

Week 2: Importance of Electronics in Automation Industry

Week 2, Day 2, Session 2

VFD Panel (Variable Frequency Drive Panel)

In most of the situations the industrial work space is dusty, dirty, wet, humid, corrosive, or hot. In such harsh environments, it is not recommended and safe to mount the VFD exposed. A VFD Control panel (an enclosure that protects the VFD and other electric components) can be used.

What is a VFD control panel used for?

- Keeping all components in one panel
- Keeping dust, dirt, and weather out of electrical parts
- A complete motor control solution (bypass, harmonic filtering, etc.)

What is typically inside a VFD control panel?

There are many components inside a VFD control panel. Here are some examples of what you might find:

1. VFD – The main component of the motor control panel. The VFD inside will vary in voltage, horsepower, full load amps (FLA), and other specifications. It may contain redundant VFDs installed in case of a VFD failure.
2. Line reactors – 3% or 5% to reduce harmonic distortion
3. Harmonic filters – a more effective way to reduce harmonic distortion
4. Circuit breaker – protects the electrical circuit from overload or short circuit
5. Bypass – keeps the system running even if the VFD fails
6. PLC – Programmable Logic Controller – for more advanced operations
7. Modem – for communication purpose
8. AC or other cooling units – keeps the panel at a certain temperature depending on surrounding environment

9. Soft-starter – starts motor slowly but without speed control
10. Surge protector – protects the system from voltage spikes
11. Multiple motor overloads – an option for powering multiple motors off one VFD, typically used on fan walls
12. Anti-condensation heater (available in NEMA 3R panels) – eliminates the buildup of dew inside the VFD panel
13. Motor starters – for running motors across the line

VFD panels adopt enclosed cabinet structure. Variable frequency drive control panel (also named VFD panel, AC drive electrical control panel) is consisting of VFD inside the cabinet with external control, protect, display and other electrical connections. It's a frequency conversion device to control three phase AC motor (including fans and pumps) in variable speed to save energy.

Variable speed drive is a dedicated component of the electrical control panel, the panel's frequency convention and main features are depending on the VFD and other components configuration. VFD panels are different according to their different functions and applications. Generally, it needs customized manufacture base, on specified environment, like in constant water supply panels (one panel control 1, 2, 3 pumps, etc.), escalators control panels, central air condition circulating pump panels, and fan's control panels.



Application of VFD drives for speed control in industry

Variable Frequency Drive (VFD) can be used in lots of fields. Variable frequency drives are widely used to control the speed of AC motors, like conveyor systems, blower speeds, pump

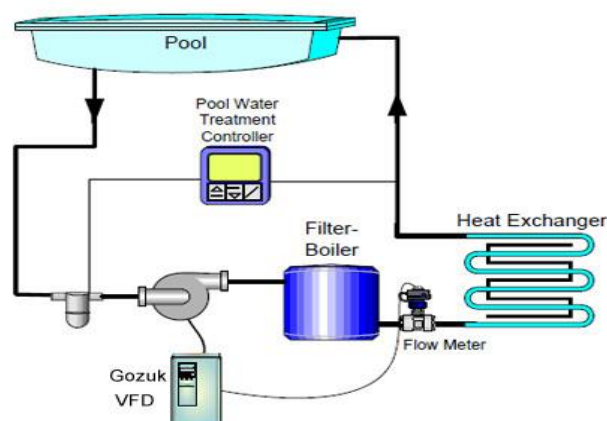
speeds, machine tool speeds, & other applications that require variable speed with variable torque.

In some applications such as speed control for a conveyor, the variable frequency drive is installed with a remote potentiometer that personnel can adjust manually to set the speed for the conveyor.

1. VFD on Swimming Pool Filtration System

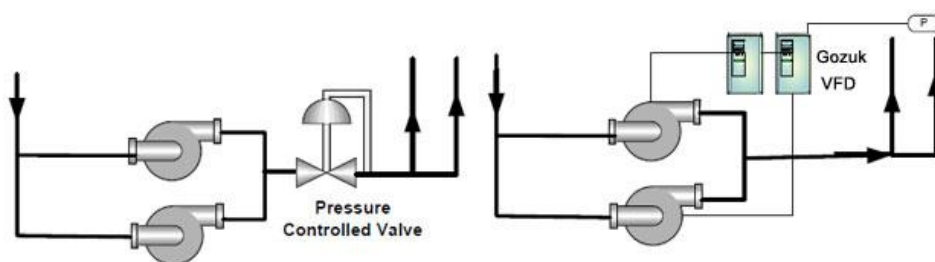
Due to decreasing prices of variable frequency drives, VFDs are being used on smaller and smaller systems, such as swimming pool systems.

Nearly 40% of the total energy used by indoor swimming pools is consumed by the filtration and circulation pumps which are responsible for maintaining the cleanliness of the pool water.



2. Variable frequency drive on Booster Pumps

Pressure booster pumps essentially add pressure to a commercial buildings water supply at times when the water mains pressure is not sufficient. Most multi-storeyed apartment complexes, hotels, etc., require pressure booster pumps to supply adequate pressure to terminal units such as showers and bathrooms.



VFD can be added to pressure booster pumps as an alternative to using pressure control valves. This saves the energy and eliminates its cost and maintenance. The vfd savings can amount to 20% or more, simply due to the safety factor used during the design of the system. If the suction pressure of the pump varies, the over-sizing of the pump required to handle the lowest suction pressure does not penalize the installation, when the suction pressure increases.

3. Variable frequency drive in pharmaceutical industry

Electric motors in pharmaceutical industries consume significant amounts of electricity; estimated to be about two-thirds of all usage. Even a simple air conditioning system, costing a few hundred pounds, can be expected to consume many tens of thousands of pounds worth of electricity over its useful lifetime. Variable frequency drives can help to make significant energy savings by controlling the motor speed.

Creating closer links between these two areas of a business is an important objective. Tools like online variable frequency drive payback calculators will go some way towards achieving this; however, by themselves they won't produce a result – there also has to be real buy-in from the business itself.

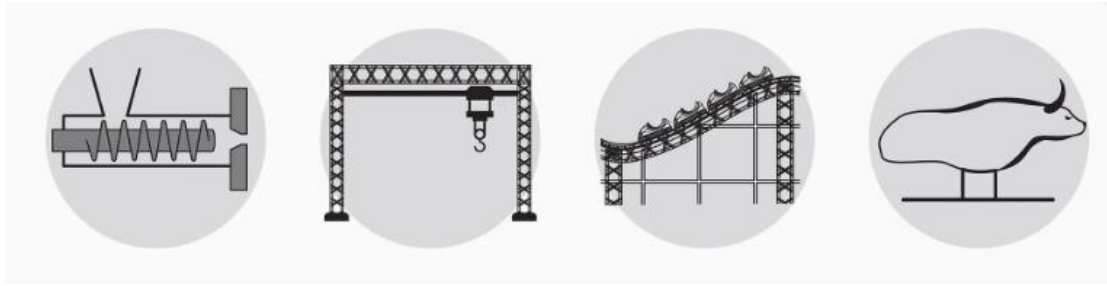
4. VFD in Cement Industry

In cement plants, VFDs provide controlled torque and speed to the kiln (grinding a mixture of limestone and clay to make a fine "rawmix", heating the rawmix to sintering temperature (up to 1450 °C) in a cement kiln, grinding the resulting clinker to make cement), which increases the life of the mechanical system, and reduces maintenance and operating costs. The VFDs also provide feedback signals, which improve cement kiln process control.

The use of VFDs is widespread in numerous industrial and commercial applications.

The industrial applications include,

- Extruders
- Electric cranes
- Roller coasters
- Mechanical bulls



The commercial applications

- Pumps to control flow and even volume in a tank
- Lifts and escalators
- Swimming pool filtration system

Domestic applications include

- Washing Machines
- Water pumps
- As Pressure booster pumps to supply adequate pressure to terminal units such as showers and bathrooms in apartments