

REQUEST FOR QUOTATION

	BHARAT HEAVY ELECTRICALS LIMITED Electronics Division PB No. 2606, Mysore Road Bangalore - 560026 INDIA	RFQ NUMBER: LCMM900051 RFQ DATE : 26.AUG.2008	Due Date 22.SEP.2008 Time: 13:00 HRS VENUE : NEW ENGG. BLDG
MMI:PU:RF:003			

	(for all correspondence) Purchase Executive : MESHRAM LC Phone : 00918026998781 Fax : 00918026744227 E-mail: meshram@bheledn.co.in
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Please submit your lowest quotation subject to our terms and conditions attached for the material mentioned below. The quotation must be enclosed in a sealed envelope / Fax superscribed with RFQ no.and due date, should reach us on or before the due date by **13.00** hours IST and will be opened on the same day at **13.30** hours at the venue mentioned above. **PLEASE DROP THE OFFER IN THE BOX PROVIDED AT RECEPTION.**

1. TENDER / OFFER SHALL BE SUBMITTED IN TWO PARTS.
2. QUOTATIONS MAY BE SUBMITTED BY OEM OR THEIR AUTHORISED DEALERS.
3. VENDOR IS EXPECTED TO HAVE ESTABLISHED SALES,SERVICE AND SUPPORT NETWORK PREFERABLY, IN INDIA. A LIST OF THE SAME NEEDS TO BE ENCLOSED WITH THE OFFER.
4. A LIST OF REFERENCES INCLUDING CUTSTOMER#S DETAILS LIKE CONTACT, MACHINES INSTALLED, DATE OF INSTALLATION IN INDIA AND ABROAD SHALL BE SUBMITTED THAT ESTABLISHES THE SATISFACTORY PERFORMANCE OF SUPPLIER#S EQUIPMENT FOR AT LEAST THREE YEARS.
5. VENDOR IS ADVISED TO GO THROUGH THE GENERAL TERMS AND CONDITIONS **DOCUMENT CPD-00** ENCLOSED WITH RFQ.
6. BHEL RESERVES THE RIGHT TO RESORT TO REVERSE AUCTION BEFORE THE PRICE BID OPENING.
7. VENDOR HAS TO CONFORM TO ALL THE CLAUSES LISTED IN THE TECHNO-COMMERCIAL TERMS (ANNEXURE-B OF **DOCUMENT CPD-00**). DEVIATIONS, IF ANY, TO BE HIGHLIGHTED AND BROUGHT OUT CLEARLY.
8. VENDOR HAS TO CONFORM TO ALL THE CLAUSES IN THE PURCHASE SPECIFICATIONS.
9. DELIVERY REQUIRED: WITHIN 12 WEEKS FROM THE DATE OF PURCHASE ORDER.
10. TERMS OF PAYMENT: 75% ON RECEIPT OF MATERIAL, 15% AFTER INSTALLATION AND COMMISSIONING AND THE REST 10% AGAINST SUBMISSION OF PBG.

Sl No.	Description	Qty	Unit	Delivery qty	Delivery Date
1	CU9095003614 1.2 MW IGBT VFD WITH LOCAL CONTROL BOX AND ACCESSORIES AS PER PS/445/053	1	NO	1	24.DEC.2008


Total Number of Items - 1

Please note that the tender will be opened in the presence of the bidders or his authorised representatives (maximum two per organisation) who choose to be present with authorisation letters. Refer annexure for the terms and conditions.
 Preference will be given to vendors who accepts our standard payment terms i.e.100% payment - 30 days after receipt of material at our works subject to acceptance.
 Please specify Terms of delivery, Excise duty, sales tax, Ex-BHEL, Ex-works surcharge, Insurance,P&F, Freight and other taxes very clearly .

- i). This is only RFQ not an order.
- ii). In all correspondence quote RFQ No. & due date.
- iii). In Quotation BHEL material code / RFQ Sl. No. should be mentioned clearly.
- iv). Quotation Envelope / Fax not superscribed with RFQ No.and due date is liable for rejection.
- v). Quotation should remain valid for a minimum peiod of 90 days from due date.

For and On behalf of BHEL. Page 1 OF 2

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 MMI:PU:RF:003	BHARAT HEAVY ELECTRICALS LIMITED Electronics Division PB No. 2606, Mysore Road Bangalore - 560026 INDIA	RFQ NUMBER: LCMM900051 RFQ DATE : 26.AUG.2008	Due Date 22.SEP.2008 Time: 13:00 HRS VENUE : NEW ENGG. BLDG		
		(for all correspondence) Purchase Executive : MESHGRAM LC Phone : 00918026998781 Fax : 00918026744227 E-mail: meshram@bheledn.co.in			
Please submit your lowest quotation subject to our terms and conditions attached for the material mentioned below. The quotation must be enclosed in a sealed envelope / Fax superscribed with RFQ no.and due date, should reach us on or before the due date by 13.00 hours IST and will be opened on the same day at 13.30 hours at the venue mentioned above. PLEASE DROP THE OFFER IN THE BOX PROVIDED AT RECEPTION.					
Sl No.	Description	Qty	Unit	Delivery qty	Delivery Date
vi). In case of non-receipt of Quotation or regret letter for 3 consecutive RFQs you are liable to be removed from our vendors list. vii). All Prices should be written in words and numbers. viii). Excise Chapter Heading should be mentioned for all items where VAT is applicable .					

For and On behalf of BHEL.



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TECHNICAL SPECIFICATION FOR 1.2 MW IGBT VFD SYSTEM
FOR SQUIRREL CAGE INDUCTION MOTOR

1. **Application** : Speed Control of Squirrel Cage Induction Motors (Refer Pg 25)
2. **Quantity** : 1 Set - Complete VFD System consisting of the following equipment (Ref Pg 25)
 - a) Input ONAN (Mineral Oil Filled) Transformer
 - b) 690V VFD Panels
[with IGBT AFE Converter & Two (2) Inverter Bridges]
 - c) Output Sine Wave Filter for one Inverter.
 - d) Output ONAN (Mineral Oil Filled) Transformer for one Inverter.

Configuration and Scope of Supply shall be in line with Fig-1 – Single Line Diagram on Page 25

3. STANDARD OPERATING CONDITIONS:

- (a) **Input Supply to VFD System** : 415 V +10 %, -15%, 3 Ph, 50 Hz \pm 5 %
- (b) **Site Ambient Temperature** : 45°C
- (c) **Storage temperature** : -40°C to +60 °C
- (d) **Noise Level for VFD Panels** : Not to exceed 80 dB at a distance of 1 metre from the Outline of Inverter Panels at a height of 1.5 metres from the floor, with all fans running in Converter and in one Inverter.
- (e) **Relative Humidity** : < 95% (non condensing)
- (f) **Altitude** : Less than 1000 metres above mean sea level
- (g) **Site Location** : BHEL-Electronics Divisions Works, Bangalore (India)
- (h) **Location of VFD Panels** : Indoor

4. Motor data	:	Motor M1	Motor M2
Rated Power	:	1000 KW	1000 KW
Rated Voltage	:	6.6 kV	690 V
Rated Speed	:	1500 rpm	1500 rpm

Motors are designed for operation with IGBT PWM Inverter

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REVISIONS 00

APPROVED BY V.Venkatesh

PREPARED BY

Prachi Rao.V

ISSUED BY

TRACTION ENGG

DATE

10.07.2008



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5. VFD System Operation: (Ref Fig-1 Single Line Diagram)

VFD System shall consist of a 690V Drive System connected to the Input 415V AC Line through an Input Transformer and IGBT Active Front End (AFE) Converter. The Inverter Section shall have Two (2) Bridges. Inverter 1 (INV1) shall be connected through an Output Sine Filter and Output Transformer to a 1.0 MW, 6.6KV, 3Ph, 50 Hz Squirrel Cage Induction Motor (M1). Inverter 2 (INV2) shall be directly connected to a 1.0 MW, 690 V, 3Ph, 50Hz Squirrel Cage Induction Motor (M2).

Modes of Operation of Inverters :

Detailed in Annexure – 3.

6. VFD System Output shall meet the following requirements:

- (a) Output Power : 1.2 MW at 45 deg C (Site Ambient)
- (b) Output voltage : 0 to 6.6KV (when operating through Inverter1 and Output Transformer)
0 to 690V (when operating through Inverter 2)
- (c) Output Frequency : 0 to 50Hz , Resolution - 0.001 Hz, Accuracy - 0.01%

7. VFD Efficiency : Shall be > 96%

8. VFD Panel Construction

- a) Protection Class : IP42
- b) Panel : Free standing, floor mounting type, comprising of rigid welded structural frames with Cold Rolled Sheet Steel enclosure of minimum thickness 2 mm for load bearing and 1.6 mm for other members. All doors & removable covers shall have neoprene gaskets. Ventilating louvers shall have easily removable and washable dust filters
- c) Cooling : Air Cooled (Natural or Forced Air Cooled)
If forced air cooling is adopted, same shall be with low noise ventilation fans at the top of the cubicle, which shall suck air through the Power modules. The arrangement shall preferably be such that ventilation air passes only through Power modules heat sinks in a separate duct to prevent dust deposition. Suitable thermal relays for exit air temperature monitoring and control shall also be incorporated.
- d) Door Interlock: The VFD shall have a door-interlocked input AC line disconnect switch with fuses. The fuses should be of semiconductor type and have as asymmetrical short circuit interrupting capability of 200 kA.
- e) Cables : Armoured 3 Core, Stranded Aluminium Conductor
Details of Cable Size, Outside Diameter of Cable, No. of Cables, Voltage Rating etc shall be given by BHEL during drawing approval stage. Cable Gland Plates shall be blank (undrilled) to be drilled at site. Gland Plates shall be 6mm thk Aluminium (steel not allowed)

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f) Painting : 2 Coats of Primer and 2 Coats of Finish Paint to be given for all surfaces of enclosure. Paint shall be epoxy based. Paint shade shall be as detailed below:

Outside : Front & Rear - RAL 9002 Grey.
End Covers - RAL 5012 Blue.
Powder Coated with Matt Finish.
Inside : Front & Rear - RAL 9002 Grey.
End Covers - RAL 5012 Blue.
Powder Coated with Matt Finish.

Paint Thickness : 60 MICRONS (minimum). Paint shall be air drying type.
Note: Final Paint Shade shall be confirmed during drawing approval stage.

g) Limiting Dimensions: Height of Panels from finished floor level shall be 2400mm

9. VFD Requirements :

- a) Analog Input : 2 nos. User programmable.
- b) Analog Outputs : 2 nos. 4 – 20 mA (Isolated)
- c) Digital Inputs : 8 nos. optocoupled. User programmable
- d) Digital Outputs : 4 nos. user programmable relay outputs for VFD ON, VFD Ready, VFD Fault and VFD Alarm.
- e) Varistors : Metal Oxide Varistors (MOVs) shall be provided for transient voltage suppression on the 3-phase AC incoming power line.
- f) Input Choke : Input chokes to be provided if necessary.
- g) Local/Remote Switch (Door Mounted) : Selector switch shall be provided for operator to select
Local - Operation from VFD Panel for Speed Control or
Remote - Operation from DCS Panel

If VFD is set for speed reference from Remote, it shall be possible to program the VFD to either shutdown, go to minimum speed or continue operation at its last known speed reference point whenever a loss of speed reference is detected.

- h) Door Mounted Local Start/Stop Pushbutton : To be provided
- i) Door Mounted Emergency Stop : Lockable Push-Button to be provided.
- j) Anticondensation Heater : One heater to be provided inside the Inverter.
- k) PLC : PLC shall be provided for Interlocking and Protection.

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10. VFD Features:

- b) Soft Start & Auto Restart
- c) Auto Speed Search Facility (Catch on Fly) shall be available for starting into rotating loads.
- d) Power loss ride through (Kinetic Buffering) for minimum 2 secs time
- e) Automatic VFD tuning during start-up.
- f) Flux optimisation function shall be provided to reduced the total energy consumption and noise level in case drive is operated below nominal load.
- g) DC magnetising features shall be provided to automatically magnetise the motor before start to ensure the highest possible break away torque.
- h) Selectable reverse run prohibition
- i) Adjustable motor overload feature
- j) Settable minimum and maximum operating frequency
- k) VFD shall produce not greater than 1% torque pulsation to the shaft of driven equipment.
- l) Field adjustable Torque limits and acceleration & deceleration ramps.
- m) Eight (8) user programmable preset speeds.

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11. Controls And Monitoring with Local Control Box (Keypad) & Accessories

- a) VFD shall be with an interactive and user-friendly door mounted digital operator interface with LCD display and sealed membrane type keypad. Operator shall be able to access the following from the Keypad:
 - Keypad Control
 - Active Faults
 - Fault History
 - System Menu
 - Monitor
 - Parameter Menu
 - Operate Menu
- b) The operator interface shall be used for drive programming, drive monitoring and drive trouble shooting. The operator interface must also be able to start and stop the drive, reset VFD faults and manually adjust the VFD's speed reference.
- c) The operator interface shall have LED indicators for drive fault, drive run, drive in current limit and forward direction of rotation.
- d) The digital operator shall allow simple monitoring of inverter operating conditions including speed, current, voltage, torque, power etc.
- e) Messages shall be Alpha numeric in nature. All the fault messages shall be in clear English language.
- f) The operator interface shall be removable and remote mountable.
- g) The operator interface shall be able to display all real time operating variables and all drive programming parameters.
- h) The operator interface shall be capable of displaying a specific user selected parameter on power-up. This power-up parameter would typically be a parameter that is important to the operator such as motor speed or motor load.
- i) All VFD operating parameter shall be stored in nonvolatile memory (EEPROM).
- j) The drive shall have built in monitoring of following parameters as minimum on its digital operator interface :
 - Output Voltage
 - DC Bus Voltage
 - Output Frequency
 - Output Current
 - Output Power (It shall be possible to display power output of the drive in KW and the accumulated power output over the time (kWhr)
 - Motor Speed
 - Torque

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- k) Necessary transducers shall be provided with 4-20 mA output for indicating motor speed and current in the DCS. Transducer shall be capable of driving 500 ohms load.
- l) The following indications shall be provided on the VFD Panel Door:
- Motor M1 (6.6 KV Motor) Running
 - Motor M2 (690 V Motor) Running
 - Motor M1 Stopped/Tripped
 - Motor M2 Stopped/Tripped
 - Inverter 1 "ON"
 - Inverter 2 "ON"
 - AC Mains "ON"
 - Auxiliary Control Supply "ON"
 - VFD System "HEALTHY"
 - VFD System "READY"
 - VFD System "ON"
 - VFD System "FAULT"
 - Emergency Stop Activated
- m) 2 nos. of 6 Element Flag Relay (One each for Input Transformer and Output Transformer) shall be provided on the Front Panel for annunciation of Transformer Alarms & Faults. Details of the faults and alarms to be annunciated is indicated at Annexure-1.
- n) Emergency Stop Pushbutton shall be provided on the Front Panel.
- o) The VFD shall store fault logs of minimum last 10 faults in memory.
- p) The interface details of VFD shall be incorporated as required for data communication with DCS system with serial interfaces with RS485 & RS 422 data links. Necessary hardware shall be included in the scope and the interface protocol shall be defined. Supplier to confirm whether Modbus Interface Protocol is available.

12. Protection :

Following protections shall be built in within the inverter and any other protection as required:

- a) Motor Overload / Over Torque
- b) Instantaneous Over current (This device shall monitor the peak output current continuously and shall provide instantaneous shutdown without component failure whenever its trip point is surpassed. The trip point must be greater than or equal to 250 % of the VFD's rated full load output current)
- c) Ground Fault
- d) Output Short Circuit
- e) Output Phase Loss/Fuse Failure



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- f) Over Voltage/Under Voltage
VFD shall be able to withstand 30% dip in supply voltage for 3 cycles without damage to semiconductors or fuses.
- g) Phase Sequence Protection
- h) Input Phase Loss/Single Phasing Preventer
- i) Over Speed
- j) Heat sink over temperature/VFD Panel Temperature High Stall prevention
(During acceleration, deceleration and constant speed operation)
- k) Loss of Cooling Fans

13. Type of control (Also refer Modes of Operation as per Annexure – 3):

Completely programmable by the user as :-

- a. Flux vector control with speed feedback
- b. Flux vector control without speed feedback
- c. Scalar v/f.
VFD shall be capable of maintaining motor speed within ± 1 rpm without the use of a motor mounted encoder or tachometer.
- (d) Torque Control

The drive shall have programmable V/F patterns along with a user definable custom V/F patterns.

14. Software for computer interface :

The software should be an easy to use commissioning tool for drives and shall be provided along with the system. The interface details of VFD shall be incorporated as required for data communication with DCS system with serial interfaces with RS485 & RS 422 data links. Necessary hardware shall be included in the scope and the interface protocol (i.e. modbus or profibus) shall be defined. Supplier to confirm whether Modbus Interface Protocol is available.

15. Harmonic limitations – Shall be as per IEEE – 519

Refer Pg. 25 of this specification for Single Line Diagram

- I) Voltage harmonics
Maximum individual voltage harmonics to be limited to 3% and Total Harmonic Distortion of System to be limited to 5% as per IEEE 519.
- II) Current Harmonics
 - a) Source side
 - i) 5th harmonic Maximum 30 %
 - ii) 7th harmonic Maximum 20 %
 - iii) 11th harmonic Maximum 10 %

16. Switching frequency :

Shall not be less than 2 kHz.



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17. Auxiliary Supply:

Auxiliary Supplies required for VFD System including Aux. Feeders for Transformers etc shall be derived from input feeder to VFD.

18. Input / Output Transformer:

Relevant Standards: IS 2026, IS 3629, IS 335, IS 2099, IS 3347.

Transformers shall be ONAN Mineral Oil Filled Type. Installation shall be Outdoor under direct sunlight. Transformers shall be suitable for operation with VFD System. Output Transformer shall be connected to a 1 MW, 6.6KV, 3Ph Squirrel Cage Induction Motor. Approximate cable lengths between Transformers and VFD Panels / Motors shall be as follows:

Input Transformer to VFD Panels : 75 metres

Output Transformer to VFD Panels : 125 metres

Output Transformer to Motor M1 : 125 metres

The same shall be taken into account while sizing the transformers.

Noise Level : Not to exceed values specified in NEMA TR-1

The following drgs and documents shall be submitted for approval

- GA Drgs of Trfs , Foundation Details, GA & wiring Details of Marshalling Box etc

Fittings and accessories shall be as per Annexure-1.

Data Sheet as per Annexure-1 shall be filled in and submitted along with Technical Offer.

19. RECOMMENDED/COMMISSIONING SPARES:

- (a) Supplier will provide the list of recommended spares required during commissioning and for three (3) years trouble free operation with item-wise price for the Complete VFD System including all equipments in their scope.
- (b) Supplier should quote equipment wise & item wise price for all the spares listed against (a) above.
- (c) Unpriced List of Spares quoted for shall be provided in the Technical Offer.
- (d) BHEL reserves the option of deleting or changing the quantities of the items listed above. Unit Prices shall remain firm irrespective of the quantity being ordered.

20. Tools & Tackles : Any special tools & tackles required for commissioning and troubleshooting shall be provided.

21. Maintenance : The procedure for maintenance of VFD System and the schedule thereof shall be mentioned in the offer.

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22. Inspection, Training & Commissioning :

- a) **Final Inspection:** BHEL representative will be present at manufacturer's works for witnessing of final testing. This is to be incorporated in the Quality Plan. No charges shall be applicable for the same.
- b) **Training :** Training is required for two persons from BHEL for a minimum period of 1 week per person at manufacturer's works. No charges shall be applicable for the same.
- c) **Commissioning:** Commissioning of the complete VFD System at BHEL-EDN works shall be in the scope of supplier. Final Acceptance shall be based on successful completion of the same.

23. Testing & Quality Plan :

- a) Routine tests shall be carried out on the VFD System as per relevant standards.
- b) Type test certificates for similar equipment supplied by the Bidder shall be submitted along with offer.
- c) Test Protocol and Quality Plan for the complete VFD System shall be submitted by supplier For approval. These documents shall explicitly list out all final tests done on all equipment comprising the VFD System.
- d) Sl.Nos. 9.0 (j), (k), (l) of Data Sheet for VFD Panels Page 12 to be demonstrated by manufacturer's works. These tests shall be necessarily be included in the Test Protocol submitted by supplier.
- e) The following type tests shall be performed on Transformers :
 - Acoustic Noise Level Test
 - Temperature Rise TestItemised Price for the same shall be submitted along with Technical offer.

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24. Information required along with offer :

- a) Dimensional Drg of VFD Panels along with minimum clearance to be maintained for effective cooling
- b) Tentative Dimensions of Input and Output Transformer.
- c) Tentative Scheme of VFD System.
- d) Weight of all VFD System Components
- e) Total Losses at Rated Load (Total including Cooling Fans)
- f) Quantity and Rating of Cooling Fans provided
- g) Experience list of similar rating
- h) Catalog
- i) User Manual
- j) Confirmation to all pts in Sl.25 (a) to (c) below

25. Confirmations required from Supplier :

- a) After Sales Service & Support shall be given by vendor of for a minimum period of 5 (Five) years. Address of the after sales and service representative in India to be given. The same shall be binding on the Principals irrespective of any change in the Indian Representative. Annual Maintenance Contract (AMC) for the above period to be provided for the system if the same is required by BHEL. Price for the same shall be indicated in the offer as an optional price.
- b) Mean Time Between failures (MTBF) shall be greater than 40000 running hours. All components of VFD shall be considered for MTBF calculations
- c) The vendor shall confirm that supply of spares and services shall be rendered for a period of 10 years after commissioning.

26. Maintenance manuals/Documentation to be given after Order Placement:

- a. Erection, Commissioning and Maintenance manuals - 10 Copies
- b. All drawings for approval
- c. 1 no. CD ROM consisting of final drawings and documentation as mentioned above.
- d. Test and guarantee certificates.
- e. Complete Bill of Material (itemwise) for the equipment supplied.

27. Confirmations/Deviations to Specification :

Point-wise confirmation to this to be given along with offer. Deviations if any, shall be indicated separately. If there are no deviations to the specifications, supplier shall mention the same explicitly. A reply from vendor stating that "Equipment will generally meet the specifications" will not be accepted by BHEL.

Clause-wise Confirmation of all Clauses Cl. 1) to 26) of Specification, Data Sheets and Annexure 1-4 shall be furnished in the format below.

Cl.No.	Page No.	Confirmation / Deviation	If Deviation, Details	Remarks, if any



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DATA SHEET – VFD SYSTEM
(To be filled in by supplier and attached along with offer)

Sl.No	Description	Unit	Specification requirement	Vendor's Details
1.0	Type of Drive		IGBT Based PWM Controlled. AFE Converter with Two(2) Inverters Provided with provision for isolation of each inverter from DC Bus. Confirm	Yes/No
2.0	Manufacturer Name OEM/ Authorised Representative of OEM		* If representative, authorization certificate from OEM attached	Yes/No
3.0	Application		Test Facility	--
4.0	Type of Motor		Squirrel Cage Induction Motor	--
5.0	Rating of Motor M1		1000 KW, 6.6KV,3Ph,50Hz	--
6.0	Rating of Motor M2		1000 KW, 690V,3Ph,50Hz	--
7.0	Ambient Temperature	DegC	45 deg C	--
8.0	Power Supply System			
	a) Input Supply to VFD System		415V, 3 Ph, 50 Hz	--
	b) Variation in Voltage		+10%, -15%	--
	c) Variation in Frequency		+/- 5%	--
	d) Combined Voltage & Frequency variation		+/- 10%	--
	Location of VFD Panels		Indoor	--
9.0	VFD System Offered :			
	(1) VFD Panels		*	
	a) Type No.			
	b) Rated Output Power at site ambient	MW	1.2 MW (Minimum)	
	c) Rated Output Voltage of Inverter-1 through output trf.	Volts	6.6 KV	
	d) Rated Output Voltage of Inverter-2	Volts	690 V	
	d) Rated Continuous Current at 40 deg C temperature (Calculation to be provided)	Amps		
	e) VFD suitable for Std Duty Class I as per IEC 146		Confirm	Yes/No

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Sl.No	Description	Unit	Specification requirement	Vendor's Details
	f) VFD suitable for site ambient temperature		Confirm	Yes/No
	g) Dimensions		LxBxH (Metres)	
	h) Type of Cooling		Air Cooled	Yes/No
	i) Degree of Protection		IP 42	Yes/No
	j) Power Loss Ride Through Time	Secs	2	
	k) Auto restart after power loss		Yes	Yes/No
	l) Kinetic Buffering	Secs	2	Yes/No
	m) Soft Start		Yes	Yes/No
	n) Catch on Fly		Yes	Yes/No
	o) Accelerate/Decelerate time		*	
	(2) Input Transformer		As per Annexure-1	Yes/No
	(3) Output Transformer To be suitably selected for working with a sine filter at its input		As per Annexure-1	Yes/No
	(4) Sine Wave Filter To be suitably designed for operation with the selected output transformer.		Confirm	Yes/No
10.0	Switching Frequency		> 2 KHz	
11.0	VFD System Efficiency including transformers			
12.0	Harmonic Limitation			
	1) Voltage Harmonics		As per IEEE 519	
	a) Source side			
	b) Load side			
	2) Current Harmonics			
	a) Source side			
	(i) 5 th		Maximum 30%	
	(ii) 7 th		Maximum 20%	
	(iii) 11 th		Maximum 10%	



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ANNEXURE – 1 – TRANSFORMER

Input/Output Transformers shall be in accordance with IS2026 and other relevant standards.

All accessories shall be provided confirming to IS 3639. The following fittings and accessories shall be provided for each transformer. Auxiliary Supply for Transformer shall be derived from Input Feeder to VFD System. Paint for Transformer and accessories shall be Epoxy based Shade 631 of IS 5. Transformer Alarms and Trips shall be annunciated at the VFD Panel with 6-Element Flag Relays for each Input & Output Transformer.

Alarms – Trf Oil Temp/Level Alarm, Winding Temp Alarm, Bucholz Alarm,
Trip – Trf Oil Temp Trip, Winding Temp. Trip, Bucholz Trip.

<u>SL.NO</u>	<u>DESCRIPTION</u>	<u>QTY</u>
01.	Oil filling hole with cover	1
02.	Conservator with sump & drainvalve with plug/cover plate. The Breather shall be mounted at a height less than 1600 mm from the ground.	1
03.	a) Magnetic Oil level gauge(Dial type) with minimum and maximum filling level markings. It should have two independent electrically insulated low level alarm contacts suitable for 220V DC. The oil level at 30 deg C shall be marked on the gauge. Contact suitable for 220V DC.	1
	b) Prismatic oil level gauge	1
04.	Thermometer pockets	1
05.	Air release plug on tank cover	1
06.	Lifting lugs	1 SET
07.	Top filter valve	1
08.	Dehydrating breather with Silicagel and oil seal	1
09.	Off circuit tap changing switch on tank cover with tap position indicator, locks and handle.	1
10.	Rating and terminal marking stainless steel/anodised aluminum plate, with details etched in MKS & SI units.	1
11.	Earthing terminals without lugs suitable for connecting 50x6 mm galvanized mild steel flat.	2
12.	Diagram plate	1
13.	Drain cum bottom filter valve	1
14.	Base channel with towing holes/lugs	2

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<u>SL.NO</u>	<u>DESCRIPTION</u>	<u>QTY</u>
15.	Double diaphragm explosion vent with sight glasses and equaliser pipe connection to conservator.	1
16.	Pressure Relief Valve with Trip Contacts (PRV)	1
17.	Four Jacking Pads to enable transformer with oil to be raised or lowered using hydraulic or screw jacks.	1 SET
18.	Manufacture's name plate (stainless steel)	1
19.	Bi-directional rollers + Bi-directional skids	1 SET
20.	Detachable radiator with bottom drain plug, top air release plug and top & bottom shut off valve.	1 SET
21.	Buchholtz relay should be of double float type with testing & sampling cocks, alarm and trip contacts and one isolating valve on conservator side	1 SET
22.	150mm dial type oil temp. Indicator and winding temp. Indicators with max. pointer with alarm and trip contacts. Contacts suitable for 220V DC. Indicator accuracy $\pm 2\%$. Alarm and trip points to be adjustable. Full scale temp. 240 deg C. Least count 2 deg C. Oil / Winding temp. Indicators should be provided with resetting device.	1 SET
23.	Cable glands & lugs Cable sizes shall be informed at the time of drawing finalisation. Cable lugs shall be of tinned copper for crimping to stranded aluminium conductor cable. Cable glands will be of double compression type.	1 SET
24.	Marshalling box (protection class IP55 and IS 2147) epoxy painted. Should be vermin, weather, dust proof. Terminal connector of control cable should be DOWELL make or equivalent. 20% extra spare terminals reqd. All TBs to be complete with insulating barriers, clip on type terminals suitable to 2.5 sq mm stranded copper wire. The marshaling box and temperature indicators shall not be mounted at a height greater than 1600 mm from the ground level. The box shall be tank mounted with sloping roof. All incoming cables shall enter from bottom. Sheet steel to be 1.6 mm thick. Thermostatically Controlled space heaters shall be provided.	1 No
25.	Inspection openings on tank with handles	2 Nos
26.	Remote WTI- For Remote Control Panel It shall not be a repeater dial of Local WTI	1 No.

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DATA SHEET - TRANSFORMER

Filled in Data Sheet (Separately for Input and Output Transformer) shall be submitted with offer. Calculations for Selection of Input and Output Transformer Ratings shall be submitted.

If there are special features like screen, the same shall be mentioned explicitly. The construction Features of 2 Winding Transformer to be described.

- 1) Manufacturer's Name and address :
- 2) Service Class / KVA rating :
- 3) Rated Voltage
 - a) HV Winding KV :
 - b) LV Winding KV :
- 4) Rated frequency :
- 5) Number of phases :
- 6) Connections
 - a) HV Winding :
 - b) LV Winding KV :
- 7) Connection symbol :
- 8) Type of cooling :
- 9) Tap changing equipment
 - a) Manufacturer :
 - b) Type :
 - c) No of steps :
 - d) Tap range % to % :
- 10) Guaranteed positive sequence impedance at 75 deg C with 100% rating
 - a) Principal tap :
 - b) Maximum tap (Approx) :

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- 11) Temp. rise over an ambient of 50 deg C
 - a) Top oil deg C :
 - b) Winding (by resistance measurement method deg C) :
- 12) Guaranteed losses at rated voltage on principal tap and at rated current rated frequency:
 - a) No load loss KW
 - b) Copper loss at full load and 75 deg C KW
- 13) Withstand time for three phase short circuit at terminals (sec.) :
- 14) No load current at rated voltage and rated frequency (Amps) (Approx) :
- 15) Insulation level
 - a) Separate source power frequency voltage withstand
 - i) HV Winding (KV rms) :
 - ii) LV Winding (KV rms) :
 - iii) HV Bushing :
 - iv) LV Bushing :
 - v) Neutral Bushing :
 - b) Induced over voltage withstand
 - i) HV Winding (KV rms) :
 - ii) LV Winding (KV rms) :
 - c) Full wave lightning impulse withstand
 - i) HV Winding (KV) :
 - ii) LV Winding (KV) :
 - iii) HV Bushing :
 - iv) LV Bushing :
 - v) Neutral Bushing :



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d) Switch impulse withstand voltage

i) HV Winding (KV) :

ii) LV Winding (KV) :

iii) HV Bushing :

16) Regulation at full load at 75 deg C

a) At unity power factor (percent) :

b) At 0.8 power factor (percent) :

17) Terminal arrangement

a) High Voltage :

b) Low Voltage :

c) LV Neutral :

d) HV Neutral :

18) Over excitation withstand time (sec)

a) 120% :

b) 150% :

19) Bushing

a) High Voltage

i) Manufacturer :

ii) Type :

iii) Minimum creepage distance(mm) :

b) Low Voltage

i) Manufacturer :

ii) Type :

iii) Minimum creepage distance(mm) :



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c) Neutral

i) Manufacturer :

ii) Type :

iii) Minimum creepage distance(mm) :

20) Proposed method of transformer shipment :

21) Total quantity of oil (litres) required for first filling :

22) Is vacuum filling required, if so, state absolute pressure :

23) Efficiency at 75 deg C at unity power factor

a) At full load (percent) :

b) At 3/4 full load (percent) :

c) At 1/2 full load (percent) :

24) Approximate dimensions

a) Tank enclosure (mm) :
L x B x H

b) Overall L x B x H (mm) :

25) Untanking height (mm)

26) Approximate weight

a) Core and winding (Kg) :

b) Tank cover (Kg) :

c) Tank fitting (Kg) :

d) Oil (Kg) :

e) Total weight (Kg) :



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- 27) Despatch details (Kg)
- a) Approximate mass of heaviest package (Kg) :
 - b) Approximate dimensions of largest package
 - i) Length (mm) :
 - ii) Breadth (mm) :
 - iii) Height (mm) :
- 28) Reference standards :
- 29) Type of Construction (Core/Shell) :
- 30) Thermal time constant (Hours) :
- 31) Magnetizing inrush current (Amps) :
- 32) No load current at rated frequency and at(Approx)
- i) 90% voltage (Amps) :
 - ii) 100% voltage (Amps) :
 - iii) 110% voltage (Amps) :
- 33) Power factor of no load current :
- 34) Zero sequence impedance at principle tap :
- 35) Capacitance between winding and to earth (micro farads) :
- 36) Percentage reactance at rated current and frequency and at
- i) Principal tap :
 - ii) Maximum tap :
 - iii) Minimum tap :



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37) Off circuit tap changer details

a) Ratings

- i) Rated voltage :
- ii) Rated current :
- iii) Step voltage :
- iv) Numbers of steps :

38) Radiator

- i) Overall dimensions lxbxh (mm) :
- ii) Total weight with oil (Kg) :
- iii) Total weight without oil (Kg) :
- iv) Type of mounting :
- v) Thickness of Radiator tube(approx) :
radiator sheet steel (approx)

39) Weight of Transformer

- a) Core (Kg) (approx) :
- b) Windings
 - i) HV (Kg)(approx) :
 - ii) LV (Kg) :
- c) Insulation (Kg)(approx) :
- d) Tank/enclosure and fittings (Kg) :
- e) Oil (kg) :
- f) Untanking weight (Heaviest weight) (Kg) :
- g) Total weight (Kg) :



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40) Dimensions

a) Tank enclosure (mm) :
L x B x H(approx)

b) Overall L x B x H (mm) :

41) Shipping details

a) Weight of heaviest package (Kg) :

b) Total shipping weight (Kg)(approx) :

c) No. of packages :

d) Dimensions of largest package :
(mm) l x b x h

e) Parts detached for transport: conservator tank,;
radiator,eq.pipe,explosion vent etc.

42) Size of filter hose (mm) :

43) Core

a) Form of core :

b) Net core area (mm²) :

c) Type of joint between core and yoke :

d) Thickness of stamping (mm) :

e) Percentage silicon content (percent) :

f) Maximum flux density in core at
rated frequency and at

i) 90% voltage (Wb/m²) :

ii) 100% voltage (Wb/m²) :

iii) 110% voltage (Wb/m²) :

g) Type of core binding :



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44) Winding

a) Type of winding

i) HV :

ii) LV :

b) Current density at rated load

i) HV (A/mm²) :

ii) LV (A/mm²) :

c) Conductor area

i) HV (A/mm²) :

ii) LV (A/mm²) :

d) Maximum current density under short circuit

i) HV (A/mm²) :

ii) LV (A/mm²) :

45) Clearance

a) Minimum clearance between phase

i) In oil (mm) :

ii) In air (mm) :

b) Minimum clearance of HV winding to tank/enclosure (in oil, if applicable),(mm) :

c) Minimum clearance of HV winding to earth (In oil, if applicable),(mm) :

d) Clearance between core and coil (mm) :

e) Clearance between coils (mm) :



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46) Tank/enclosure details

- i) Side (mm) :
- ii) Bottom (mm) :
- iii) Cover (mm) :

47) Insulation levels

- | | HV | LV |
|-------------------------|----|----|
| i) Power Frequency : | | |
| ii) Lightning Impulse : | | |

48) Bushings

- | | HV | LV |
|--------------------------|-----------|-----------|
| i) Type : | Porcelain | Porcelain |
| ii) Rated Voltage : | | |
| iii) Lightning Impulse : | | |
| iv) Creepage distance : | | |
| v) Power Frequency : | | |

49) Magnetic Oil Level Gauge :
(Dial type) Size

- 50) List of deviations (if any) enclosed : YES / NO
enclosed with offer.
If no deviations please mention the same here.

NOTE : Under Sl. No 19 (c) of this data sheet the neutral bushing if applicable will be enclosed in a box with adequate clearances on top of transformer tank. No external cable connections will be taken from it. Adequate insulation level should be provided for this isolated neutral.



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ANNEXURE - 2

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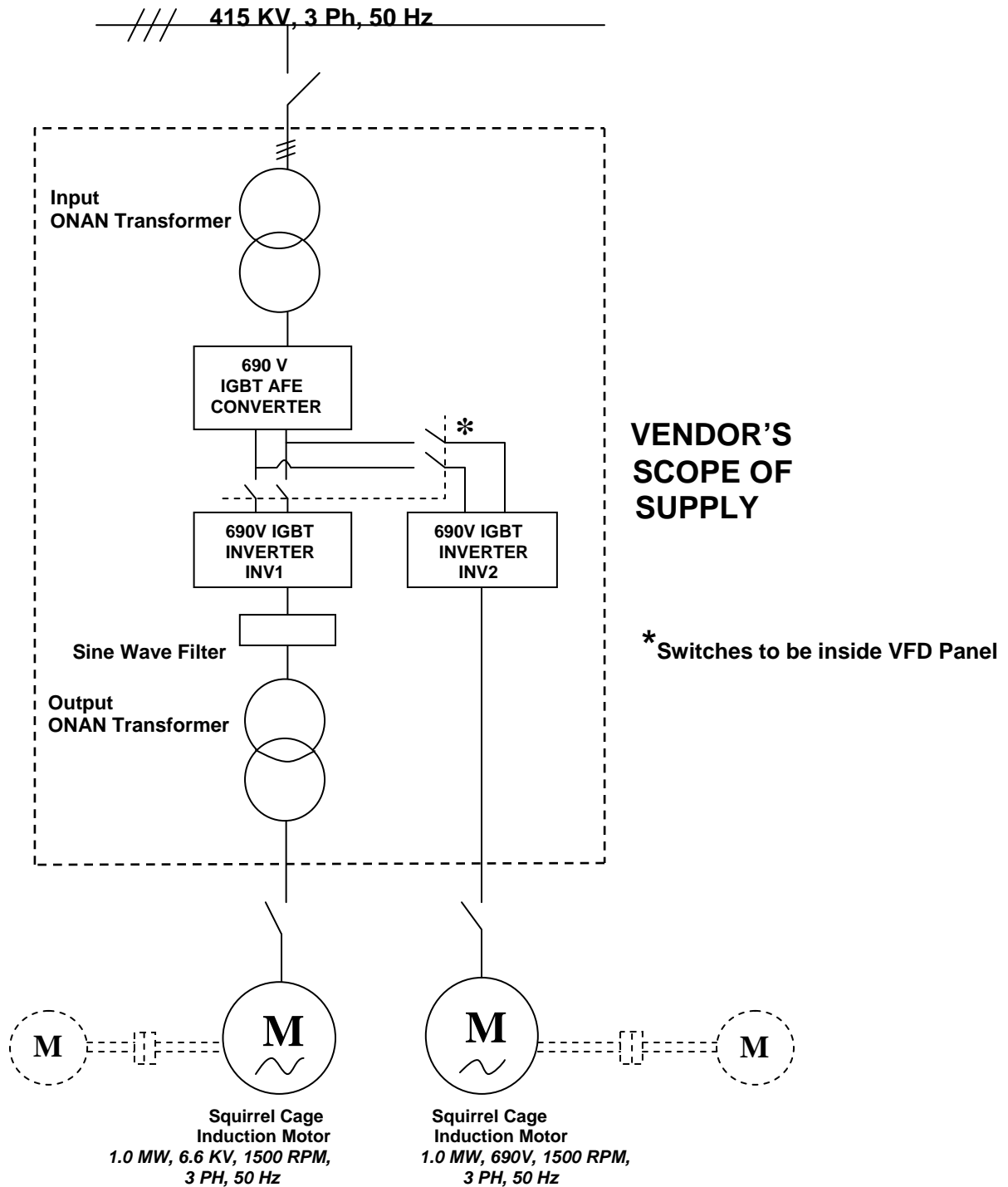


FIG-1 : SINGLE LINE DIAGRAM



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ANNEXURE – 3

MODES OF OPERATION : (Refer Annexure – 2 for Single Line Diagram)

There shall be separate controllers for the Active Front End (AFE) Converter and also separate controllers for each of the Inverter Bridges. Both the Inverters will have the same DC Link.

It should be noted that both the motors fed from the Inverters are isolated and mechanically de-coupled. However, each of these machines is mechanically coupled to other motors. For all modes, the rotation of the motors is uni-directional.

The Inverters and AFE are sized such that full output power of 1.2 MW is obtained from each of the modes of operation as given below:

- (a) INV1 (Inverter-1) Motoring and INV2 (Inverter-2) Off.
- (b) INV1 in Regeneration and INV2 Off.
- (c) INV2 Motoring and INV1 Off.
- (d) INV2 in Regeneration and INV1 Off.
- (e) INV1 Motoring and INV2 in Regeneration.
- (f) INV1 in Regeneration and INV2 Motoring.

It should be noted that the case of both Inverters in Motoring or both in Regeneration is not applicable.

(A) DETAILS OF CONTROL IN SL (a) ABOVE :

- Loading to full torque only after a certain speed due to presence of Output Transformer.
- Control in Speed Mode with adjustable set point.
- Uni-directional rotation.
- Speed Regulation ± 1 rpm in steady state.
- Current Limit Active.
- Regeneration active to the extent of keeping speed regulated to ± 1 rpm of set point.
- ***Vendor to specify speed over which machine can be loaded to given rated torque.***



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(B) DETAILS OF CONTROL IN SI.(b) ABOVE:

- Loading to full torque only after a certain speed due to presence of Output Transformer.
- Regeneration with adjustable torque set-point (-ve) torque.
- Current limits and speed limits to be active.
- *Vendor to specify speed over which the regenerative torque set point (-ve) can be set at rated value.*
- On loss of mechanical power from prime mover, motor speed to come to zero.

(C) DETAILS OF CONTROL IN SI.(c) ABOVE:

- The control is same as in (A) above but loading to full load torque should be possible above 5% of rated speed (75 rpm). *Vendor to confirm.*

(D) DETAILS OF CONTROL IN SI. (d) ABOVE:

- The control is same as in (B) above but loading to full load torque should be possible above 5% of rated speed (75 rpm). *Vendor to confirm.*

(E) DETAILS OF CONTROL IN SI. (e) ABOVE:

- **INV1** in Motoring Mode and loading to full load torque only over a certain speed due to the presence of Output Transformer. Vendor to specify this minimum speed.
- Regeneration, if required, to be done only to keep speed regulation at ± 1 rpm of set speed.
- Current limits in Motoring and Regeneration to be active.
- Speed set point to be adjustable.
- **INV2** will be in regeneration with adjustable torque set point (-ve) with current and speed limits active.
- Full load torque loading over 5% of rated speed (75 rpm). *Vendor to confirm.*
- On loss of mechanical power from prime mover, motor speed to come to zero.



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F) DETAILS AS IN SL. (f) ABOVE:

- **INV1** in Regeneration Mode and loading to full load torque over minimum speed. Vendor to specify this speed.
- Current and Speed limits active.
- Adjustable torque set- point (-ve).
- On loss of mechanical power from prime mover, motor speed to come to zero.

- **INV2** will be in motoring mode and loading to full load torque to be possible over 5% of rated speed (75 rpm).
- Regeneration, if required, is to be done only to keep the motor speed regulated to ± 1 rpm of set speed.
- Speed set-point adjustable.
- Current and Speed Limits active.

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ANNEXURE – 4

PERFORMANCE AND PRE-QUALIFICATION CRITERIA:

01. The vendor shall be an Original Equipment Manufacturer (OEM). Only the OEM or their authorized dealers in India along with an authorization letter can submit offers. An authorized Representative/Dealer in India, cannot quote for the same equipment from more than one OEM.
02. The vendor should have already supplied and installed 3 nos. of similar rating 690V IGBT based VFD Drive Panels with Active Front End during the past 5 years and these must be operating satisfactorily for at least past one year. Detailed reference list including installations with details of rating, application, supply and commissioning dates, customer contact details where these VFDs have been supplied shall be provided along with offer.
03. The offer shall be only for Standard Cataloged Type No. from the manufacturer for the VFD Panels and not custom-made one. All the specifications should be supported by Standard Catalogs and Data Sheets of the manufacturer for the Type No. as specified in Data Sheet for VFD Panels Sl.9 (1) a).
04. Offer shall be for a new equipment and not for any refurbished / used equipment. All the parts used in the equipment shall also be new and not used / refurbished ones. A declaration to the above effect to be furnished.
05. Foreign OEM shall have Authorized Indian dealer(s) / representative(s) for After- sales service and support. The authorization letter for the dealer/ representative shall be provided with confirmation that after sales service support shall be provided by them.
06. The vendor or their authorized service representatives shall have trained engineers in India for commissioning & service for the offered equipment and shall be in a position to provide prompt after sales service and spares support for our installations.
07. The vendor shall be in a position to undertake AMC or provide service support for the equipment supplied, after the expiry of the warranty/ guarantee period either directly or through a service representative.
08. If required by BHEL, the vendor shall arrange for a demonstration of the equipment or a similar equipment operating in India.
09. The vendor shall furnish a comprehensive warranty for at least 12 months from the date of commissioning.

NOTE:

1. Pre-qualification will be carried out based on the details furnished by the vendor / feedback from their customers / inspection of the company / product if required by BHEL and at its sole discretion.

2. The Pre-qualification criteria are mandatory requirements and the technical bids will be evaluated only when the Pre-Qualification criteria are met.

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Bharat Heavy Electricals Ltd.,

(A Government of India undertaking)

Electronics Division

PB No.2606, Mysore Road, Bangalore-560026,India

Ph: +91-80-26742974 / 26998609

Fax: +91-80-26740138

General Terms & Conditions for Supply of Imported & Indigenous Capital Items (Two part bid)

Bidders are required to read the general terms & conditions carefully and submit their quotation covering all the points. Any order resulting from this enquiry shall be governed by the general terms and conditions listed below.

1. **TWO PART BID:** Quotation shall be submitted in two part bid i.e.

- a) **Techno-commercial i.e., Un-priced Bid:** Techno-commercial bid shall be submitted with complete description of the equipment, specification compliances to the enquired specification and all the commercial terms & conditions indicated in the **QUOTATION FORMAT (ANNEXURE - A / ANNEXURE - B)** preferably in the same format. Any other enclosure, which the supplier wishes to submit like product catalogue, technical literature etc., may also be submitted in a sealed envelope super scribed clearly as **“TECHNO-COMMERCIAL BID” with RFQ No. and DUE DATE.** Un-priced copy of price bid (without price) shall also be enclosed with the techno-commercial bid i.e. a copy of the price bid without prices.

Confirmation to BHEL specifications shall be indicated by the vendor in the respective columns provided in the purchase specification wherever applicable. Deviations to the specification / item description, if any shall be brought out clearly indicating **“DEVIATION TO BHEL SPECIFICATION”** without fail as a part of technical offer.

Compliance to Pre-qualification criteria (if applicable) shall also be enclosed with the Techno-commercial bid.

Manufacturer's name, their trade mark and brand if any, should be invariably mentioned in the tender and illustrative leaflets giving technical particulars etc., are to be attached to the tender to facilitate consideration of the offer.

b) **Price Bid :**

Price bid should contain basic unit prices, discount if any, applicable taxes & duties, packing & forwarding charges (if applicable), Freight & insurances (if applicable) FOB charge (if applicable) etc., in a sealed envelope super scribed clearly as **“PRICE BID” with RFQ No. and DUE DATE.** Installation, commissioning, start-up and training charges (if any) shall also be included in the price bid.

Please indicate the rates in both figures and words. However in case of difference / discrepancy, the rates indicated in figures shall be considered as correct.

Both these sealed envelopes [(a) Techno-commercial i.e., un-priced Bid and (b) Price Bids] shall be kept in a single sealed envelope and superscribed clearly with **RFQ No. and DUE DATE.**

2. The above sealed envelope (Tender) shall reach our office on or before the due date by **13:00 hrs.** Quotations are to be dropped in the tender box marked for the OPENING ON respective days i.e., MONDAY / WEDNESDAY / FRIDAY kept at BHEL-EDN's Reception area of our works with caption "CE, M&C, SC&PV, TSC, DEFENCE, TELECOM, CPD". Quotations also can be dispatched by Couriers / Registered post / FAX / e mail to the Purchase Executive indicated in the RFQ. Late Tenders i.e. Tenders received after due date & time are liable to be rejected.
3. The rates quoted against each item shall be in the same units stated in the enquiry. If the quotations are submitted in any other unit than specified, relationship between two sets of units must be furnished in the offer.
4. As far as possible, the quotations shall be free from corrections / overwriting. Corrections if any should be initialed with your seal and signature. Any typographical errors, totaling mistakes, currency mistakes, multiplication mistakes, summary mistakes observed in your priced bids, BHEL may consider whichever is beneficial to BHEL for evaluation.
5. Quotations are to be duly signed. Unsigned bids/offers are liable for rejection.
6. All the bidders or their authorized representatives (with authorization letter from their principals) can witness opening of techno-commercial bid on the due date.
7. After evaluation of techno-commercial bids, price bids of only those which are technically & commercially accepted, will be opened on a subsequent date, which will be intimated to the concerned in advance for witnessing of price bid opening.
8. The quantities in each item to be purchased may vary from quantities enquired according to the actual requirement at the time of placing the purchase order. Quantity discount if any should be mentioned in your offer.
9. BIDDERS (for indigenous purchase) shall indicate clearly Excise duty, Education cess, Sales Tax/VAT, Octroi, Entry tax, Service Tax as applicable for the quoted items. In the absence of clarity of these, any claim at a later date will not be entertained. Any changes in Taxes and duties after award of the contract will not be considered except such are those, which are imposed by Govt., notification within the contractual delivery. Seeking price amendments for change in Excise duty due to crossing of turnover limits will not be considered under any circumstances.
10. **TOTAL COST TO BHEL:** Purchase order will be placed on the lowest bidder (L1) only among the technically & commercially accepted offers. Lowest Bid (L1) is determined on the basis of the total cost to BHEL.

(a) FOR FOREIGN PURCHASE:

Total cost to BHEL = Total basic value in foreign currency + FOB charges (if any) + Packing & Forwarding charges (if any) + Cost Insurance Freight (CIF) + Basic Custom Duty (BCD) + Counter Veiling Duty (CVD) + Educational Cess + Special Additional Duty (SAD) + Entry TAX + Service TAX (if applicable) + Loading factors for deviations to commercial terms & conditions.

Note: Exchange rate ruling on the date of Tender opening (Techno-commercial / un-priced Bid) will be considered for converting foreign currency to Indian currency. Exchange rates published in Economic Times (TT selling) will be considered.

(b) FOR INDIGENOUS PURCHASE:

Total cost to BHEL = Total basic value + Packing & forwarding charges + Excise duty Education cess + sales Tax/VAT + Octroi + Exit/Entry tax + Freight & Insurance + Service Tax (if applicable) + Loading factors for deviations to commercial terms & conditions.

11. FIRM PRICE: Rates quoted should be firm and no enhancement in the rates and changes in the techno-commercial terms will be allowed once the quotation is accepted and order is placed.

If Installation & Commissioning is in supplier's scope, then the price shall remain FIRM till commissioning & handing over of the complete system.

12. TERMS OF PAYMENT:

(a) FOR FOREIGN PURCHASE:

Payment will be made against “**SIGHT DRAFT**” on presentation of documents to our bankers. Payment through LC is also made subject to loading factors as per **Clause 26 (Ai)**.

The payment terms are as follows:

- a) 75 % against complete dispatch documents i.e. AWB / BOL, Invoice, Packing list, Warrantee certificate, Nil shortage certificate, Certificate of country of origin etc.
- b) 15 % on successful installation, commissioning and start-up trials.
- c) 10 % on submission of Performance Bank Guarantee (PBG)
- d) If PBG is not submitted by the vendor, then the final 10% payment will be made against submission of supplementary invoice after warranty period + 6 months of claim period.

(b) FOR INDIGENOUS PURCHASE:

- a) 90% within 30 days from the date of receipt of equipments & balance 10% against submission of PBG (where commissioning is NOT involved).
- b) 75% within 30 days from the date of receipt of equipments, 15% after the successful installation, commissioning & start-up trials & balance 10% against submission of PBG (wherever commissioning is involved).
- c) If PBG is not submitted by the vendor, then the final 10% payment will be made against submission of supplementary invoice after warranty period + 6 months of claim period.

13. ADVANCE PAYMENT: Quotations with payment terms of “**Advance**” or “**Inland Letter of Credit**” will not be considered and such offers are liable for rejection commercially.

14. PENALTY: Failure to supply the item within the delivery date specified in the purchase order will make the supplier liable to an unconditional penalty of ½% (One half percent) of the basic value of the goods in arrears per week subject to a maximum of 10%.

If pre-shipment inspection is involved, date of issue of pre-shipment call by the vendor along with test certificates / test reports / certificate of conformance / calibration reports as proof of completion will be treated as date of dispatch for the purpose of penalty calculation.

In the absence of reports stated above, actual date of inspection will be considered as date of dispatch for penalty calculation.

- 15. PBG:** Performance Bank Guarantee (PBG) to be submitted as per the BHEL prescribed format given in **ANNEXURE - D / ANNEXURE - E** for 10% of the basic equipment value obtained from any BHEL member banks.

PBG shall be valid for 12 months from the date of commissioning or 18 months from the date of dispatch whichever is earlier. The PBG shall also have 6 months claim period from the date of dispatch / commissioning.

The Bank Guarantee shall be submitted directly to the concerned Purchase Executive by the issuing Bank with their forwarding letter.

- 16. WARRANTY:** Goods dispatched shall have warranty period of 12 months from the date of dispatch or as mentioned in the RFQ.

17. TERMS OF DELIVERY:

(a) FOR IMPORTED PURCHASE:

Price offered shall be for goods packed and delivered **F.O.B.** (named international Airport) including packing, forwarding, Handling, Ancillary charges like processing of Sight Draft, Letter of credit (L/C) if applicable, negotiation of bank documents, Export declaration, Certificate of origin etc.

Packing shall be Airworthy & Roadworthy, best suitable for trans-shipment and to prevent transit damages.

Vendors shall indicate the name of International Airport.

Note: Name of International Airport has to be selected from any one of the airports indicated in the table provided in **ANNEXURE - C** herewith.

(b) FOR INDIGENOUS PURCHASE:

Equipment shall be delivered on EX-EDN/BHEL, Bangalore basis, inclusive of packing & forwarding charges.

Packing shall be Road / Air / Rail worthy, best suitable for transshipment and to take care of transit damages.

Dispatch the consignments through EDN/BHEL approved transporters on Door Delivery basis furnished below.

1. M/s Awagaman Road Carriers Ltd., Bangalore. (AWG)
2. M/s BLR India pvt., Ltd., Bangalore. (BLR)
3. M/s Delhi Assam Roadways corporation Ltd., Bangalore. (DRL)
4. M/s Indo Arya Central transport Ltd., Bangalore. (IACT)
5. M/s Prakash parcel Services, Bangalore. (PPS)
6. M/s Road Carrier of India, Bangalore. (RCI)
7. M/s Union Roadways Ltd., Bangalore. (URL)

Small consignments can be dispatched through M/S First Flight Couriers Ltd.

Transit insurance shall be arranged by BHEL. Vendor shall intimate the dispatch details to BHEL immediately after effecting shipment, to arrange transit insurance accordingly.

18. DELIVERY REQUIREMENT: Equipment shall be delivered, as per the delivery schedule indicated in the RFQ.

19. VALIDITY: Quotation should remain valid for a period of **90 days** from the date of technical bid opening.

20. BHEL reserves the right to RE-FLOAT/REJECT/CANCEL the TENDER ENQUIRY (RFQ) without assigning any reason or cause thereof. Quotes received against this TENDER ENQUIRY are subject to and governed by all these terms and conditions. BHEL's decision will be final in awarding of the contract and binding on all vendors.

21. REVERSE AUCTION: BHEL reserves the right to resort to reverse auction / online Bidding before opening of price bid.

22. POST-ORDER REQUISITES:

- a) Pre-shipment inspection at vendor's works, if required, will be carried out by BHEL. Required assistance will have to be provided by the vendor at the time of pre-shipment inspection.
- b) Test certificates, Calibration certificates and warranty certificates as stipulated at the time of ordering shall be furnished.
- c) Items shall be dispatched by Air/Road/Sea worthy packing. Any damage and later rejection, due to poor / improper packing shall be to supplier's account.
- d) Any damage/rejection should be made good or replaced immediately without any extra cost to BHEL.
- e) Wherever commissioning is involved, it shall be carried out by the vendor's qualified engineers. Scope of work includes installation, commissioning and start-up trials till satisfactory performance level is reached as certified by BHEL.
- f) BHEL will not be responsible for any loss, damage or injuries to vendor's personnel sustained during installation / commissioning / start-up trials. Vendor shall ensure compliance with all statutory requisites as laid down by local bodies, state & Central Government.
- g) Performance Bank Guarantee to be executed on Rs.100/- non-judicial stamp paper as per BHEL prescribed format as given as Annexure (c).

23. Any dispute arising out of this contract shall be referred to the sole arbitration of Head of Materials Management, Control Equipment, BHEL, EDN, Bangalore or any other officer nominated by him and his decision shall be final and binding on the parties. The venue of the arbitration in all cases shall be Bangalore.

24. All suits in respect of the above lie in the court of Jurisdiction of Bangalore (India) only.

25. Equipment shall comply with the standard requirements of ISO 14001 & OHSAS 18001.

26. REGRET LETTER: In case, the supplier is unable / not willing to quote (for BHEL's registered vendors), a letter of regret shall be sent.

27. LOADING FACTORS:

Loading factors as detailed below will be added to the quoted price (basic) to evaluate the lowest quote for non compliance of BHEL standard commercial terms.

A(i). For non compliance of standard Terms of payment (For Foreign Purchase Orders)

SI. No.	BHEL standard term	If you quote	Loading factor in % for non-compliance
1	100% against "SIGHT DRAFT" on presentation of dispatch documents to our Bankers.	(a) 100% Through Letter of Credit (LC)	(a) 3.50 %
2	90% against "SIGHT DRAFT" + 10% against PBG (wherever PBG is involved)	(b) 90% Through Letter of Credit (LC)	(b) 2.25 %
3	75% against "SIGHT DRAFT" + 15% after commissioning + 10% against PBG (wherever commissioning & PBG is involved)	(c) 75% Through Letter of Credit (LC)	(c) 1.875 %

A(ii). For non compliance of standard Terms of payment (For Indigenous Purchase Orders)

SI. No.	BHEL standard term	If you quote	Loading factor in % for non-compliance
1	100% within 30 days from the date of receipt (credit payment)	Payment through bank	2 % x percentage quoted through bank
		Payment against proforma invoice	1.25 % x percentage quoted through proforma invoice
2	90% within 30 days from the date of receipt + 10% against PBG (wherever PBG is involved)	Payment through bank	2 % x percentage quoted through bank
		Payment against proforma invoice	1.25 % x percentage quoted through proforma invoice
		100% within 30 days from the date of receipt & PBG	Nil
3	75% within 30 days from the date of receipt + 15% after commissioning + 10% against PBG (wherever commissioning & PBG is involved)	Payment through bank	2 % x percentage quoted through bank
		Payment against proforma invoice	1.25 % x percentage quoted through proforma invoice
		100% within 30 days and after commissioning &	Nil

		PBG	
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B. For non compliance of Penalty clause:

Sl. No.	BHEL standard term	If you quote	Loading factor for non-compliance
1	Penalty of 0.5% per week subject to max. of 10% on the basic value of the items not supplied /delayed	Not agreed.	10 %
		5% max., agreed.	5%
		Other than the above.	10% - (minus) agreed max. %

C. For non compliance of Performance Bank Guarantee (PBG):

Sl. No.	BHEL standard term	If you quote	Loading factor for non-compliance
1	PBG for 10% of the basic material cost shall be furnished in the BHEL prescribed format.	Not agreed.	10 %
		5% agreed.	5 %
		Other than the above.	10% - (minus) agreed max. %

D. For Non conformance to delivery requirement indicated in the RFQ:

Sl. No.	BHEL standard term	If you quote	Loading factor for non-compliance
1	Delivery requirement as indicated in the RFQ in number of weeks from the date of issue of PO or from the document approval	Not agreed for the stipulated delivery in the enquiry	1 % per week up to max. of 10% for the difference in period

E. For non compliance of Warranty:

Sl. No.	BHEL standard term	If you quote	Loading factor for non-compliance
1	12 months from the date of dispatch or as indicated in the RFQ	Not agreed.	6%
		Less than 12 months or as indicated in the RFQ	0.5 % per month for the difference in period

ANNEXURE - A

TECHNICAL BID (TO BE ENCLOSED WITH TECHNO-COMMERCIAL BID)

(for Foreign Purchase Orders)

Sl. No.	Particulars	Bidder's confirmation
1	Price basis: Firm i.e., from the date of PO to completion of supply [Price Variation Clause (PVC) not acceptable]	Acceptable / Not acceptable
2	Terms of Payment: Against "SIGHT DRAFT" on presentation of documents to our bankers. (a) 90 % is payable on negotiation of complete set of original documents & balance 10% against submission of PBG (where commissioning is NOT involved). (b) 75 % is payable on negotiation of complete set of original documents, 15% after satisfactory commissioning & balance 10% against submission of PBG (wherever commissioning & PBG is involved). (c) Deviation if any please specify Note: Refer clause 12 above .	(a) Acceptable / Not acceptable (b) Acceptable / Not acceptable (c)
3	BHEL's penalty clause: (a) Delay in delivery as per PO delivery date will result in penalty of 0.5 % per week subject to maximum of 10% on the value of the items not supplier/delayed. (b) Deviation if any Please specify	(a) Acceptable / Not acceptable (b)
4	Performance Bank guarantee: PBG for 10% of the basic material cost shall be furnished in the BHEL prescribed format as detailed in clause 15 .	Yes / No
5	Terms of delivery: (a) F.O.B international Airport/Seaport as per clause 17 Indicate name of International Airport/Seaport (b) Deviation if any Please specify	(a)Acceptable / Not acceptable (b)
6	Warranty: (a) 12 months from the date of dispatch (b) Deviation if any Please specify	(a)Acceptable / Not acceptable (b)
7	Delivery period: Indicate number of weeks from the date of issue of Purchase order	_____Weeks
8	Validity: (a) Quotation should remain valid for a period of 90 days from the due date (b) Deviation if any Please specify	(a) Acceptable / Not acceptable (b)

Signature of renderer / with seal

ANNEXURE - B

TECHNICAL BID (TO BE ENCLOSED WITH TECHNO-COMMERCIAL BID)

(For Indigenous Purchase Orders)

Sl. No.	Particulars	Bidder's confirmation
1	Price basis: Firm i.e., from the date of PO to completion of supply [Price Variation Clause (PVC) not acceptable]	Acceptable / Not acceptable
2	Excise duty: If applicable indicate %.	Applicable / Not applicable ED:_____%
3	Sale tax: If applicable indicate %	Applicable / Not applicable (a) VAT_____ % (b) CST_____ % against form C
4	Payment terms: (a) 90 % basic + 100% taxes, duties & freight charges within 30 days from the date of receipt & balance 10% against submission of PBG (where commissioning is NOT involved) (b) 75 % basic + 100% taxes, duties & freight charges within 30 days from the date of receipt, 15% after satisfactory commissioning & balance 10% against submission of PBG (wherever commissioning & PBG is involved). (c) Deviation if any please specify Note: As per clause 12	(a) Acceptable / Not acceptable (b) Acceptable / Not acceptable (c)
5	BHEL's penalty clause: (a) Delay in delivery as per PO delivery date will result in penalty of 0.5 % per week subject to maximum of 10% on the value of the items not supplier/delayed. (b) Deviation if any Please specify	(a) Acceptable / Not acceptable (b)
6	Performance Bank guarantee (PBG): PBG for 10% of the basic material cost shall be furnished in the BHEL prescribed format as per clause 15 .	Yes / No
7	Terms of delivery: (a) Ex EDN / BHEL, Bangalore (Free delivery to EDN/BHEL Bangalore including packing & forwarding charges) (b) Deviation if any Please specify	(a)Acceptable / Not acceptable (b)
8	Warranty: (a) 18 months from the date of dispatch or 12 months from the date of commissioning (b) Deviation if any Please specify	(a)Acceptable / Not acceptable (b)
9	Delivery period: Indicate number of weeks from the date of issue of Purchase order	_____Weeks
10	Validity: (a) Quotation should remain valid for a period of 90 days from the due date (b) Deviation if any Please specify	(a) Acceptable / Not acceptable (b)

Signature of renderer / with stamp

ANNEXURE - C

LIST OF INTERNATIONAL AIRPORTS

Sl. No	Country	Air Ports
1	Austria	Vienna, Linz, Graz
2	Australia	Sydney, Melbourne, Perth
3	Belgium	Antwerp, Brussels
4	Canada	Toronto, Montreal
5	China	Shangai
6	Cyprus	Lamaca
7	Czech Republic	Prague (Via Frankfurt)
8	Denmark	Copenhagen
9	Egypt	Cairo
10	Finland	Helsinki
11	France	Paris (Rossy), Lyon
12	Germany	Darmstadt, Manihem, Nurnberg, Hamburg, Stuttgart, Munich, Koln, Dusseldorf & Hannover, Frankfurt, Berlin
13	Hongkong	Hongkong
14	Italy	Rome, Milan, Turin, Bologna, Florence
15	Ireland	Dublin
16	Isrel	Telaviv
17	Japan	Tokyo, Osaka
18	Malaysia	Kaulalampur, Penang
19	Neatherlands	Amsterdam, Rotterdam
20	Newzealand	Auckland
21	Norway	Oslo
22	Oman	Muscat
23	Philiphines	Manila
24	Romania	Bucharest
25	Russia	Moscow
26	Saudi Arabia	Riyad
27	Singapore	Singapore
28	Slovakia	Bartislowa
29	South Africa	Johannesburg, Durban
30	South korea	Kimpo
31	Spain	Barcelona
32	Sweden	Stockholm, Gothenburg, Milano
33	Switzerland	Basle, Zurich, Geneva
34	Taiwan	Taipei
35	U.A.E.	Dubai
36	U.K.	Landon (Heathrow), Newcastle, Oxford, Cheltham, Bristol, Wellingborough, Birmingham, East Midland, Manchester, Leeds, Glasgow.
37	U.S.A.	Newyork, Chicago, Sanfrancisco, Los Angeles, Atlanta
38	Ukraine	Kiev

ANNEXURE-D

PERFORMANCE BANK GUARANTEE
(FOR FOREIGN PURCHASE ORDERS)

BANK NAME AND ADDRESS

Bharat Heavy Electricals Limited (BHEL),
Electronics Division,
PB No. 2606,
Mysore Road,
BANGALORE- 560 026
INDIA

Dear Sir,

Ref: CONTRACT PERFORMANCE GUARANTEE.

WHEREAS you have entered into a contract reference No PO NO. _____ with M/s _____ having its registered office at _____ for the supply of _____ as detailed in your purchase order No. _____ which is hereinafter referred to as "the said contract" and WHEREAS M/s _____ has undertaken to produce a Bank Guarantee for 10% (Ten Percent) of _____ the contract price amounting to _____ (_____) to secure its obligations to Electronics Division, BHEL having its registered office at New Delhi for the performance of the contract including the warranty of the equipment supplied, We _____ Bank, _____ hereby expressly, irrevocably and unreservedly undertake and guarantee as principal obligors on behalf of M/s _____ that in the event Bharat Heavy Electricals Ltd. (B.H.E.L.) declares to us in writing that M/s _____ has not fulfilled any obligation according to the contractual obligation of the said contract, to pay you on demand and without demur to Bharat Heavy Electricals Ltd., Electronics Division , Mysore Road, P.B.No. 2606, Bangalore-560 026, India an amount of _____ (in words _____) subject to as may be determined below:

- 1) Notwithstanding any right M/s. _____ may have directly against you or any disputes raised by M/s _____, Your written demand shall be conclusive evidence to us that repayment is due under the terms of the said contract and shall be binding on us.
- 2) We shall not be discharged or released from this undertaking and Guarantee by any arrangements, variations made between you and M/s. _____ with or without our consent and Knowledge or by any alterations in the obligations of M/s. _____ by any forbearance whether as to payment, time, performance or otherwise.
- 3) This guarantee shall remain valid until the end of twenty-four weeks after the close of the warranty period or until the same is reported by BHEL to us whichever is earlier.

- 4) We agree and undertake not to revoke this guarantee during its validity unless discharged in writing by you subject to the provision of clause (7) below.
- 5) This guarantee shall be a continuing guarantee subject to the foregoing and shall not be discharged by any change in the constitution of the Bank or M/s.
_____.
- 6) This guarantee shall be governed by and constructed in accordance with the Laws of India.
- 7) At any time _____ Bank may render this guarantee null and void by paying to Bharat Heavy Electricals Ltd. the full amount being _____
(in _____ words _____)

For and on behalf of Bank
by its Authorised Signatory

Note:

- (1) To be executed in INR 100 Non-Judicial stamp paper by any authorized Indian Bank.
- (2) To be submitted directly by banker to concerned executive in purchase dept., Please give BHEL address to banker.
- (3) Do not enclose with Bank document.
- (4) Any Modification & omissions to this are not permitted

ANNEXURE - E

PERFORMANCE BANK GUARANTEE
(FOR INDEGENOUS PURCHASE ORDERS)

THIS DEED OF GUARANTEE made and executed on the _____ day of _____(year), by the _____ (Bank), registered under the Companies Act 1956/Nationalised Bank constituted under the Banking Companies (acquisition and transfer of undertakings) Act constituted under the State Bank of India Act / Subsidiary Banks Act, having its registered / head office at _____ represented herein by its Branch Manager / authorised representative Sri. _____ & Sri. _____(Hereinafter called 'guarantor ' which term shall mean and include its successors and assigns)

IN FAVOUR OF BHARAT HEAVY ELECTRICALS LIMITED

_____ (Buyer's Name), a company registered under the companies Act, 1956 having its registered office at BHEL House at Siri Fort , New Delhi-100 049 and its Electronics Division at Mysore road, Bangalore-26 (hereinafter referred to as the 'Company' Which term shall include its successors and assigns):

Whereas the company has placed an order on _____ (State the name of the company / firm and its address) (hereinafter referred to as the 'Supplier' which term shall mean and include its liquidators, successors and assign) for the supply of system under order / Contract No _____ Dt _____.

AND WHEREAS the supplier has agreed to supply the materials and carryout the works as detailed and in accordance with the terms set out in the said order/contract.

AND WHEREAS the company is not required to pay to the supplier a sum of Rupees _____being the 10% of the value of the goods supplied / Works performed / Services rendered under the said order / contract between the supplier and the company, till the company is satisfied with the mechanical Warranties and the performance standards stipulated in the said order / contract between the company and the supplier has been duly fulfilled, except against a Bank Guarantee for the said sum of Rs _____ in favour of the company by reputed Bank, in which case the company has agreed to make payment to the supplier of the said sum of Rupees _____ being (...%) of the value of the goods supplied / Works performed / Services rendered under the agreement between the supplier and the company and the Guarantor has at the request of the supplier, agreed to furnish this Guarantee subject to the terms and conditions stated below:

NOW THIS DEED WITNESSES THAT IN pursuance of the above said agreement, the guarantor hereby agrees and covenants With company is as follows :-

- 1) That during the period this contract of Guarantee remains effectual, the guarantor shall be liable in respect of the amount due and owing to the company in respect of the payments to the extent of Rs _____ (in words) _____ against any loss or damage caused to or suffered by the company by reasons of any breach of the terms of the said order / contract / Agreement by the supplier.
- 2) The Guarantor hereby undertakes to pay the amounts due and payable under this guarantee without any demur, merely on demand from the company intimating that the amount claimed is due by way of loss or damage caused to or suffered or would be caused or suffered by the supplier of any terms contained in the said order / contract. Any such demand made on the

guarantor shall be conclusive as regards the amount due and payable by the Guarantor irrespective of the fact whether the Contractor / supplier admits or denies.

- 3) The Guarantor further agrees that the agreement herein contained shall remain in force and effect till all the supplies to be made / Works to be performed / Services to be rendered under the said order / contract / agreement are completed to the entire satisfaction of the company or till company certifies that the terms and conditions of the said order / contract / agreement have been fully and properly carried out by the said supplier and accordingly discharges the Guarantee. Unless a demand or claim under this guarantee is made on the guarantor in writing on or before the expiry of claim period indicated in clause 6 below , the guarantor shall be discharged from all the liability under this guarantee thereafter.
- 4) The guarantor further agrees with the company that the company shall have the fullest liberty without the consent of the guarantor and without effecting in any manner the obligations of the guarantor hereunder to vary any of the terms of the said order / contract / agreement or extend the time of performance by the said supplier from time to time or refrain from exercising the power exercisable by the company against the said supplier or to forebear or omit to enforce any of the terms and conditions relating to the said order / contract / agreement, and the guarantor shall not be relieved of its liability in whole or in part , by reason of any act, commission or forbearance on the part of the company or by reason of any such variation, or extension being granted to the said supplier or by reason of any such matter or thing whatsoever which under the law relating to sureties would but for this provision have effect of so relieving the guarantor.
- 5) The guarantor undertakes not to revoke this guarantee during its currency except with the previous consent of the company in writing.
- 6) Notwithstanding anything herein above contained, the liability of the guarantor under these presents is restricted to Rs_____. The guarantee shall be in force till its expiry on _____ unless a demand is made on the guarantor within SIX months from the date of expiry, all the liability of the guarantor under this guarantee shall stand fully discharged. The decision of the claimant in regard to breach of contract is final and binding on the Bank.

IN WITNESS whereof, the guarantor, acting through it authorised representative has executed this deed of Guarantee on the day, month and year first above written.

(Seal of the Bank to be affixed)

WITNESS

1.

2.

ANNEXURE - F

BHEL MEMBER BANKS

PBG SHALL BE ISSUED FROM THE FOLLOWING BANKS OR THEIR BRANCH OFFICES ONLY

State Bank of India, CAG Branch 10 th Floor, Vijaya Building Barakamba Road, NEW DELHI - 110 001	Deutsche Bank, Tolstoy Marg, NEW DELHI - 110 001
Canara Bank, 74, Janpath, NEW DELHI - 110 001	HDFC Bank Ltd, 5 TH floor, H T House, K G Marg, , NEW DELHI - 110 001
Punjab National Bank, 74 Janpath, NEW DELHI - 110 001	CITI Bank NA, Jeevan Vihar Building, Sansad Marg NEW DELHI - 110 001
Bank of Baroda, Corporation Banking Branch, 11 th Floor, BOB Building, Sansad Marg, NEW DELHI - 110 001	Standard Chartered Bank, H2, Block Connaught Place NEW DELHI - 110 001
State Bank of Hyderabad, Surya Kiran Building, K G Marg, NEW DELHI - 110 001	ICICI Bank Ltd, ICICI Tower, Bisham Pitamah Marg, Pragati Vihar, NEW DELHI - 110 003
State \Bank of Mysore, Antrikash Bhawan, K G Marg, NEW DELHI - 110 001	IDBI Bank Ltd, 19 K G Marg, Surya Kiran Building, NEW DELHI - 110 001
State Bank of Mysore, Industrial Finance Branch, 18, Ramanashree Arcade,, M G Road, BANGALORE 0 560 001	HSBC Ltd, ECE House, 28K G Marg, NEW DELHI - 110 001
State Bank of Travancore, Travancore House, IF Branch, NEW DELHI - 110 001	
