

		<p>21. For the purpose of design of equipment/systems, an ambient temperature of 50 deg C and relative humidity of 95% (at 40 deg C) shall be considered. The equipment shall operate in a highly polluted environment.</p> <p>22. Motor operating through variable frequency drives shall be suitable for inverter duty with VPI insulation. Also, these motors shall comply the requirements stipulated in IEC: 60034-18- 41 and IEC: 60034-18-42 as applicable.</p> <p>23. AC motors shall be suitable for rated frequency of 50 Hz with a variation of +3% &amp; -5%, and ±10% combined variation of voltage and frequency.</p> <p>24. Phase to Phase and Phase to Earth clearance shall be as per relevant standard.</p> <p>25. The responsibility of coordination with other agencies and obtaining all necessary clearances shall be of the Bidder scope.</p> <p>26. All motor shall be AC3 type contactor.</p> <p>27. Bidder shall provide fully compatible electrical system, equipment's, accessories, and services.</p> <p>28. All acceptance and routine tests as per the specification and relevant standards shall be carried out.</p> <p>29. Type test report &amp; PESO, ATEX certification to be submitted for motor approval.</p>
10	VFD	<p><b>Codes &amp; Standard:</b></p> <p>VFD: IEC 60034/ IEC 61800</p> <p>Harmonics &amp; EM compatibility: IEEE 519/IEC 61000</p> <p>Contactor/Switches/Fuses etc.: IEC 60947, IS 13947</p> <p>The voltage level for the VFD shall be as follows: -</p> <ol style="list-style-type: none"> <li>1. Up to 160 kW: 415V/690V, Low Voltage, Three Phase AC</li> <li>2. Above 160kW: Medium Voltage, Three Phase AC</li> </ol> <p>The VFD System shall include the following equipment for each drive:</p> <ol style="list-style-type: none"> <li>1. Power/control panels consisting of line converters, inverters and control system for drive including complete control &amp; protection of drive and the motor.</li> <li>2. VFD transformer on the source side, as per system requirement.</li> <li>3. Breaker/Contactor on the VFD/Motor/Transformer/CT/PT/Meters/Bypass (if applicable) side with complete Control, Protection and Diagnostics features of the VFD, as per system requirement.</li> <li>4. Bypass Arrangement of the VFD system if specified.</li> <li>5. DC air core reactor or capacitor, as per the system requirement.</li> <li>6. Inverter Duty Motor suitable for VFD application.</li> </ol>

	<p>7. Medium Voltage VFD: The Variable frequency drive (VFD) system shall be of a modern proven design for similar applications in power plants/industry. The system shall be either Current Source Inverter (CSI) or Voltage Source Inverter (VSI) type with minimum eighteen (18) pulse design. MV VFD shall have dry type transformer and preferably installed in SWGR room in non AC room, however, Integrated MV VFD also acceptable but provision for dry type transformer shall be kept in non AC room.</p> <p>8. 415 V/690 V LV VFD: The Variable frequency drive (VFD) system shall be of a modern proven design for similar applications in power plants/industry. The system shall be either Current Source Inverter (CSI) or Voltage Source Inverter (VSI) type with minimum Twelve (12) pulse design. For drives less than 100 KW Six (6) pulse can be offered meeting all other requirements.</p> <p>9. VFDs shall comply with the latest edition of IEEE 519 &amp; IEC 61000 for both individual as well as total harmonic voltage and current distortion limits. The Voltage and Current limits shall be applicable at the Point of Common Coupling (PCC), which shall be the MCC/ Switchgear/ from which the VFD system is fed.</p> <p>10. The system shall be suitable to maintain speed variation within range 10-110% with speed set accuracy of +1% of rated maximum speed and steady state regulation of +0.5% of rated speed as per system requirement.</p> <p>11. The VFD System shall maintain a power factor of 0.95 (minimum) from 25 % to 100 % of rated speed.</p> <p>12. For MV VFD Drives, to ensure that there are no problems with motor heating, VFD output current waveform, as measured at the motor, shall be inherently sinusoidal at nominal loads, with a total harmonic current and voltage distortion within acceptable/standard limits. VFD utilizing output transformers are not acceptable.</p> <p>13. The system design shall not have any inherent output harmonic resonance in the operating speed range.</p> <p>14. VFD shall provide stable operation of motor from high voltage dv/dt stress, regardless of cable length to motor. The vendor shall clearly state the limitations in the motor cable distance in his proposal. However, due to system requirements &amp; constraints if the cable length becomes critical, filters/ chokes etc. shall be provided by the VFD manufacturers as an integral part of the VFD to mitigate the reflected wave effect of harmonics.</p> <p>15. Efficiency (Drive only) shall be minimum 98% for both MV VFD and LV VFD. Overall efficiency shall be minimum 96.5% for both MV and LV VFD at rated load and speed. Overall Efficiency evaluation shall</p>
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		<p>include input transformer, harmonic filters, and power factor correction (if applicable), VFD converters, cooling fans and output filter, as applicable in the system. Auxiliary controls, such as internal VFD control boards, cooling fans/pumps.</p> <p>16. The VFD shall be designed to operate indoor under temperature range of 0 deg C to 50 deg C and relative humidity of 95%.</p> <p>17. VFD transformer outdoor, Mineral oil filled ONAN type or Indoor natural air-cooled Dry type, Three phase unit, rectifier/converter duty type transformer.</p> <p>18. Transformer shall be suitable for operation with non-sinusoidal wave shape and DC components under normal and abnormal conditions of the system without exceeding the temperature.</p> <p>19. All Panels shall be of dust-proof and vermin-proof construction and shall be provided with a degree of protection of IP: 4X as per IS/IEC 60947.</p> <p>20. Each panel shall be provided with illuminating lamp, space heater with switch fuse and variable setting thermostat.</p> <p>21. VFD Manufacturer shall submit cable sizing &amp; selection criteria of drive cables including grounding/ earthing philosophy to address all the key issues such as EM Noise emissions, Common mode noise, voltage reflections, stray capacitances etc., for owner's review and approval.</p> <p>22. The system offered shall incorporate adequate protection features, properly coordinated for the drive control and for motor.</p> <p>23. The VFD shall include a microprocessor/PLC based digital diagnostic system which monitors its own control functions and displays faults and operating conditions.</p> <p>24. All acceptance and routine tests as per the specification and standard IEC -61800-2 and IEC 61800-4 shall be carried out.</p> <p>25. The Contractor shall submit type test for Employer's approval as per relevant standards.</p>
11	<b>Cable vault &amp; Tranches</b>	<ol style="list-style-type: none"> <li>PCC flooring of built up trenches shall be sloped for effective drainage with sump pits and sump pumps.</li> <li>No sub zero level cable vault/trenches shall be provided below control building/switchgear rooms in main plant.</li> <li>Clear access passage of at least 750mm wide &amp; 2.1 mt clear heights shall be provided at entrances and along the cable trays in cable vault. Wherever the passage is through cable routes &amp; across the cable tray the clear height shall not be less than 1.5 mts.</li> <li>Cable vaults shall be provided with adequate drainage facilities for drainage of fire water.</li> <li>Each cable vault should have at least two doors.</li> </ol>