The USES® Theory Of Operation

USES® reduces power in at least three different ways.

1. It creates a leading power factor of at least 50% leading, which reduces the inductive VARs on the system by up to 40 KVAR per unit depending upon the phase and voltage (600 volts 3 phase, 60 hertz). The resultant reduction in the line current means lower conductor and transformer losses. This alone could mean 1-2% improvement in losses.

2. As a voltage regulator, it stabilizes and regulates the inter-phase voltages to the load and from the voltage supply.

3. By far the greatest savings by the USES® device is the ability to develop a negative current from the adjacent phases (such as B-C and C-A into phase-B). This current is inserted into each phase by means of inducing current through magnetic coupling of the other phases. Devices such as choke coils, current transformers, or reactors are used and by wrapping the in such a way produce a negative current with a relatively large 120 cycle content.

   The net result is a reduction of power consumption of ten (10) to fifteen (15) percent depending upon circuit parameters.

   The units also act as a surge and transient suppressor as well as a supplemental power source for a few cycles, (UPS).

As an example, examine figure 5 of the patent application. Capacitor no. 240 and varistor 242 are meant as an RC network to act as a filter for harmonics and surges. Usually there is also a surge arrestor.

Capacitor no. 224 and 238 are in the circuit to provide a leading power factor. L1 and L2 are magnetically coupled through choke coils 214, 230, 218, 234.

This negative current is achieved in the winding direction of the choke coils and reactors. Let us assume we are looking at phase B. When phases A and C are magnetically induced in phase B, they are subjected to a 180º phase shift as they pass through the choke coils. The wave form in phase B would have the basic sine wave form with a leading power factor plus two negative wave forms from phase C (leading) and phase A (lagging). The resultant wave form would be a basic sine wave, less 120º cycle clipping, which will appear identically in all three phases, thus the overall current will appear as a 60 cycle wave form with a 120º cycle

current superimposed. Since this current is negative, it will be 180º out of sync with the main phase current.

This will have the net result of reducing current from the source and since it is a leading current, will reduce the inductive VARs in the circuit.

On the main feeder current, the effect can be observed with an oscilloscope, when comparing the before and after USES® application, by a reduced cresting factor of the wave form. Thus the treated wave form has a lowered peak and appears more square. This reduced RMS current results in a perceived lower I^2R load value to the source. Thus a 5% "in phase" current reduction will result in 10% power reduction.

There are several key particularities to these USES® devices. Some are as follow:

a. A static current source converting magnetic fields to electrical energy.
b. Producing a negative current, which does not contribute to improving load side consumption of energy but reduces the upstream effect. As an example let us take a 100 amp with a USES® device upstream. Whether the USES® device is on or off, this load will basically be the same except for minor variances caused by a slight stabilization of phase voltage.

   However, the current backflow to the source will be reduced by the current from the USES® device. This agrees with Kirchoff's law, that the algebraic sum of all current at a point equals zero.

In other words, the current from the USES® device does not flow to the load, but up line towards the source.

Ohm's Law is fulfilled by $E=IR$ or $E - E_{back\text{-}voltage}=IR$

There has been one theory put forth that most of the savings are due to motor circulating currents caused by phase imbalances. If this were true, then motor currents would be drastically reduced with the application of USES® units, which normally is not. However, if the total power savings are much greater than the watts produced by 50% of the USES® current (50% leading power factor), then one would find that some of the surplus savings would come from the correctional voltage imbalance.