standalone control panel, however, may be provided depending on the design and application that requires special ventilation arrangements and due to space constrains within the MCC cubicles. If so, the detailed technical proposal shall be submitted for ADM review and approval.

D. The VFD shall be of proven design to provide high pump efficiency, high availability, minimum maintenance, substantial energy reduction, and longer bearing and seal life at reduced speeds.

E. The VFD shall control pump speed by employing advanced torque control techniques and auto tuning that measure and set all constant and critical parameters of the motor automatically.

F. The VFD cubicle shall be considered as a starter with the addition of a VFD with display unit and a keypad, and therefore shall comply with the requirements of Clause 3.12 (MCC)

G. The Contractor shall provide a properly matched pump-motor-cable-drive system for the specific duty operating in conjunction with VFD considering load–torque characteristics, kW rating, efficiency, thermal capacity, power factor improvement, EMI mitigation, etc. This shall include the use of braided and armoured field cable, if required by the VFD manufacturer.

H. Braided cable shall be used with VFDs, in any event, if the cable length exceeds 100m or the cable passes near a source of large electromagnetic interference (such as a large motor or HV cables).

I. If required, the VFD shall incorporate output reactors to negate the effects of cable capacitance and ensure correct operation of the VFD.

J. The pump driving motor speed shall be variable between maximum speed at full load and at any intermediate speed down to a tenth of full constant torque availability at any speed with a starting torque of 1.5 times full load torque at maximum speed. The VFD shall be capable of supplying the motor continuously at any frequency.

K. The VFD shall utilise a full-wave bridge design incorporating diode rectifiers or semi-controlled bridge consisting of diodes-thyristors combination or 6-pulse/12-pulse converters (whichever satisfy regulations pertaining to reduced harmonics distortion) or the latest available technology.

L. A dc link choke-smoothing reactor shall be included to limit fault throughput.