From the Desk of Managing Director

The Obstacle in our Path

Once there was a very wealthy and curious king. The king had a huge stone placed in the middle of a road. After placing the stone in the middle of the road, he hid nearby to see if anyone would try to remove the gigantic stone from the road.

The first people to pass by were some of the king’s wealthiest merchants and courtiers. Rather than moving it, they simply walked around it. A few loudly blamed the King for not maintaining the roads.

Not one of them tried to move the stone.

Finally, a peasant came along. His arms were full of vegetables. When he got near the stone, rather than simply walking around it as the others had done, the peasant put down his vegetables and tried to move the stone to the side of the road. It took a lot of effort & time but he finally succeeded in pushing the stone to a side of the road.

The peasant gathered up his vegetables and was ready to go on his way when he saw a purse lying on the road where the stone had been kept. The peasant opened the purse. The purse was stuffed full of gold coins and a note from the king.

The king’s note said, “The purse’s gold was a reward for moving the stone from the road.”

Many of us fail to understand the hidden message in the king’s note.

Every obstacle presents an opportunity to improve our condition.

Piyush Patel (M.D.)
**TRAINING CALENDAR**

<table>
<thead>
<tr>
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<th>MONTH</th>
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<th>DAYS</th>
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*Note: Dates are likely to change depending on prevailing situation in the country.*

**Product training module:**
- About Amtech
- VFD and AC Motor fundamentals
- Physical familiarity of VFD and Soft Starter
- Understanding the specifications, different models, selecting the proper rating and options provided for VFD and Soft Starter
- Installation and Commissioning of VFD and Soft Starter
- Understanding of different applications of VFD and Soft Starter
- Trouble shooting of VFD and Soft Starter
- Drive support software Axpert-CommunicatorTM for PC

**Product Portfolio:**

![AXPERT-EAZY* SERIES VFD](image1)

![AXPERT-VT240S SERIES VFD](image2)

![AXPERT-OPTI TORQUE SERIES SOFT STARTER](image3)

![ENGINEERED SYSTEMS](image4)

![AXPERT-iSine Series](image5)

- Active Harmonic Filter
- Active Front-end Converter
- Active Static VAR Compensator
Comparison between AC reactor and DC reactor

A reactor designed for Variable Frequency Drive (VFD) is typically nothing more than a coil of wire wrapped around a laminated steel core. The characteristic of the reactor that we desire is inductance, “the opposition to a rapid change in current flow”. VFDs draw current from the power line in sharp pulses, causing harmonic current to flow. The current is drawn in sharp pulses because the input diodes only conduct current at the peak of the voltage waveform to keep the capacitors fully charged.

It is this feature that allows reactors to smooth the current flow to VFD and reduce harmonics. Additionally, smoothing the current flow limits the high peak current pulses from abusing the capacitor bank inside the VFD. Thereby extending the life span of the VFD, and improving the true power factor of the VFD.

Reactors for VFDs are available as either AC reactors (also called line chokes) or DC reactors (also called DC link chokes). Both reactor types serve the same primary purpose, to smooth the current flow to the VFD, to increase the power factor and to reduce damaging harmonics produced on the power line. They also improve current balancing of line current. However, there are advantages and disadvantages of both AC & DC reactors.

AC reactors are placed in series with the incoming AC power line. An advantage they provide is some protection from voltage transients created by power factor capacitor switching and lightning surges because they are installed before the VFD. A disadvantage they cause is a voltage drop to the VFD. If input AC voltage to the VFD drops (due to dip) AC reactor causes further drop in the voltage. This results in higher output current and sometimes nuisance trip of the VFD due to under voltage condition.

For example a 5 % impedance rated AC reactor could drop a 415 VAC line, down to 394 VAC into the VFD. This could potentially lead to nuisance under voltage tripping of the VFD. Also, the VFD will draw more current as the voltage has reduced.

DC reactors (link chokes) are connected after the input diodes in the power circuit. A disadvantage of DC reactors is they are located after the input diodes, and do not protect the diodes from possible voltage transients. The DC reactor requires only 2 connections whereas AC Reactor requires 6 connections.

By virtue of their position in the power circuit, the DC reactor do not cause voltage drop unlike AC reactor. So, with DC reactor, there will not be any increase in output current and no nuisance under voltage tripping.

Reactor Selection Criteria

While selecting a value of the reactor, one has to look for voltage drop, % reduction in the harmonic distortion and cost of the component.

First & foremost consideration is the reduction of harmonics. A VFD with no reactor either in AC line or in DC line produces current harmonic distortion of the order of 60 % to 130 % in the power line depending on the source impedance. Reactors are generally available as having % impedance values of the order of 1 %, 3 %, 5 %, 7 % etc. Higher the % impedance, better is the harmonic reduction.

Along with % reduction in harmonics, one has to look for cost of the reactor also. Higher the % impedance, higher the cost of the reactor. Hence there is always a trade off between % impedance value & associated cost of the reactor.

Generally a reactor with 5 % to 6 % impedance value gives satisfactory performance in terms of harmonic reduction. A higher value of impedance (more than 5%) does not give proportionately better benefits in terms of harmonic reduction and it also results in more losses due to increased value of choke.

While AC reactor causes voltage drop in the AC power line, DC reactor do not give rise to voltage drop in AC Power Line. AC reactor can protect the rectifier diode against voltage transients, DC reactor can not provide protection to rectifier diodes against voltage transients.

Choke in VFD: Input side or DC Link side

Reactor at the input is easy to provide as it adds less complexity to wiring. Reactor in the DC link adds more complexity to wiring.

For the same percentage value of reactance and for the same application, rating of AC reactor in terms of its inductance value, VA and Current is lesser than that of DC reactor. Inverter design gets affected by inclusion of DC reactor. Inclusion of AC reactor does not have any bearing on the inverter design. Attenuation of 5° & 7° harmonics are relatively inferior in case of AC reactor. The THDi (Total Harmonic Distortion in current) with AC reactor will be from 35-40 % whereas it will be from 30-35 % with DC reactor. So, the performance of DC reactor is much better. In overall view, DC reactor is preferred compared to AC reactors.

Ideal Solution - AC or DC Reactor?

The ideal solution would be to use both AC and DC reactors in the system as it gives best possible advantages of both. A 3 % AC & 3 % DC reactor help in protecting rectifier diodes, reduce current harmonics to appreciable level & containing voltage drop to acceptable level there by avoiding nuisance trips.

Thus opting for both AC & DC reactor gives optimum solution in terms of cost & performance. Last but not least, VFDs with reactors last longer than VFDs without reactors.
### Application Case Study

**Industry:** Cement  
**Application:** Bag filter fan  
**Motor rating:** AC Induction Motor, 3-Phase  
- **kW:** 37  
- **Volt:** 415  
- **RPM:** 1470  
- **Hz:** 50  
- **Amp:** 68

**Previous system:** Motor was running on Star Delta Starter.  
**Problem observed:**  
1) High maintenance cost.  
2) Energy losses due to flow control by damper.  

**Present system:** Axpert-Eazy, 37 kW Variable Frequency Drive used.  

<table>
<thead>
<tr>
<th>kW (Consumption)</th>
<th>Damper Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Previous system (Without drive)</td>
<td>35 kW</td>
</tr>
<tr>
<td>Present system (With drive)</td>
<td>29.5 kW</td>
</tr>
</tbody>
</table>

**System block diagram:**

![System Block Diagram](image)

**Merits of new system:**  
1. Easy & smooth operation.  
2. Energy saving due to flow control by Variable Frequency Drive.

**Economical analysis:**

- Energy consumption without VFD - P1 = 35 kW  
- Energy consumption with VFD - P2 = 29.5 kW  
- Energy saving per day ((P1 - P2) x 24) = 132 Units  
- Saving per day @ Rs. 5/- Unit = Rs. 660/-  
- Saving per year (Approx. 300 Days) = Rs. 1,98,000/-

**Payback Period Approximately 6-7 Months**
AMTECH POWER LIMITED is an established and reputed name in the field of Power Generation, Control and Protection. APL has revolutionized the excitation system market in India with the introduction of Digital Excitation System since 1998. With installations of Captive Power plants in every part of the country and international footprints, APL is well known for its technical strength and system solutions for segments like Steam Turbine, Hydro Turbine, Co-generation plant, DG set. APL is fully equipped to design, manufacture, install, commission and provide after sales service of any kind of control and protection equipment.

APL is dealing in wide variety of protection systems for Generators, Transformers, Motors and Feeders.

**Digital Protection System For Generator**

**Digital Protection For Transformer**

**Options available on each BE1-11 relay**

**Generator protection, control, monitoring and metering for applications including power plants, backup generation, portable power and distributed generation. Differential & synchronizer options available.**

**BE1-11g specific features**

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<td>86</td>
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**BE1-11t specific features**

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<td>101</td>
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**Standard feature**

**Optional feature**

**HARDWARE**

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<thead>
<tr>
<th>H AND P-CASE (Half Rack)</th>
<th>J – Case (S1 size)</th>
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<tbody>
<tr>
<td>Case</td>
<td>Full Draw Out</td>
</tr>
<tr>
<td>Contact O/P</td>
<td>5 + 1 alarm</td>
</tr>
<tr>
<td>Digital I/P</td>
<td>4</td>
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<tr>
<td>CT Input</td>
<td>4</td>
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<tr>
<td>VT Input</td>
<td>4</td>
</tr>
<tr>
<td>Removable plug</td>
<td>8 + 1 alarm</td>
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<td></td>
<td>7</td>
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<td>4 or 8</td>
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The objective of the steam and condensate system in paper machine is to provide the steam for drying. In the dryer part the moisture is evaporated as the paper is pressed between felt and the hot drying cylinder.

The steam and condensate system is a part of a paper machine. Past the press section, the paper sheet has a water content of about 60%. The final drying is achieved in the drying section. This is achieved by means of several steam heated dryers (cylinders). These are driven in groups of few together. The paper sheet runs over a large number of dryers. The temperature of each of the dryer surfaces must be exactly controlled. In the first group this might be 70 °C (160 °F) and then rises slowly to 105 °C (221 °F) in the later groups at the dry end.

Features:
- PLC based control system
- User friendly SCADA system
- Steam pressure / flow control
- Differential pressure control
- Separator vessel level control
- Heat exchange temperature control
- Paper break control
- Various control loop mimic
- Alarm for early detection of problem
- Trend of critical parameters for troubleshooting
- Steam usage logging

Benefits:
- Assistance from concept to commissioning
- Improved Efficiency
- Simple operating philosophy helps operators understand the automation and use it
- Easy to understand and user friendly screens
- Minimized maintenance reduces the cost and provides more up time
- Easy troubleshooting
- Quick and safe commissioning
- Qualified after-sales service
To whom so ever it may concern

This is to certify that M/s Amtech Electronics (India) Ltd supplied VFDs at Damodhar Cement Works (A Unit of ACC Limited) installed at different applications is working satisfactory for the last one year.

Performance of these VFDs is very good and service support during schedule as well as emergency is prompt.

We wish them the best of endeavour to keep this up.

Ansh Singh
Dy.Manager-E&I
ACC Limited
Damodhar Cement Works
Madhukunda
P.O. Sunuri - 723121