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Quality Power is a technology based provider of Power Products, Systems, Solutions and Services. Building on our core strengths of technology leadership, pioneering spirit and a sustainable approach to business, Quality Power helps its customers to become more profitable while lowering environmental impact.

Quality Power has a Global presence with a satisfied customer base in over 75 countries and an international spread of 35 representative offices. For more details on the company and its other products please visit www.qualitypower.com | www.endoks.com.tr

**POWER QUALITY**

As every year several thousand MW of generation capacity is added to the grid to catch up with the ever growing demand, electrical grids are getting fatter and more complex. And on the other hand, demand of non-linear load is rising rapidly- this combination has serious impact on quality of electrical power supply.

Also, a welcome awareness on environment has triggered the actions such as control on carbon di oxide emission, tap renewable energy sources & minimize the transmission & distribution losses etc.

We, at Quality Power, focus on design & supply of the critical components & solutions to make functioning of Smart Grids reliable and focus to improve the power quality. Power Quality has become a very important issue for transmission/distribution companies & almost all of the customers due to:

1. Widely use of loads generating disturbances in addition to equipments sensitive to voltage disturbances
2. Limitations on Power Quality parameters with National/International regulations and standards
3. Higher costs in production processes the parameters defining the quality of electric power are given in the standard IEC 61000-4-30 as follows:

   - Frequency
   - Magnitude of Voltage
   - Flicker
   - Voltage Sags and swells
   - Outages
   - Transient Over voltages
   - Voltage Unbalance
   - Voltage and Current Harmonics

Quality Power In our Power Quality Division undertakes different Reactive Power compensation projects up to 230kV systems.

**Power quality solutions**

With over 100 man years experience in Power quality, we possess a reliable skill set is designing precise filters for the systems. We are backed up with our various analysis software including ETAP, PSPICE, MATLAB, PSCAD etc. With our experience in Arc furnaces & SVC’s we deliver a vast array of active and passive filters.
HARMONIC FILTERS

With over 100 man years experience in Power quality, we possess a reliable skill set in designing precise filters for the systems. We are backed up with our various analysis software including ETAP, PSPICE, MATLAB, PSCAD etc along with our in-house developed software. With our experience in Arc furnaces and SVC’s we deliver a vast array of passive filters:

A PASSIVE HARMONIC FILTER:
Is built using an array of capacitors, inductors, and resistors. It can take the form of a simple line reactor or may use a series of parallel resonant filters to eliminate harmonics.
Passive harmonic filters are also divided based on the way they are connected with the load

SERIES FILTER:
Here the filter is placed in series with the load & uses parallel components. i.e., inductors & capacitors are in parallel. This filter is a current rejecter.

PARALLEL FILTER:
The filter is placed in parallel with the load and its components are built in series. This filter is a current acceptor.

Based on the components used to build the passive filter, there are the following types:

- **Band Pass Filter:** Is a common passive filter that is built using a capacitor connected in series with a resistor.
- **High Pass Filter:** Has a resistor connected in parallel with a reactor. This helps in reducing the q value of the filter, which in turn help reduce the higher frequencies, when a High Pass Filter is used in combination with a band-pass filter will provide a solution for medium voltage & sub transmission voltage networks, which have moderate harmonic distortions.
- **C Type Filter:** Is used for complex loads, cyclo converters and electric arc furnaces and is a special variation of the high pass filter. This filter will provide the load with reactive power and avoid forming parallel resonance circuits with the load.

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SVC

Introduction:
SVC Systems are reactive power compensation and harmonic filtering systems developed to minimize the disturbing effects caused by fast varying reactive power, voltage variations and harmonics in electric Transmission/distribution system and industrial plants.

Switching events, faults, non-linear loads (power semiconductor based systems) & fast variation of active/reactive power demand from grid may lead to disturbing effects on power system. SVC systems are implemented with specific circuit elements by considering the load characteristics and supply conditions.

The subsystems constituting SVC systems are follows:
- Thyristor Controlled Reactor (TCR)
- Thyristor Controller Transformer (TCT)
- Thyristor Switched Reactor (TSR)
- Harmonic Filter (HF)
- Thyristor Switched Capacitor (TSC)
- Mechanical Switched Capacitor (MSC)
- Fixed Capacitor (FC)

Application Fields

Static Var Compensation (SVC) systems are installed to fulfill the following technical requests.
- Dynamic reactive power compensation
- Flicker reduction
- Load balancing
- Mitigation of harmonics
- Dynamic voltage regulation
- Increasing the system stability

System Components

Static Var Compensators (SVC) are realized by using the system components given below:

SVC Control and Protection System

Protection features of the protection relays, protections performed by control system, other functions related with environmental systems & human interface systems are integrated with the control system.

Design and manufacturing of SVC control systems are realized in international standards within our company by using the products of well-known suppliers.

THYRISTOR STACKS

Thyristor stacks are used to control the inductive reactive power produced by Thyristor Controlled Reactor (TCR) of Thyristor Controlled Transformer (TCT). Thyristor stacks are composed of thyristor modules water cooled heatsinks, RC snubbers & thyristor control units.

Thyristor stacks are designed & installed by our company up to 36 kv bus voltage.
OTHER EQUIPMENTS
System parts given below are also supplied by our company in addition to main system parts:
- Power Transformers
- Resistors
- Medium Voltage Switchgear Equipments
- Measurement / Protection Transformers
- Protection Relays
- Remote Monitoring and Control Systems

HARMONIC FILTER REACTORS
Harmonic filter reactors are used to filter out the harmonic currents caused by the loads and to keep the injected harmonic currents to the grid below the specified limits in the standards (IEEE 519-1992, IEC 61000-3-6).

CAPACITOR BANK
Required capacitive reactive power according to project specifications is achieved by:
- Fixed (FC)
- Mechanical Switched (MSC)
- Thyristor Switched (TSC)
- With harmonic filtering / Current limiting reactor
- Outdoor/ Indoor Capacitor banks.

TRANSFORMER (TCT)
Transformers with high short circuit impedance (> 70%) can be preferred instead of shunt reactors in SVC applications having installed power less than 20 MWAr. Installing thyristor power stages at the low voltage side shorter delivery times for transformer and need for smaller area for system installation brings important advantages in the project costs.

WATER COOLING SYSTEM
De-ionized water cooling system is used in the cooling of thyristor stacks. Main specifications of water cooling system are as follows:
- PLC based control and protection integrated with SVC control and HMI system
- Redundant water pumps
- Redundant heat exchangers
- Reliable water cooling capacity

SHUNT REACTORS (TCR)
Shunt reactor is one of the main components of SVC System that is used in order to obtain variable reactive power. In Thyristor Controlled Reactor (TCR) applications, SVC Control System controls shunt reactor currents by varying the firing angle of the thyristors according to the SVC Operation Mode.

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STATCOM (Static Synchronous Compensator) is a reactive power / bus voltage regulating device.

- STATCOM is based on voltage-source converter topology and can act as either a source or sink of reactive power.
- STATCOM is capable of providing both capacitive and inductive reactive power.

**Applications**

01. Arc furnaces
02. Ladle furnaces
03. Induction furnaces
04. Rolling mills
05. Welding operations
06. Unbalanced loads
07. Fluctuating reactive loads
08. Process industries

**TECHNICAL PARTICULARS**

<table>
<thead>
<tr>
<th>Voltage Level</th>
<th>1000 V AC</th>
<th>400/690V AC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated Power</td>
<td>1000 kVar</td>
<td>300 kVar</td>
</tr>
<tr>
<td>Current</td>
<td>600 A</td>
<td>450A @ 400V</td>
</tr>
<tr>
<td>Installation</td>
<td>Indoor</td>
<td>Indoor</td>
</tr>
<tr>
<td>Connection Type</td>
<td>3 phase ~ 3 wire</td>
<td>3 phase ~ 3 wire / 4 wire</td>
</tr>
<tr>
<td>Output Frequency</td>
<td>50-60 Hz</td>
<td>50-60 Hz</td>
</tr>
<tr>
<td>Reaction Time</td>
<td>&lt; 1 ms</td>
<td>&lt; 1 ms</td>
</tr>
<tr>
<td>Response Time</td>
<td>&lt; 1 cycle</td>
<td>&lt; 1 cycle</td>
</tr>
<tr>
<td>Cooling Type</td>
<td>Water Cooled</td>
<td>Forced Air Cooled</td>
</tr>
<tr>
<td>Operating Temperature Range</td>
<td>0°C- 50°C, without derating</td>
<td>0°C- 50°C, without derating</td>
</tr>
<tr>
<td>Communications</td>
<td>Modbus-RTU, Modbus-TCP</td>
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</tr>
<tr>
<td>User Interface</td>
<td>4.3 inch Touch Screen</td>
<td>4.3 inch Touch Screen</td>
</tr>
</tbody>
</table>

- Low order harmonic current filtering (5th, 7th, 11th and 13th current harmonics)
- Programmable harmonic filtering capacity
- Losses optimized according to STATCOM operation (losses < 2.5 %)
- Interface with existing scada
- Critical parts supplied from European Manufacturers