# Power Quality Solutions

## Reactors &

## Drive Isolation Transformers

HUBBELL

COMMERCIAL CONSTRUCTION

Acme Electric®

# Power Quality Solutions

Two product lines when harmonics are present:

**Line Reactor** and **Drive Isolation Transformer**

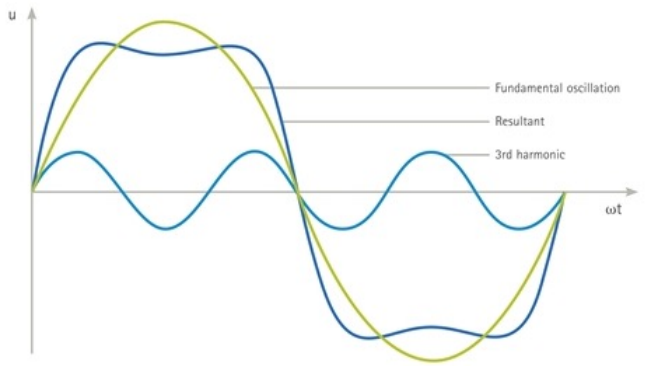
- What is it?
- When to use it?
- Which one is best?
- How to size it?

# What are harmonics?

**HARMONICS:** A sinusoidal waveform with a frequency that is an integral multiple of the fundamental frequency.

When multiple harmonics are present, the resultant sinusoidal waveform becomes distorted, which affects the current (THID) and voltage (THVD) of the power system

| | |
|---|---|
| 60hz | Fundamental |
| 120hz | 2nd Harmonic |
| 180hz | 3rd Harmonic |
| 240hz | 4th Harmonic |
| etc... | |



# Where Do Harmonics Originate?

## Harmonics primarily originate in electronic power converters.

These can be found in Non Linear Loads such as:

1. **Variable Frequency Drives**
2. Electronic Ballasts
3. Switch Mode Power Supplies
4. Oven and Furnace Controls
5. Rectifier Circuits

# Problems Created By Harmonic Currents

## Effects of Harmonics on the power system

1. Overheated Neutrals
2. Overheated Transformers
3. Malfunctioning of Equipment due to excessive voltage distortion
4. Burned-out Motors
5. Tripped Circuit Breakers
6. Blown Fuses

## Effect of Harmonics on Transformers

1. Increased temperature rise
2. Increased neutral current flow
3. Increased core losses
4. Increased sound level
5. Decreased efficiency

# Harmonic Distortion Leads To Higher Costs

1. Increased utility current required resulting in
   a) LARGER Wires
   b) LARGER Transformers
   c) LARGER Circuit Breakers
   d) HIGHER Operating Costs

2. Overheating of components will lead to premature component failure

3. Reduces utility power factor – high utility costs and possible fines

# What is it?

## Reactor

Inductor with Iron core and 3 single phase coils

480V – 3% or 5% Impedance
240V – 6% or 10% Impedance
600V – 2.4% or 4% Impedance

2Amps up to 600Amps

Open or Enclosed Configuration

Increasing impedance helps reduce helps reduce harmonics distortion
Up to 35% harmonic reduction

# What is it?

## Drive Isolation Transformer

Transformer with special voltages and kVA sizes unique to drive applications

Nominal 6% Impedance from 7.5kVA up to 990kVA

Copper Foil windings to ensure lowest possible losses and reduce short circuit

Shielded for extra protection and noise reductions

Copper terminations in both encapsulated and ventilated designs

# When to use it?

Used on the line (input) or load (output) of the drive

Need to meet IEEE-519

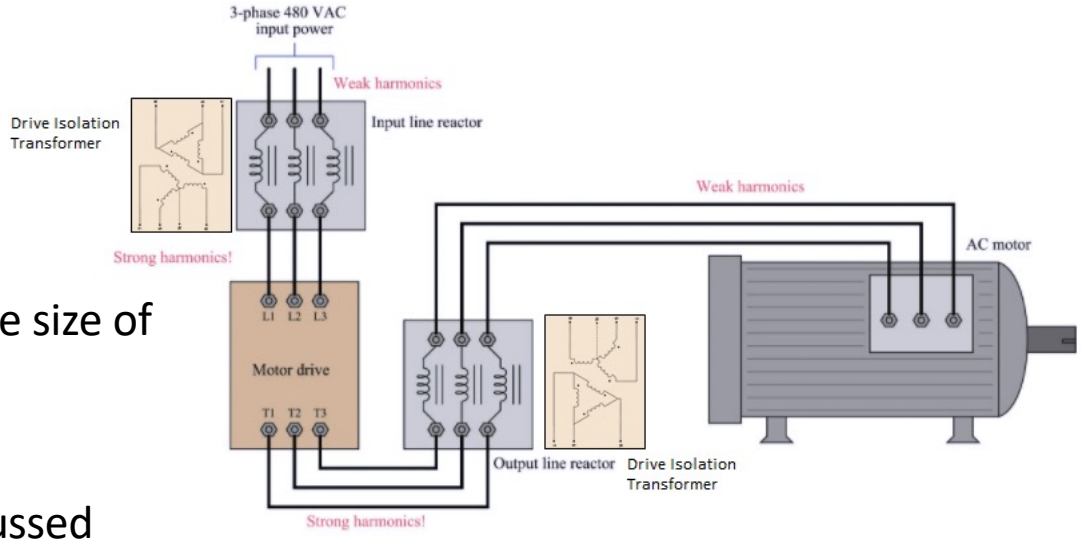
Standard for harmonic levels

In conjunction with Active Filters to reduce size of

Active Filter needed

Experiencing power quality issues as discussed

Tripping due to voltage spikes



# Application considerations

Non-linear loads account for more than 25% of the total system load

Transformers load is greater than 75%

Use of generators

Phase to Phase input voltage imbalances greater than 2%

Smaller VFD’s with no DC link chokes

Low Impedance Transformer kVA is at least 10 times the VFD kVA

# Which is the best?

| | Reactor | Drive Isolation Transformer |
|---|---|---|
| Phase to Phase Voltage Unbalance | Help Balance voltages | **Help Balance voltages & offer grounded neutral** |
| Smaller VFD's | **Starting at 1HP, small footprint, lower cost** | Starting at 5 HP, larger footprint, higher cost |
| Impedance | **Wide range (2.4% - 10%) & can be wired in series** | Nominal 6% Impedance but varies with load of transformer |
| Isolated Ground | Not able to provide | **Able to provide** |

# Which is the best?

| | Reactor | Drive Isolation Transformer |
|---|---|---|
| Use on output of VFD | **Can be used on both line & load without derating** | Customized for specific VFD |
| Voltage Change | No taps to compensate | **Taps available to compensate** |
| Physical Size | **Small & can be installed inside control cabinet** | Large with its own enclosure |
| Installation Costs | **Lower installation costs** | Higher installation costs |
| Operating Costs | **Lower losses = lower costs** | Higher losses = higher costs |

# How to size?

**Reactors**

Determine the current of the application

Determine the impedance needed for the application

Determine if open or enclosed configuration is needed

**Drive Isolation Transformer**

Determine the kVA (or HP) of the motor

Determine the line and load voltage of the application

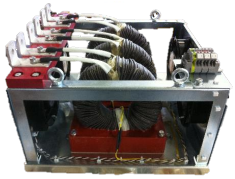
| H.P. | kVA |
|---|---|
| 5.0 | 7.5 |
| 7.5 | 11.0 |
| 10.0 | 14.0 |
| 15.0 | 20.0 |
| 20.0 | 27.0 |
| 25.0 | 34.0 |
| 30.0 | 40.0 |
| 40.0 | 51.0 |
| 50.0 | 63.0 |
| 60.0 | 75.0 |
| 75.0 | 93.0 |
| 100.0 | 118.0 |
| 125.0 | 145.0 |
| 150.0 | 175.0 |
| 200.0 | 220.0 |
| 250.0 | 275.0 |
| 300.0 | 330.0 |
| 400.0 | 440.0 |
| 500.0 | 550.0 |
| 600.0 | 660.0 |

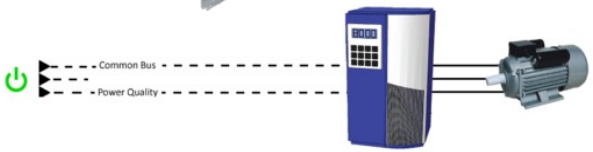
# Power Quality Solutions

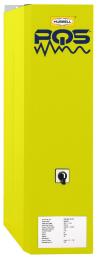
Drive Isolation
Harmonic Mitigating
K Factor

NEW ALUMINUM
Line Reactor

NEW STEEL
Sinewave Filter
dV/dT Filter





Active Filter

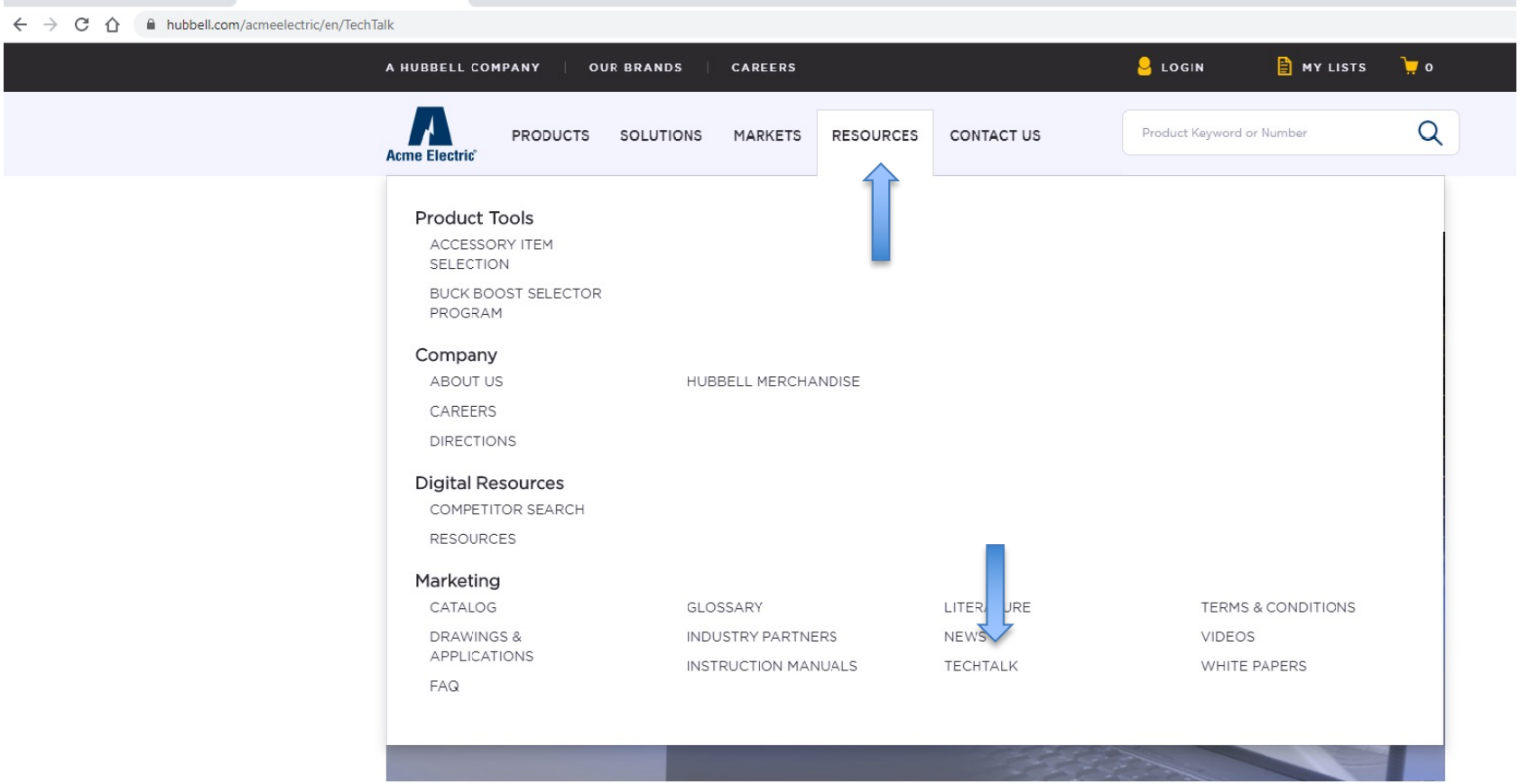
Power Resistor

Breaking Module



Breaking Resistor

# Where to find our TECH Talk Information



# Questions or Comments

Tech Service contact number:

800-334-5214 option 1

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