StarSine™ Power Quality Products

Medium Voltage Static Transfer Switch (“MV STS”)

MV STS SIGNIFICANTLY IMPROVES THE UPTIME OF FACILITIES WITH DUAL FEEDER SERVICE BY SUB-CYCLE SWITCHING FROM ONE POWER SOURCE TO ANOTHER

Whether a power outage or a voltage sag event presents itself at one of the dual feeders to a facility, downtime of unprotected loads is inevitable. A MV STS located at the facility MV substation transfers the whole facility load from an unhealthy feeder to a healthy feeder at sub-cycle speeds to minimize power interruption to critical loads within a facility.
**List of Benefits**

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<th>MV STS Features</th>
<th>Benefits to Automated Facility Operators</th>
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<tr>
<td>Reliable Power Outage and Voltage Sag Ride Through Capability</td>
<td>Voltage at MV STS load feeders meets the ITI (CBEMA) voltage tolerance curve requirements provided that at least one of the feeder is healthy</td>
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<td>No Energy Storage Used</td>
<td>MV STS makes use of facility dual distribution feeder service for sourcing the power for outage and sag compensation rather than drawing it from an energy storage device</td>
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<td>Supports Large Whole Facility Load Sizes and Fault Currents</td>
<td>Single MV STS unit can support whole facility or even the entire industrial park load bus of up to 36 MVA total load size and fault currents to up to 10 kA for 1 second</td>
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<td>Application Specific Engineered Units</td>
<td>Units engineered to meet site specific requirements; load size, system voltage, fault currents, ambient T &amp; H extremes</td>
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<td>Utility Grid Harmonics and Load Reactances Compatible Design</td>
<td>Patent pending ferroresonance-suppressing MV STS design ensures compatibility between utility grid voltage harmonics and load transformer magnetizing reactances</td>
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<td>Environmentally Friendly</td>
<td>The MV STS design utilizes power electronics ambient air cooled</td>
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**When to Use a MV STS**

The MV STS is designed to provide a whole facility power outage and voltage sag protection **as a low cost alternative to large industrial UPS systems** when a dual distribution feeder service is available (or the ones, which can readily obtain a second feeder service from its local utility).

To protect a facility, campus or an industrial park from outages of its “normal” power source (for instance, the primary feeder connected to the closest utility substation), the redundant or secondary feeder needs to be connected to an independent power source. This source has to be capable of supplying the entire load with a fraction of second notice. Examples of such an independent and fast responsive source are the second utility substation connected directly to a high voltage transmission grid or an onsite cogeneration resource also capable of backup generation.

When the dual feeders are connected to utility substations with different pricing schedules, MV STS allows the facility management to take advantage of receiving the power at the better price at all times. Using appropriate communication links and pricing information sources **the MV STS control logic can follow the source with the best pricing** by seamlessly switching the load from one source to another. A similar scheme can be used with onsite cogeneration allowing the facility to continue to receive power during rolling blackouts, excessive demand charges periods (peak shaving) and so on.
Configurations

MV STS units are available in two different circuit configurations: a double static switch configuration, feeding a common load bus (see Figure 1) and a triple static switch configuration, feeding two, split load buses, load bus “A” and “B” (see Figure 2).

Figure 1: Double (Common-Bus) MV STS

Figure 2: Triple (Split-Bus) MV STS

These two MV STS power circuit designs provide flexibility in selecting and fitting the appropriate configuration to meet the actual application requirements.

Product Design

Static Switch - Thyristor Valve

SatCon’s MV STS unit utilizes thyristor valve as its main building block to configure the static switches. Each valve is composed of a series of thyristor device pairs connected back to back to provide for AC current switching. Thyristor devices are selected to provide the required system voltage blocking capability and for proper transient voltage sharing required by the application.

This proven valve design as shown on figure 2 includes:

- Fiber optic isolation between control logic and thyristor valves for lightning impulse / switching transient voltage isolation and enhanced controls noise immunity
- Proprietary, medium voltage isolation techniques of the thyristor gate driver boards power supply
- Comprehensive basic impulse (BIL), through-fault current, high temperature and humidity type testing by independent utility lab.
Controls

SatCon’s MV STS logic continuously monitors the voltage quality of the both source voltages. The controls issue control requests to the medium voltage valves and system bypass and isolation switchgear to maximize power quality at the load bus. The controls logic and HMI panel as shown on figure 3 feature set includes:

- Fully automatic and manual transfer control capabilities
- Proprietary high reliability control logic design approach
- Alphanumeric display of diagnostics and unit operation status;
- Remote SCADA RTU interface capability and
- UPS control power backup for cold start and outage ride through

Operation Performance

Operating performance of the field installed MV STS unit during a voltage sag event of 55% of nominal, three-cycle long, is demonstrated through a capture of actual feeder 1, feeder 2 and load bus voltage waveforms. The voltage waveforms as presented at figure 4 include the voltage quality situations for both feeders and for the load bus voltage prior, during and immediately after the voltage sag event. As shown by the load voltage waveform at the onset of the voltage sag, it took the MV STS unit less then 2 milliseconds to complete the load transfer from one feeder to another.

Figure 4: Waveforms During a Voltage Sag Event at Utility Feeder 1, Feeder 2 and at Facility Load Bus
Technical Specifications

Continuous Current (CC) Rating: 100 A through 1200 A
Short-Circuit Current, 1 second: Up to 25 kA RMS Symm
Nominal System Voltage Range: 2.4 kV through 34.5 kV
Frequency: 50 Hz or 60 Hz
Lightning Impulse Basic Insulation Level, BIL: Up to 150 kV

Source Voltage Sensing and Load Transfer Times:
Voltage Sag Sensing and Transfer Time: 4.17 ms (1/4 of 60 Hz cycle) max.
Voltage Swell Sensing and Transfer Time: 8.33 ms (1/2 of 60 Hz cycle) max
Feeder Fault Sensing and Re-Generative Load Transfer Time: Up to 12.5 ms (3/4 of 60 Hz cycle)

Other SVR Unit Technical Data:
Minimum Efficiency at > 75% of the CC Rating: 99.8% (3 MVA minimum load)
Load Power Factor Range: 0.5 inductive to 0.5 capacitive
Ambient Temperature Range: -10°C to 40°C standard
Ambient Humidity Range: 0-95% RH non-condensing
Ambient Electro-Magnetic Compatibility (EMC): Select IEEE, IEC, and FCC Std.

Equipment Layout

Unit Installation
Dimensions:
26.0’ W x 4.5’ D x 10.6’ H for 300A, 21kV MV STS Unit

Unit Weight:
20,000 lbs. Approx. for 300A, 21kV MV STS Unit
Improved Uptime of Your Business

MV STS is designed to improve the uptime of your business by significantly improving the reliability of electric power service. Businesses, which can particularly benefit from MV STS improved power service include:

- Manufacturers of semiconductors and its production tools
- Operators of automotive assembly lines
- Operators of paper machines, plastic film machines, commercial printing machines and other continuous process machine types
- Owners of industrial parks, institutional campuses and commercial building complexes

For more information about how MV STS can specifically benefit your operation and be fitted in your facility power service application please refer to SatCon Power Systems (former Inverpower Controls) product pages and virtual library at www.satconpowersystems.com or contact us directly:

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