

## 5 Key Competencies for Switchmode Power Supply Manufacturers

### *Introduction*

Switchmode power supplies (SMPS) have fulfilled their potential as the “next big thing” in electrostatic precipitator (ESP) energization technology. Dozens of electric utilities and a number of ESP OEMs have standardized on SMPS. The particle collection improvements, the kVA savings, and cost of ownership benefits are now generally accepted throughout the industry.

Now that the viability of this system has been established, the challenge becomes making certain that the selected SMPS supplier has the core competencies needed to produce world-class equipment.

Since the earliest days of the industry the ESP power supply system was split into major components – Transformer/Rectifier, Current Limiting Reactor, Voltage Control and Switch Gear Cabinet. These were purchased from individual vendors who specialized in one or perhaps two of the components, as very few suppliers were competent and price competitive in supplying all of the major power system components.

In this environment the integration of the complete power system was the responsibility of the ESP supplier. For upgrades and support, users could and did purchase individual components, and thus took on the systems integration role for themselves. This approach has been the standard mode of operation.

Switch mode power supplies introduce a much different situation. The power supply is now one integrated system incorporating all of the required elements from incoming switch-gear to the high voltage output bushing. The power supply control must now be an integrated part of the system.

Most importantly - a successful supplier of SMPS units must now be a fully capable power supply systems company; not a components supplier. This is a critical distinction!

So what should ESP designers and owners look for? It is well accepted within the power supply industry that successful manufacturing companies must be competent at the design and production of the five key components listed below:



## ***1. Power Electronics Design***

Outstanding engineering talent is absolutely essential for switchmode supplier. They must have significant knowledge of circuit topology and know how to properly apply and specify various power semiconductor devices, most notably Integrated Gate Bipolar Transistors (IGBT) and specialized capacitors used in high power inverter systems.

This technology is advancing rapidly. It is incumbent on an SMPS supplier to incorporate improvements in circuitry and componentry into new designs in order to keep up with the ever more stringent demands of the marketplace.

## ***2. High Frequency High Voltage Magnetics Expertise***

High frequency transformers required in SMPS equipment are much more sophisticated than their 50/60 Hz equivalents. The materials and manufacturing techniques employed in their fabrication require very specific technical knowledge and skills. Their smaller size necessitates more sophisticated winding and insulation methods and tighter control of the coil winding process. The market for industrial grade high frequency high voltage transformers in the 50 to 100kW range has been very limited; therefore, few suppliers have had extensive experience with this operating window.

Since the transformer is the largest and most expensive component in the SMPS, the supplier should control everything from design to fabrication to final test. Optimizing the design is a key factor in achieving a competitive selling price.

## ***3. Enclosures and Packaging***

High power outdoor power supply installations require creative industrial packaging solutions to fit many critical components into a small footprint and still properly dissipate the heat losses.

The enclosures will need to be specially engineered to tightly integrate with the overall system design and to protect all components from dirt and moisture. To do this effectively, the supplier must have advanced in-house design and manufacturing capabilities.

#### **4. Controls**

Since the controls are now an integral part of the power supply, the manufacturer must have experience with and knowledge of the control functions needed to optimize ESP performance.

An SMPS supplier must have the manufacturing capability to build and integrate the power electronics, magnetics, controls, and tanks/enclosures into a single package. Ideally, the manufacturing operation will be vertically integrated so as to control the design, fabrication, and test of all these components.

#### **5. Logistics excellence and life-cycle support**

Once the SMPS is on the precipitator roof, it must be properly supported throughout its service life. The supplier needs to be able to provide the following aftermarket services:

- Spare parts support, including spare T/R tanks
- On-site field service
- Factory repair and refurbishment, including upgrades to older versions

Conventional power supplies were designed and built to order, and spare reactors and T/R sets were generally not maintained in stock by the original supplier. The ESP owner was required to maintain his own spare parts inventory or else pay a premium for expedited repairs or replacement.

A properly designed SMPS will have a common platform. The SMPS manufacturer should have a competent supply chain organization. All spare parts and assemblies will be inventoried at the supplier's warehouse, thereby alleviating the customer of the need to keep their own parts inventory. Parts can be shipped overnight, keeping equipment downtime to an absolute minimum.

#### **Conclusion**

Deciding to use (or upgrade to) a switchmode power supply for electrostatic precipitators is a very sound decision. Deciding on the right SMPS supplier is equally important to ensure years of reliable and consistent service.