

6.5.3. Starters

The use of soft starters and VFD's are recommended to avoid surge pressures in scheduled start/stop of pumps. The following items must be considered in the design:

- Direct on-line starter is allowed for motors up to 2 kW or as per ADDC requirement.
- Soft starters are mandatory for motors above 4 kW.

6.5.4. Variable Frequency Drives

Where Variable Frequency Drives (VFD) are used the Consultant shall demonstrate the consideration of the following factors in sizing the VFD:

- Operating voltage
- Motor peak current
- Ambient temperature (site temperature)

For pumping applications the most suitable type of VFD shall give both variable torque and variable speed.

6.5.5. Motor Control Centre

Motor Control Centre (MCC) panel forms the link between the electrical loads such as motors and actuator valves, and the power generation source. The design of the MCC must take into consideration the following points in Table 6-6:

Total Connected Load	The control panel size and design needs to cover the demand of the total load connected including the standby load as well.
Short Circuit Level	The short circuit level calculation shall be carried out according to the total connected load and power source from local authority electricity network. Care must be taken in the design stage to control the fault level. If the total connected load is too high then the load to the switchgear can be split into two or more assemblies to reduce the fault level. The short circuit capacity shall be 50kA/sec or as per ADDC requirement.
Type of Coordination	Type of coordination shall be Type-2. Manufacturer tests components such as contactor, circuit breaker, all together must confirm what will happen under short circuit conditions.
Form of Internal Separation	The form of separation must be according to BS EN 61439-1 or suitable equivalent. If the MCC is located above ground, Form-2B should be considered. If the MCC is located below ground, due to client/special requirement, Form-4B, with anti-flood detector and above-ground power cut-off including shunt trip, should be considered for ease of carrying out maintenance without interruption to other equipment, in case of isolation of a particular feeder.
Bus Bar Rating	The bus bar rating must be suitable to carry the total connected load as mentioned previously, consider any future loads by increasing the size of the bus bars and suitability of extension at both ends
Type of Starter	The Consultant must consider the appropriate starter as