristors for armature circuit.	6 Nos. each type		
9.3	Control cards of drive armature	1 No. of each type		
9.4	PLC CPU and input & out put cards	1 No. of each type.		
9.5	contactors, MCCBs, cooling fan, ACB	1 No. of each type.		
9.6	Feed back devices (Tacho-generator)	2 Nos.		
9.7	One complete Drive system (consisting of armature &field)	1 set.		
9.8	Indicating lamps, push buttons, selector switches, potentiometers, Relays etc.	5 Nos. of each type.		
9.9	Hard disk with back up (complete system preloaded with all customised software) like PLC,HMI,DRIVE etc.	1 No.		

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B.	**WORK:**		
1.0	Installation of panels, bus bar laying & termination connection, cable laying & termination connections, inter panel cabling & wiring, internal panel wiring and interfacing of new drive system (along with switchgear & accessories) with DC motors, transformers, control desk & PLC to be done by Vendor at BHEL's works in RBB. Vendor has to provide following details in advance within two months after placement of purchase order and to be mutually agreed between Vendor & BHEL		
1.1	Required floor space for transformers, switch gear of transformers, drive cabinets and control panels along with lay out details.		
1.2	Cable schedule & bus bar routing.		
1.3	Details of foundation, cable trenches, cable racks and bus bar supports		
1.4	Civil work drawings for equipment, cable trench, cable tray & bus bar supports etc.		
1.5	If felt necessary, supplier will depute his expert for discussions & mutual agreement on above points.		
1.6	Civil works shall be done by BHEL.		
C.	**COMMISSIONING:** Vendor shall be totally responsible for commissioning of the equipment at works. The vendor will ensure the operation/ testing, accuracy and safety with existing system & motors. The vendor shall arrange its own special tooling/ instruments required if any for commissioning.		
D.	**PROVE OUT:** The vendor will test & prove the drive system on two rotors (medium weight & heavy weight) during balancing operation at full RPM. BHEL will arrange the rotors for balancing.		
E.	**TRAINING:**		
1.0	One week training of Two Engineers at PLC & Drive manufacturer's works in field of commissioning/maintenance. Vendor will organise for this training. Expenses of Boarding and lodging of BHEL personnel shall be borne by BHEL.		
2.0	The vendor's expert will impart on job training to BHEL engineers for operation & trouble shooting of drive system during prove out at BHEL Hardwar.		

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F.	**DOCUMENTATION:** Four sets of following documents to be supplied with equipment:		
1.0	Descriptive operation & maintenance manuals with circuit diagrams/ PCB diagram details for all the items.	4 Set	
2.0	Electrical schematic diagram for all the items/ panels. Wiring diagram/ cable layouts/ bus bar layouts.	4 Set	
3.0	Installation & user instructions for PLC, DRIVE & HMI software.	4 Set	
4.0	Service & user manuals of all bought items.	4 Set	
5.0	PLC program print out & soft copy.	4 Set	
G.	**WARRANTY:** The vendor shall stand the warranty for the material supplied and work done for a period of 12 months from the date of successful commissioning/ prove out of equipment .Any material (supplied by the party) found defective within warranty period will be supplied by the party free of cost		
H.	**VENDOR'S OBLIGATION:**		
	The vendor shall bring all tools, tackles and testing equipment with them for successful commissioning of supplied system.		
I.	**QUALIFYING CONDITIONS**		
1.0	The average annual turnover during the last three years ending **March 31st 2012** should be at least Rs. 125 Lac. Audited balance sheets for the last three years should be submitted.		
2.0	Experience of having successfully completed similar works ending **31ST Aug 2012** should be either of the following.		
	Three similar completed works costing not less than Rs. 170 Lac		
	OR		
	Two similar completed works costing not less than Rs. 210 Lac		
	OR		
	One similar completed work costing not less than Rs. 340 Lac		
2.1	Definition of Similar works: Successfully supplied & commissioned DC drive System for load more than or equal to 1MW.		

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2.2	Above similar retrofitted machines should be running satisfactorily for at least 6 months prior to the date of NIT. Vendor shall provide performance certificates for satisfactory operation of above similar retrofitted machines from his customers along with name, address & contact details. BHEL reserves the right to verify the information provided.		
J.	**DELIVERY:**		
	Material: Max. 8 months from the date of award of contract. Early delivery shall be acceptable		
	Work : Within 10 weeks from the date of release of machine for work.		
K.	**LATE DELIVERY (LD) CLAUSE:-**		
1.0	LD @ ½% per week subject to a max. of 5% of the order value shall be applicable for delay in deliveries. Vendor should intimate BHEL regarding Pre dispatch inspection at least 7 days in advance. The time period from date of invitation from vendor for PDI to the date of arrival of PDI Team at vendor's works and any other reasons attributed to BHEL will not be accounted for in delivery period. This period will be excluded for the purpose of calculating Liquidated damages.		
2.0	Liquidated damages @ 2% per week subject to a max. of 10% of the Commissioning Charges shall be applicable for delay beyond scheduled commissioning date (which will be 10 weeks from date of release of machine for work) for reasons attributed to the party. Net delay for the purpose of calculating liquidity damages will be considered as the delay in commissioning.		
L.	**PRE-DISPATCH INSPECTION**		
1.0	Pre-dispatch inspection of all the items covered under Scope of Supply at para (1) shall be carried out by BHEL at party's works.		
2.0	Supplier shall invite BHEL for carrying out pre- inspection.		
3.0	Deputed BHEL persons shall do pre acceptance at vendor works and give despatch clearance.		
4.0	Expenses of Boarding and lodging of BHEL personnel during PDI shall be borne by BHEL.		

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M.	**SUBMISSION OF BILL OF MATERIAL (BOM)**		
	Before inviting BHEL for Pre-dispatch inspection, vendor shall submit to BHEL the Bill of Material (BOM) for scrutiny.		
N.	**EARNEST MONEY DEPOSIT (EMD):**		
1.0	Vendors have to deposit the EMD. EMD may be deposited in cash, through pay order in favour of BHEL, Hardwar or through demand draft only.		
2.0	EMD shall be converted to security deposit if the work is awarded.		
3.0	EMD of unsuccessful bidders shall be refunded back normally within fifteen days of acceptance of award of work by the successful bidder.		
4.0	EMD shall not carry any interest.		
5.0	EMD by bidder will be forfeited as per tender document, if		
5.1	After opening the tender, the tenderer revokes his tender within the validity period or increases his earlier quoted rates		
5.2	The tenderer does not commence the work within the period as per LOI/contract.		
O.	**SECURITY DEPOSIT (SD):-**		
1.0	Successful vendor shall deposit security. The rate of security deposit will be as below:		
	• For work Up to Rs. 10 Lakhs : 10% of work order value		
	• Above Rs. 10 Lakhs upto Rs. 50 Lakhs : Rs. 1 Lakh + 7.5% amount exceeding Rs. 10 Lakhs		
	• Above Rs. 50 Lakhs: Rs. 4 Lakhs + 5% amount exceeding Rs. 50 Lakhs		
2.0	The security deposit should be submitted before the start of work in the following forms:		
	i) Cash (As permissible under the Income Tax Act)		
	ii) Pay Order, Demand Draft in favour of BHEL, Hardwar		
	iii) Local cheques of Scheduled Banks, subject to realization.		
	iv) Bank Guarantee from Scheduled Banks/Public Financial Institution as defined in the companies Act. The Bank guarantee format should have the approval of BHEL.		
3.0	Security Deposit shall not carry any interest.		
4.0	EMD of successful tenderer can be converted and adjusted against the Security Deposit.		
5.0	100% of the Security Deposit amount shall be refunded to the vendor after post commissioning successful running of the machine for one month. **SD shall be released after the submission of Performance Bank Guarantee(PBG) by the vendor**		

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P.	**Performance Bank Guarantee (PBG):**		
1.0	Vendor shall be required to submit a performance bank guarantee (PBG) for 10% of the total work order value which shall be valid for a period of 12 months from the date of commissioning.		
2.0	The PBG shall be submitted on a non-judicial stamp paper of value not less than Rs.80/- issued by any one of the nationalised banks.		
Q.	**PAYMENT TERMS:** **(Note: No advance payment shall be made to the vendor.)**		
1.0	Part payment will be made after completion of following milestones		
1.1	First payment of 80% of material cost along with 100% taxes & duties shall be payable after receipt of material at BHEL		
1.2	Final payment of balance 20% of material cost, 100% of commissioning cost and refund of 100% of the Security Deposit amount will be made after post commissioning successful running of the machine for one month, subjected to submission of PBG as per **"Para N"**		
2.0	All the payments shall be made through e-payment after submission of following documents along with first bill		
2.1	E-payment form duly filled (Form will be provided by BHEL)		
2.2	Income tax exemption letter(if applicable)		
3.0	Excise duty & CST/VAT will be paid on material cost and service tax will be paid on commissioning charges at actual. Related original documents to be submitted for availing MODVAT credit by BHEL.		
R.	**GENERAL CONDITIONS:**		
1.0	**A point wise compliance statement shall be submitted by the party with reference to the above scope of supply against each clause/ sub-clause with relevant details & comments. Non-compliance to any of the clauses & quoting inadequate quantity can lead to dis-qualification of the offer.**		
2.0	The Vendor is advised to inspect system & site to ascertain all the relevant details required for successful completion of the work.		
3.0	The proposed electrical schematic for the machine shall be provided by the vendor prior to commissioning.		

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4.0	Complete specifications such as part no., Model, Type etc of drive controllers, PLC and all other components shall be stated in the offer by the party. Ordering brochure / catalogue should be attached. Complete Bill of Material (BOM) shall be supplied by the party at the time of signing of contract agreement.		
5.0	Vendor must quote the quantity exactly as per the Scope of supply. No reduction in quantity as per the above Scope of supply is permissible.		
6.0	Vendor must quote the Spare parts individually priced along with the offer.		
7.0	The offers of the bidders who are on the banned list as also the offer of the bidders, who engage the services of the banned firms, shall be rejected. The list of banned firms is available on BHEL web site www.bhel.com		
8.0	**The award of works will be made on the basis of the total of material cost (including spare parts) & commissioning charges**		
9.0	The Vendor should submit their best price at this stage itself and they will not be allowed to revise the price. Any revision / discount given by the vendor subsequently will be ignored.		
10.0	Check List as per **Annexure 'C'** must be enclosed with techno-commercial bid		
11.0	BHEL reserves the right to cancel the tender at any stage of tendering till signing of agreement without assigning any reason(s). The tender cost in that event shall not be refunded.		
S.	**BHEL'S OBLIGATION:**		
1.0	Existing electrical schematic of the machine shall be provided by BHEL to the vendor.		
2.0	Crane facility and lifting tackles like slings, rope, D-Shackles shall be provided.		
3.0	Any machining facility required for rectification/fitting of supplied material, subject to the extent available in BHEL, shall be provided.		
4.0	Any civil work required for the erection of panel shall be done by BHEL.		
5.0	Electricity, water, fasteners, welding sets, Gas cutting equipment, general purpose welding rods and holders required during commissioning shall be provided.		
T.	**OFFER :-** The offer should be submitted in two parts and in following manner.		
1.0	**Techno-commercial Bid** :		

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1.1	The envelop shall contain the Techno-commercial Bid (**ANNEXURE 'A'**) with technical details and commercial terms & conditions along with relevant documents like copies of ESI, PF code, PAN No., Service Tax Regn. No., TIN No., CST No., Experience Certificates, Audited Balance Sheet of last 3 years, **EMD** and Check List as per **ANNEXURE 'C'**		
1.2	The envelop shall be super scribed with "Techno-Commercial Bid", Name of work & NIT No.		
1.3	Point-wise compliance of this scope of supply and work is to be given by vendors while submitting their techno-commercial offer.		
2.0	**Price Bid :**		
2.1	The second envelope shall contain only the price bid with separate price for material & work on Price Bid Format as per **ANNEXURE 'B'**.		
2.2	Any other information in the price bid shall not be considered and the quotation is likely to be rejected. Price bid document shall be signed by the bidder at the bottom of the page.		
2.3	The envelope shall be sealed and super scribed with "Price Bid", Name of work & NIT No.		
2.4	Price bids of techno commercially accepted vendors shall be opened.		
3.0	Both the above two envelopes shall be kept in another sealed cover. The cover shall be super-scribed with "Quotation for (name of work), NIT No. & due date and shall be submitted in **Tender Box kept in the Tender room of Purchase department at the 4th floor of the Main Administrative Building of BHEL, HEEP, Haridwar-249403,Uttarakhand** and it should also contain Bidder address.		
U.	**COMMERCIAL TERMS:**		
1.0	Prices shall be quoted on "Firm Price" basis only. The prices should be on F.O.R BHEL, Haridwar basis inclusive of Packing & Forwarding, transit insurance & Transportation charges. Applicable % of ED & Sales Tax, Installation/ Commissioning Charges & Service Tax should be clearly indicated in attached Price bid format as per **"Annexure B"**		
2.0	Validity of offer shall be for a minimum period of 180 days from the date of Tender Opening.		
3.0	BHEL Reserves right for doing reverse auction (RA).If BHEL opts for RA, then the formalities regarding it will be informed accordingly.		
4.0	Freight & transit insurance charges from Dispatching station to BHEL, Haridwar shall be borne by the party.		

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5.0	The material will be dispatched to Central Plant Stores, HEEP, BHEL, Haridwar with instructions to forward the same to **Sr.Engr (WEX-MCR/E), Block-6 Annexe, HEEP, BHEL, Haridwar-249403**		
V.	**PACKING:**		
	Supplier shall arrange for adequate protection and packing of the consignment so as to avoid loss and damage during transit and also take appropriate measures to prevent metal parts from rusting and corrosion during transit. Handling instructions shall be clearly printed /painted on the packages. Each package should carry a detailed packing slip. Supplier shall be responsible for any loss/damage during transit due to defective/inadequate packing.		

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