



## ON THE TESTING OF USES UNITS

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As a power conditioner, the USES Unit can be specified for newly designed electrical systems or retrofitted into the electrical systems of operating facilities. When being considered for an operating facility, tests to demonstrate the effectiveness of USES are important. The instantaneous reduction of amperage and wattage and the improvement of power factor can easily be shown by the table-top demonstration, however, many plant managers require more specific evidence of the interaction of USES with their systems to support a decision to proceed. Over the years, because the principle of USES was new and poorly understood, we have been drawn into extensive temporary installations and their testing and evaluation. It has been possible to demonstrate instantaneous wattage reduction for individual loads using a portable watt meter, and even for entire systems using the newer electronic demand meters. However, the instantaneous on/off measurements tell only part of the story. By closely monitoring facilities which have been fully engineered with USES, we have consistent evidence of additional beneficial effects. We must answer the question: How do these additional savings occur if they are not shown in an on/off test?

The on/off tests evaluate the instantaneous effects only, such as the beneficial balancing of phase voltages and currents on motors and the beneficial effects of the squaring of the current waveform on the efficiency of rectifiers and transformers. Additionally, the interphasic magnetic chokes of the USES Units capture waste electrical and magnetic energy which would not otherwise be available to the load. Waste energy is found only in actual electrical systems which contain conditions not represented in the general AC theory. These waste reduction effects only accumulate over time and are not seen in the on/off wattage reduction test. To demonstrate these additional saving features of USES, watt-hour data must be accumulated. Such tests are expensive and difficult to control. The proper interpretation of instantaneous measurements of wattage reduction in the on/off test is an important demonstration of the technology. If properly understood, then on/off test results support the empirical rules that we use to predict the total savings resulting in a fully engineered USES installation.

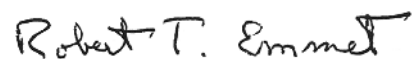
In the theory of alternating current as developed by Steinmetz, Langsdorf and others, power is expressed as the sum of two terms. The first is the instantaneous average power and the other is the time dependent component. In the ideal case of sinusoidal harmonic voltage and amperage, the time dependent component averages out to zero over a single cycle and is therefore neglected in the general theory. In the case of the real world, where current and voltage are not sinusoidal or continuous, the time dependent term in the power equation becomes important, and must be considered in evaluating the time dependent properties of the USES Unit.

An on/off test can be designed to look at the average power demand of the circuit with and without USES. Such tests are useful because they are quick and the time variability inherent in all systems can be controlled to give a statistically significant result. If the power in the circuit were theoretically ideal, with unity power factor, sinusoidal voltage and current, and with no voltage spikes and surges, then the total effect of USES would be described by the on/off test. Extensive experience shows, however, that the USES effect also includes time dependent savings. The only way to measure the time dependent effects is to measure the demand over a sufficient time interval, i.e., to accumulate KWHr data, which will show additional savings occurring during non-ideal events and which will accumulate through out the billing cycle. These KWHr accumulation tests require a facility that is fully engineered with USES Units. The tests are expensive, time consuming and the results are difficult to evaluate because control conditions are difficult to monitor.

In the on/off test we can demonstrate that there is an interaction between the USES and the loads which is independent of time and which does contribute to a reduction in KW demand. This amounts to about 1 KW for the CMES-3D-208V unit and 3 KW for the CMES-3D-480V unit. Based on continuous monitoring of many facilities which have been fully engineered with USES Units, we have found that each CMES-3D-208 unit saves about 2,000 KWHr per month and reduces the KW demand by about 1.5 KW, while each CMES-3D-480 unit saves about 3,200 KWHr per month and reduces the KW demand by about 3 KW. These total effects are 2-3 times the effects shown by the on/off tests.

Because of our experience with the units, after careful inspection of a facility and the utility bills in order to understand the extent and the history of electrical usage, we can recommend a placement of USES Units designed to achieve maximum KW savings and power factor improvement with sufficient surge and spike protection. We guarantee that if the USES Units are installed as recommended, the rated savings will occur. If a client is not satisfied, then we will remove the USES Units at no cost. Because of the beneficial effects of USES, which become apparent during the test period, very few of our clients have been dissatisfied.

Yours truly,



Robert T. Emmet, Ph.D.  
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