

# Motor Protection From Overvoltage Spikes

## Motor Protection

### Applications

- VFDs
- Servo drives

### Benefits

- Protects motors
- Reduces overvoltage spikes
- Suitable for open and close loop application

### Features

- Low power loss
- Reduces temperature
- Very stable and difficult to saturate
- Compact case



Traditional Solution vs.  
New Enerdoor Solution

### Introduction

This white paper discusses Enerdoor's approach with customers in need of protecting motors against overvoltage spikes, widely known as  $dV/dt$ .

Voltage wave reflection is a function of the voltage rise time ( $dV/dt$ ) and the length of the motor cables. This phenomenon creates additional overvoltage spikes causing premature degradation and failure to motor insulation.

### The Challenge

It can be challenging for OEMs, system integrators and distributors to ensure the installed motors are well protected. Markets using a variable frequency drive (VFD), adopted a special motor better known as a VFD-rated motor or inverter duty motor.

The VFD-rated motor can vary significantly, from manufacturer to manufacturer. However, following the National Electrical Manufacturer's Association (NEMA), the difference between a standard motor and inverter duty motor is the insulation.

For example, an application at 480 Vac with a standard motor recommends maintaining the peak voltage below 1000V. However, for an inverter duty motor the peak voltage is recommended to be below 1500 Vac.

## The Solution

Enerdoor's goal is to propose a solution using low power loss, in order to contain the overvoltage spikes. A well-known solution to reduce overvoltage spikes and  $dV/dt$  is the load reactor. This traditional device is designed with a high performance laminated material.

When applied to the main line, one of the benefits of the laminated material is limited power loss. This is true with both line reactors and transformers. However, when installed between the VFD and the motor, the temperature increase due to output frequency can negatively affect the material causing saturation to the load reactor.

Enerdoor developed a solution to overcome the temperature problem using a different type of composite material that works much better in a high frequency range up to 1 KHz, containing the power loss on the products.

Our solution greatly reduces the product footprint, offering a compact case equipped with terminal blocks that offer a complete finger-safe solution.

## The Result

Enerdoor's unique combination of R&D and field testing experience helped to design these particular models of high frequency inductances capable of working with high speed motors up to 200.000 rpm without needing extra fans or cooling. The Enerdoor inductances can be installed inside the cabinet in close proximity to other devices.

Below is a short list of recommended inductances per application. Please contact Enerdoor for the appropriate solution.

| Model     | Description      | Max Frequency Output | Length of Cable | Feedback          |
|-----------|------------------|----------------------|-----------------|-------------------|
| FIN958    | Output reactor   | 1 kHz                | <100m           | Open / close loop |
| FIN960F   | Output reactor   | 2.5 kHz              | <100m           | Open loop         |
| FIN915SFH | Sine-wave filter | 2.5 kHz              | >100m           | Open loop         |

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