

## **VFD Operation**

Variable frequency drive (also referred as VFD, variable speed drive, VSD, or “inverter”) is common in pump operation for energy efficient pump operation by changing pump speed and to control the flow rate and pressure. However, there are few points that need to be considered during VFD operation of a pump. Following confirmation are necessary to proceed with VFD operation of a pump:

### **1. Considering the load on the pump**

Operating a pump on VFD increases its operating current by around 10%, and its temperature by around 21%. This is caused by high frequency output waveform of the VFD. To ensure that this phenomenon does not result in operating current to exceed the rated current of the pump, Tsurumi recommends that 50 Hz pumps be limited to operations at maximum 48 Hz, and 60 Hz pumps be limited to operations at maximum 57.5 Hz.

Trimming the impeller down to reduce the load can also be another option.

### **2. Thermal Protectors**

Pumps with circle thermal protectors cannot send signal to control panel or the VFD, in case of protector trip. Therefore, the VFD continues to operate, even when the pump is stopped by the protector. And when the circle thermal protector resets, the motor draws its starting current which is generally 5 to 6 times the rated current, significantly higher compared to the maximum current that VFD's can withstand which is usually 200% of rated current for about 0.5 seconds.

To prevent this from happening, circle thermal protector needs to be removed, and if thermal protector is required, miniature thermal protector is to be provided on the pump.

### **3. Risk of electric shock during pump operation**

Due to the high speed sinusoidal nature of the output from a VFD, it is easy to generate induced voltage to the motor frame, in case of improper grounding. The possibility of generating an induced voltage is higher than that with commercial power supply. So, the chance of electric shock is also higher with VFD operation.

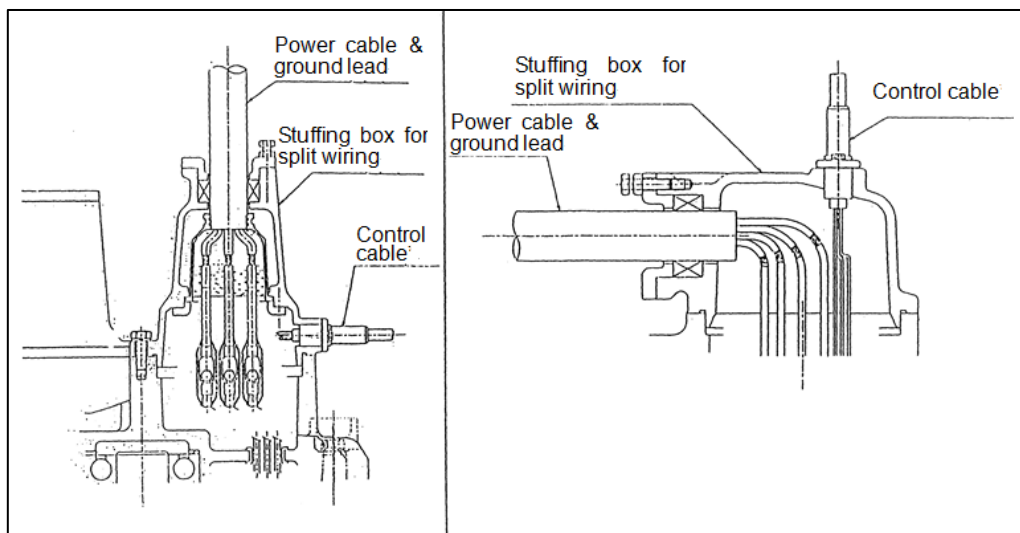
Being in the pump vicinity or touching the pump under VFD operation should

be avoided. Also, grounding of the pump control panel and VFD circuits should be done properly in compliance with local electrical standards and regulations.

#### 4. Noise in the control cables

The induced voltage is also generated around the cables which will create unwanted noise and can interfere with signals of the control cables for the sensors.

To avoid this kind of problem, special care is necessary to isolate the control cables from the power cable. Tsurumi has special cable glands for this kind of application.



Special Cable Glands to separate power and control cables

#### 5. Surge voltage

Semi-conductors in VFD will generate surge voltage which is harmful for the insulation resistance of the motor. Usually, for the power supply voltage of 200V the surge voltage would be about 600V, which is under the voltage resistance capability of motors of around 850V. However, for motors of 380V and above, the surge voltage can easily cross 1000V. This will deteriorate the insulation resistance and the motor may burn out under continuous operation.

As a preventive measure against this, surge suppression filters need to be provided in the connection between the VFD output terminal and the pump.