**Electrical Engineering Department, Indian Institute of Technology Delhi**

Date: 29-04-2013

**NIQ for purchase of “Three-level Voltage Source Converter”**

Sealed quotations are invited for purchase of three in number “Three-level Voltage Source Converter” with the following specifications:

<table>
<thead>
<tr>
<th><strong>DC bus rating</strong></th>
<th>1000 V</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DC link capacitance</strong></td>
<td>Nominally around 3000 μF</td>
</tr>
<tr>
<td><strong>AC output voltage</strong></td>
<td>415 V</td>
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<tr>
<td><strong>AC output current</strong></td>
<td>35 A</td>
</tr>
<tr>
<td><strong>Output frequency</strong></td>
<td>50 Hz</td>
</tr>
<tr>
<td><strong>Switching frequency</strong></td>
<td>20 kHz</td>
</tr>
<tr>
<td><strong>Output power</strong></td>
<td>25kVA</td>
</tr>
<tr>
<td><strong>Type of cooling</strong></td>
<td>Forced air cooling (1 phase Fan)</td>
</tr>
<tr>
<td><strong>Snubbers for switch</strong></td>
<td>Required with proper design for proper function of system</td>
</tr>
<tr>
<td><strong>Thermal protection</strong></td>
<td>Required (set according to safe operation of devices)</td>
</tr>
<tr>
<td><strong>Gate driver specifications.</strong></td>
<td>Supply +15 V 0 V (nominal)</td>
</tr>
<tr>
<td></td>
<td>Supply current nominally less then 100mA</td>
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<td></td>
<td>Input signal voltage levels for on/off typically +15/0 V respectively</td>
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<tr>
<td></td>
<td>Input threshold voltage nominally 12.5 V (high), 4.5 V (low)</td>
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<tr>
<td></td>
<td><strong>Internally isolated grounds</strong></td>
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<td></td>
<td>14 A peak current driving capacity</td>
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<tr>
<td></td>
<td>Maximum average current of 200mA per leg (4 IGBT)</td>
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<td></td>
<td>Operating temperature -30 to 80 °C</td>
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<td></td>
<td>Maximum switching frequency 40kHz</td>
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<tr>
<td></td>
<td>Collector-emitter voltage sense across the IGBT 1600V</td>
</tr>
<tr>
<td></td>
<td>dV/dt typically 45 KV/μs</td>
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<td></td>
<td>Output-turn on gate voltage 15 V w.r.t. emitter.</td>
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<tr>
<td></td>
<td>Output-turn off gate voltage -7 V w.r.t. emitter.</td>
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<td></td>
<td>Internal dc-link dead short circuit protection.</td>
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<tr>
<td></td>
<td>Device short circuit current protection (V_{ce} protection)</td>
</tr>
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<td></td>
<td>Operating temperature -35 to 80°C</td>
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<tr>
<td></td>
<td>Turn on and off propagation delay not more than 2μ seconds</td>
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<tr>
<td></td>
<td>MTBF 10^5 hrs</td>
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<tr>
<td><strong>IGBT module specification</strong></td>
<td>All the switches in one leg (4-IGBTs with inverse diodes and 2 freewheeling diodes) should be in a single module.</td>
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<tr>
<td></td>
<td>V_{ces} at T_{j} 25°C 1200 volts</td>
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<tr>
<td></td>
<td>The collector current rating IGBT (I_{c}) at T_{j} 175°C (T_{s} 25°C 200 A T_{s})</td>
</tr>
</tbody>
</table>
70°C 165 A with I_{CRM} 500 A
Typical IGBT time parameters
T_{don}=175\,\text{ns}, T_r=50\,\text{ns}, t_{don}=425\,\text{ns}, T_f=100\,\text{ns}
di/dt_{on}=5000\,\text{A/\mu s}\quad (\text{IGBT typical})
di/dt_{on}=1800\,\text{A/\mu s}\quad (\text{IGBT typical})
V_{GE} \text{ range } \pm 20 \,\text{V}
On resistance of switch maximum 7\,\Omega \text{ at } T_j \, 25^\circ \text{C and 8}\,\Omega \text{ at } T_j \, 150^\circ \text{C}(V_{GE}=15\,\text{V})
V_{CEO} \text{ maximum } 1\,\text{V at } T_j \, 25^\circ \text{C and } .9\,\text{V at } T_j \, 150^\circ \text{C}
Inverse diode current rating \quad T_j \, 175^\circ \text{C} \quad (T_s \, 25^\circ \text{C} \, 175 \,\text{A} \quad T_s \, 70^\circ \text{C} \, 140 \,\text{A}
\text{with } I_{FRM} \, 500 \,\text{A})
V_{FD} \text{ for inverse diode maximum } 1.2\,\text{V at } T_j \, 150^\circ \text{C and 1.6}\,\text{V at } T_j \, 25^\circ \text{C}
Clamping diode current rating \quad T_j \, 175^\circ \text{C} \quad (T_s \, 25^\circ \text{C} \, 175 \,\text{A} \quad T_s \, 70^\circ \text{C} \, 140 \,\text{A}
\text{with } I_{FRM} \, 500 \,\text{A})
V_{FD} \text{ for clamping diode maximum } 1.2\,\text{V at } T_j \, 150^\circ \text{C and 1.6}\,\text{V at } T_j \, 25^\circ \text{C}
R_{th(j-s)} \text{ not more than } 0.4K/W \text{ for both types of diode}

### Packaging
Enclosed in transparent acrylic sheets with all salient power terminals
(Three terminals of DC bus and three-terminals of three-phases) available for connection with standard banana connectors. Terminals for connecting 1-ph input to cooling fan. Terminals for connecting +15V bias supply for gate drivers. Terminals for connecting all gate inputs with isolated +15V and ground.

### DC bus structure
Sandwiched platted DC link structure.

Where $T_j$ is junction temperature and $T_s$ is heat sink temperature

**TERMS & CONDITIONS**

1. Please submit the TECHNICAL and FINANCIAL bids in separate sealed envelopes. Mark the two envelopes clearly as “Technical Bid” and “Financial Bid”. Both the sealed envelopes should be sent in a single sealed envelope, with clearly marked as “NIQ for 3 level inverters”. The quote should reach the following address on or before **13/05/2013** up to **5:00 PM**.

   **Name** : Prof. Bhim Singh
   **Address** : Professor, Room No. II-118, Deptt. of Electrical Engineering, Indian Institute of Technology, Delhi Hauz Khas, New Delhi-110016 (India)

2. Please quote prices at FOB/ CIF New Delhi, inclusive of installation charges.
3. Quote should be in Indian Rupees or in US Dollars (if imported item) and to valid for at least three months.
4. Attach all the technical literature and a list of similar installations done in India.
5. **A technical compliance chart of the quoted product mentioning technical specification of quoted product verses asked specification is compulsory. Attach the compliance chart with technical bid.**
6. Mention the warranty period. Also mention if there are additional prices for on-site warranty.

7. Mention if you can provide any technical support like training of IIT Delhi personnel at IIT Delhi or in your factory and providing a technical person for operation of the machine for the initial period of 2 years. Kindly mention about this in technical bid.

8. If the quote is being submitted by the representative of the Principals/manufactures themselves, a valid Agency ship/Dealership Certificate authorizing the agent to quote to IIT Delhi on behalf of the Principals should be enclosed.

9. The Institute reserves the rights to accept/reject any/all quotations without assigning any reasons thereof.

10. Complete set of manuals for the operation and servicing of equipment should be given. All circuit diagrams, other mechanical and electrical schematics must be provided to Main unit, sub systems and accessories.

11. **Delivery as early as possible in weeks on receipt of PO.**

12. Clearly specify the installation requirements – such as space, power, frequency, environment (Temperature and humidity) etc.

13. If the items quoted are proprietary in nature, please enclose proprietary certificate from the principals stating “Certified that ------------ is a proprietary item of M/s ----------- and no other manufacture make these items”.

14. If the bidder is Indian agent, the agency certificate should be enclosed.

15. Please produce compliance certificate for the specification.

16. Please ensure that the Indian agent has been enlisted with the Department of Expenditure, evidence may please be attached.

17. All bank charges payable in India are to buyer’s account and bank charges in seller’s country to seller’s account.

(Principal Investigator) 

(Chairman, Purchase Committee)