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## **GUIDELINES FOR VFD CONTROL OF LW REWINDABLE SUBMERSIBLE MOTOR SERIES**

Variable Frequency Drives together with submersible pumps are today often being used when water demand varies over time. The pump will run with the VFD at a speed optimal to the actual demand, leading to possible energy savings.

There are a wide number of different frequency drives available on the market and they often have different characteristics. Therefore it is important to choose a VFD and other electric components that will work satisfactory together with the motor. VFDs generate voltage peaks and if the peaks are too high and too steep they will damage the windings in any submersible motor.

The LW submersible motors can be used with Variable Frequency Drives if the following guidelines are respected.

### **Frequency limitations**

You should never run the motor with the VFD on a higher frequency than the data plate on the motor states. With a higher frequency than stated, overload and overheating problems could occur. Generally you are never allowed to run the pump with a frequency below 30Hz. Always make sure that the flow around the motor is enough to cool the motor at all the duty points of operation. Values for the flow can be found in the submersible motor technical catalogue.

### **Ramp up time**

The ramp up time to the minimum running frequency should be set as quick as possible (maximum 1s) to ensure the correct lubrication of the thrust bearing in the motor.

### **Filters**

Filters for reducing voltage peaks and steepness generated by the VFD are recommended and should be specified by the VFD manufacturer according to the below voltage peak and rise time limits.

### **Voltage drop with long cables**

The VFD should be installed as close as possible to the motor. When this is not possible a maximum of 4% voltage drop at the motor is acceptable.

### **Use of VFD with LW submersible HT motors (high temperature version)**

It is always recommended the use of HT motors with VFD operation. The reason for this is that the HT version has a higher tolerance for voltage peaks. For HT motors the voltage peaks to the pump may never exceed 1000 Volts and the voltage rise time  $dV/dt$  should be lower than  $500V/\mu s$ . If the VFD can not fulfil this recommendation filters between the VFD and the motor has to be used. The requirement will then be that the VFD together with the filters does not generate higher peaks than 1000V and that the voltage rise time  $dV/dt$  should be lower than  $500V/\mu s$ .

### **Use of VFD with LW submersible standard motor**

Standard LW motors can be used if it can be guaranteed that the VFD will not generate higher voltage peaks than 690V and if voltage rise time  $dV/dt$  is lower than  $500V/\mu s$ . If the VFD can not fulfil this recommendation filters between the VFD and the motor has to be used. The requirement will then be that the VFD together with the filters does not generate higher peaks than 690V and that the voltage rise time  $dV/dt$  should be lower than  $500V/\mu s$ .

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### **Water temperature and VFD use**

Together with VFD we recommend the usage of the High Temperature (HT version) of the motor up to 30°C of water temperature. For higher water temperatures a derating of the motor should be made.

Derating of the motor depends on the quality of the output from the VFD. If the quality is close to the quality of the supply without VFD then there is no special restriction regarding water temperature for VFD use. Refer to the technical catalogue for submersible motors for water temperature limits.

### **End notes**

If the installation requires operation other than stated in the guidelines or if questions arise that is not covered in the guidelines please contact Lowara AED department for guidance.

Please note that Lowara reserves the right to disclaim the warranty in case of:

- a) the product is out of standard warranty period;
- b) the defect is a consequence use or installation in a manner contrary to the Supplier's instructions;
- c) technical analysis show that the above VFD guidelines or general motor guidelines have not been followed.