THE ELECTRICAL WATCH DOG
USES®

An Introduction To the

USES® SHUNT EFFICIENCY SYSTEM

The patented **USES® Shunt Efficiency System** provides power conditioning and protection from potentially damaging power line surges and spikes. Additionally, the **USES® Shunt Efficiency System** can reduce the electrical energy costs associated with the operation of inductive loads - motor driven equipment and appliances and magnetically ballasted lighting systems.

USES® technology capabilities include:

- protection from surges and spikes, including secondary lightning effects;
- power conditioning, dynamic power factor correction, RF noise reduction, and reduction of the total current content including harmonic current; and
- reduction of the electrical power drawn from the utility to operate inductive loads such as air conditioning and ventilation systems, pumps, compressors, & magnetically ballasted fluorescent & high pressure sodium lighting systems.

The benefits derived from **USES®** units include:

- improved equipment reliability, including computer and electronic systems;
- reduced life cycle maintenance, repair, and replacement costs; and
- an average return on investment is from 6 to 36 months.

The **USES®** approach is superior to other methods for improving electrical system performance, reliability, and efficiency from both an operational and cost standpoint. The technology's patent and listing by UL and CSA attest to the validity of **USES®'** capabilities. The devices are maintenance-free, have a three year limited warranty, and have a projected life of 10 years. Models range from 120/240 volt residential units up to three-phase 600 volt industrial units.

USES® works, it works very well, and it saves energy and money. The unique application of the wrap-around magnetic chokes enables wasted magnetic energy to be converted to useful energy which is then supplied to the electrical system. This reduces the electrical power that the utility must provide resulting in lower electric bills. The units consistently provide real power (KW) savings when installed in systems with inductive loads. These savings exceed the KW reduction achieved merely from the reduction of I^2R losses. Specific savings are contingent on the electrical load configuration, equipment operating hours, and KWH cost. Additional savings can be realized from the reduction of demand charges and the reduction or elimination of power factor penalties. Units generally pay for themselves through utility cost savings in approximately 2 years.

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DESCRIPTION

Our Savings Unit was designed to cut demand and save money on your electric bills. As you realize, demand is what determines a commercial customers rate on his bill. Our Unit also acts as a surge suppressor, as we had to incorporate a suppressor into our unit to protect our own product.

Our unit balances the load in the panel box, takes out the spikes and surges, reduces the I^2R loss and reduces the noise pollution in the lines. A good electrical current is like a wave, versus the irregular waves you now receive. Our unit corrects the irregular waves to create as perfect a wave as possible to supply cleaner power.

The unit is also a positive envelope, which means that only 130 volts will be expelled to the electrical system at any one time, therefore protecting the system from surges. The unit reduces wear and tear on motors and lights. By reducing the wear and tear, your motors run cooler. The ballasts and fluorescent bulbs last longer as the unit takes the spikes out of the lines.

In our demonstration we can show by using an amp meter how we can reduce the initial start and running wattage on eight energy saving lamps by more than one amp and in some cases by much more. We cut the initial start up on motors by much more. We can also demonstrate how our unit has no effect on the light output or running of a light or motor.

Not all electrical equipment is pure resistance. Any piece of equipment which requires a magnetic field to operate, for example a motor, a transformer, a fluorescent ballast, or a solenoid will cause the voltage and current to get out of phase unless some corrective action is taken. Even if it is only a fraction of a second, it takes time to create and collapse a magnetic field which is what happens in an AC current circuit. This is similar in effect to physical inertia and is called inductance.

Many utilities do not show a penalty on their bills but they do have a KVAR or a KVA demand charge. Both of these are another way of penalizing an end user for poor power factor. If a plant is being charged for KVA demand and all that demand is not being converted to KW or useful work then the end user is paying the higher KVA demand and the related charges on the utility bill. Less current flowing in the end users conductors which means lower I^2R losses in the lines. This will result in lower basic KWH energy charges, lower sales taxes and lower fuel adjustment charges. It also means higher voltages at motors, which will run cooler, thereby, increasing their life.

As said previously, our unit is also a very heavy duty surge suppressor. This is a very important factor, whether it is used in a home or in a commercial building. Although, most homes do not have high power bills, many people wonder why they should purchase a unit. The unit will reduce the power bill, but most important it will protect their refrigerator motors and other motors from harmful spikes. The unit will also protect their televisions and microwaves, which are very easily damaged by spikes and brown outs. Saving an appliance such as these would make the purchase of a unit worthwhile. The unit is also very important if one lives in a trailer park where power supply is usually below standard.

In a commercial application, not only would the unit save on the bill, but it would protect the air conditioning, heat pump and any other large motors from surges. The motors would run cooler, more efficiently and would require less maintenance. We have not even tried to calculate the savings achieved by reducing the maintenance on motors, replacement of fluorescent bulbs and ballasts. In most applications the savings could be very substantial.

USES, Inc. has designs to correct above problems and actual models for the following units which are wired in a receptacle no more than 10' from a panel. Our model numbers are as follows; RDES-1, CMES-1, CMES-3Y, CMES-3D, CMES-3Y 480, CMES-3D 480, CABO-120 and CABO-240 for different voltages.

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SAVES MONEY AND CONSERVES ENERGY **USES® Shunt Efficiency System**

These devices are closed type power factor correction units with surge suppression. They e a polymeric enclosure. They function as a solid state surge and spike suppressors for voltage. They are intended to limit the maximum amplitude of voltage spikes and surges on power lines to specified values. The devices intend to reduce line transmitted interference or noise generated by motors or appliances. They improve voltage regulation. They reduce magnetic fields through wire and equipment from the point of connection of the Unit back to the source by reducing current. When these devices are connected to inductive loads, connected on each hot leg they intend to balance the current on each of these legs and lower the current on the neutral. They are intended to be installed on the load side of the main disconnect.

In order to provide you with an overview, the following is a brief synopsis of the benefits of the **USES® Shunt Efficiency System:**

- HELPS LOWER DEMAND AND KILOWATT HOURS
- HELPS LOWER ELECTRIC BILLS
- IMPROVES MOTOR PERFORMANCE AND HELPS EXTENDS LAMP AND BALLAST LIFE.
- LOWERS I^2R LOSSES.
- INCREASES EFFECTIVENESS OF ELECTRICAL SYSTEMS
- REDUCES MAGNETISM.
- PROTECTS AGAINST POWER SURGES AND SPIKES.

Briefly our device is a UL and CSA approved product. These devices are closed type power factor correction units with surge suppression. They use a polymeric enclosure. They function as a solid state surge and spike suppressors for voltage. They are intended to limit the max amplitude of voltage spikes and surges on power lines to specified values. The devices intend to reduce line transmitted interference or noise generated by motors or appliances. They improve voltage regulation. They reduce magnetic fields through wire and equipment from the point of connection of the Unit back to the source by reducing current. When these devices are connected to inductive loads, connected on each hot leg they intend to balance the current on each of these and lower the current on the neutral. They are intended to be installed on the load side of the n disconnect.

The **USES® Shunt Efficiency System** technology can significantly reduce both KW demand and KWH usage for residential, commercial and industrial electrical systems. The device corrects power factor, balances loads, reduces spikes, surges, harmonics and noise. For all types of inductive equipment the device reduces eddy currents, hysteresis losses and counter EMF. Purely resistive loads receive minimal benefit.

Additional savings are obtained from lower maintenance requirements for motors, longer times between replacement of fluorescent bulbs and higher reliability of solid state circuitry in computers and communications systems.

The new technology uses magnetic chokes oriented to create crossing lines of magnetic force across the voltage and current of each electrical phase. Based on the magnetic fields sensed, an appropriate capacitance, inductance or resistance is introduced to the system. **USES®** monitors the load approximately every 1 X 10 seconds and responds to spikes and surges in less than 5 nanoseconds (<5 X 10). This degree of response permits dynamic power factor correction regardless of load variations.

A **USES®** Unit is easily installed across an existing 20 or 30 amp circuit breaker in your distribution panel. For optimum savings one unit is installed for every 200 amps of load. Units are sized for 120/240 volt single phase residential systems to 3 phase 4 wire 480 volt industrial systems.

USES® Shunt Efficiency System has been patented. In December 1990, the devices completed tests and approval for listing by the Underwriters Laboratories under category 5B81 "Industrial Control Equipment".

Without changing voltage or current to an eight energy saving lamp load or a High Pressure Sodium light, a good reduction in initial start and running wattage can be demonstrated. Depending on your electrical loads and energy consumption, you can expect a substantial savings ur electric bill.

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Technical Description

Power factors are generally lagging because of the exciting currents required by induction motors, transformers, fluorescent lighting, induction heating furnaces, etc.. Power factor improvement can be obtained through the use of synchronous motors or capacitors at the proper locations.

Low power factor has an adverse effect upon system operation. This fact applies to both industrial and utility power systems. For this reason, the rate structures of many utilities contain power factor clauses which penalize consumers with low power factor loads. The savings from improvement in power factor can be calculated from daily load chart of the plant and the particular rate structure involved. It is not uncommon for the capacitors to pay for themselves in a period of a few years.

Low power factor should be avoided for three reasons. First, since circuits and circuit elements tend to be more reactive than resistive, reactive components of current produce larger voltage drops than an equal resistive component of current. System voltage regulation suffers and additional voltage regulating equipment may be required for satisfactory operation.

The second disadvantage of low power factor is the inefficient utilization of system equipment due to the increased current flow per unit of real power transmitted. This larger current magnitude produces additional heating in system equipment and in effect, derates these components. Power factor correction will release this system capacity and permit increased loading without installation of additional distribution equipment.

A third disadvantage is the cost of the increased losses throughout the system. These losses vary as the square of the current and also inversely as the power factor squared. The reduction in system losses can result in an annual gross return of as much as 10 percent of the investment in power factor improvement equipment.

Motors and other utilization equipment are designed for operation at rated voltage. A loss in performance or life is experienced if other than rated voltage is applied to the equipment terminals. The ultimate effect of voltage variation is a function of the design of the equipment and the magnitude of the variation. Recognizing the fact that constant rated terminal voltage may not be maintained, various standardized bodies have allowed certain voltage tolerances within which the equipment will operate satisfactorily but not necessarily within guaranteed performance values.

A maximum voltage variation of $\pm$ 10 percent of rated is allowed for satisfactory operation of electric motors. Synchronous motor performance is generally affected the same manner, with the exception of the pull out torque, which is a direct function of voltage.

The major effects of motor operation at reduced voltages are increased losses, increased temperature rises, and reduction in starting and maximum running torques. Operation at voltages higher than rated produces greater starting and running torques, higher starting current and decreased power factor. In general there is less adverse effect on motor performance at terminal voltages slightly in excess of rated values than for voltages less than rated.

Power factor is the ratio of the true power or watts to the apparent power or volt amperes. The power factor is expressed as a decimal or in percentage. Thus power factors of 0.8 and of 80 percent are the same. In giving the power factor of a circuit, state whether it is leading or lagging. The current is always taken with respect to the voltage. A power factor of 0.75 lagging means that the current lags the voltage. The power factor may have a value anywhere between 0 and 1.0 but never greater than 1.0.

The power factor in a noninductive circuit is one containing resistance only, is always

1, or 100 percent; i.e, the product of volts and amperes in such a circuit gives true power. The power factor in a circuit containing inductance or capacitance may be anything between 0 and 1 (0 and 100 percent), depending on the amount of inductance or capacitance in the circuit.

The term kilowatt (kW) indicates the measure of power which is all available for work. Kilovolt amperes (KVA) indicate the measure of apparent electric power made up of two components, an energy component and a watt less or induction component. Kilowatts indicate real power and kilovolts-amperes apparent power. They are identical only when current and voltage are in phase, i.e., when the power factor is 1. Ammeters and voltmeters indicate total effective current and voltage regardless of the power factor, while a watt meter indicates the effective product of the instantaneous values of EMF and current. A watt meter, then indicates real power.

Standard guarantees on AC generators are made on the basis of loads at 80 percent power factor. However, it must not be inferred that a given generator will deliver its rated power output at all power factors. The generator rating in kilowatts will be reduced in proportion to the power factor and probably in a greater ratio if the power factor is very low. The method of rating AC generators by kilovolt amperes instead of by kilowatts is now in general use.

In industrial plants, excessively low power factor is usually due to under loaded induction motors because the power factor of motors is much less at partial loads than at full load. If motors are under loaded, new motors of smaller capacity should be substituted.

A single phase alternating EMF will be induced in an armature coil which has its sides set in a generator frame, the same distance apart as are a north and a south magnet that are forced to sweep continuously past the coil sides at a uniform speed. The distance between a north and south pole is always called 180 electrical degrees. The distance between a north pole and the next north pole is called 360 electrical degrees. In a given generator, the circumferential distance is the same between any two adjacent north and south poles.

Power capacitors are capacitors with relatively large values of capacity which are used on power distribution systems or in plants for improving the power factor. Since many power companies include low power factor penalties, kilovolt ampere demand rates, or power factor bonuses in their rate schedules, it is often economical for industrial consumers to install capacitors for power factor improvement. These capacitors are connected across the line and neutralize the effect of lagging power factor loads, thus reducing the current for a given kilowatt load.

The best point to connect capacitors to the circuit depends upon cost considerations. Relatively small capacitor units can be connected at the individual loads, or the total capacitor kilovolt amperes can be grouped at one point and connected to the main bus. Greater power factor corrective effect for a given total capacitor kilovolt amperes will result with the capacitors located directly at each individual load, since the current is thereby reduced all the way from the load to the source. The first cost of an installation of individual capacitors will be greater, however, than that for one unit of the same total kilovolt amperes located at a central point. The greater saving in operating expense due to individual capacitors must be weighed against their increased first cost.

The life of a fluorescent lamp is affected not only by the voltage and current supplied to it but also by the number of times it is started. Electron emission material is sputtered off from the electrodes continuously during the operation of the lamp and larger quantities each time the lamp starts. Since life normally ends when the emission material is completely consumed from one of the electrodes, the greater the number of burning hours per start, the longer the life of the lamp. When the emission material is exhausted, lamps on a preheat type of circuit will blink on and off as the electrodes heat but the arc fails to strike. Lamps designed for instant or rapid start will simply fail to operate. Blinking lamps should be removed from the circuit promptly to protect both the starter and the ballast from overheating.

The rated average life of a fluorescent lamp in burning hours is based upon the average life of large representative groups of lamps measured in the laboratory under specified test conditions. Many fluorescent lamps have a rated average life of 12,000 to 20,000 hours at 3 burning hours per start.

With the proper ballast operating voltage within the line voltage limits shown on the ballast label, rated lamp life should be obtained.

All semiconductor devices are intolerant of voltage transients in excess of their voltage ratings. Even such a short lived transient as a few microseconds can cause the semiconductor to fail catastrophically or may degrade it so as to shorten its useful life.

Frequently, damage occurs when a high reverse voltage is applied to a non-conducting PN junction. The junction may avalanche at a small point due to the non uniformity of the electric field. Also, excess leakage current can occur across the passivated junction between the terminations on the pellet surface. The current can create a low resistance channel that degrades the junction blocking voltage capability below the applied steady state voltage. In the avalanche case thermal runaway can occur because of localized heating building up to cause a melt through which destroys the junction.

If the base-emitter junction of a transistor is avalanched or zenered by a reverse pulse, the forward current will be degraded. The triggering sensitivity of a thruster will be reduced in the same manner by zenering the gate cathode junction. Thrusters can also be damaged if turned on by high voltage spike (forward break over) under bias conditions that allow a rate of current increase (di/dt) beyond device capability. This will occur in virtually all practical circuits because the discharge of the RC dv/dt protection circuits will exceed device capability for di/dt and destroy the thruster.

The high voltage generated by breaking current to an inductor with a mechanical switch will ultimately cause pitting, welding, material transfer, or erosion of the contacts. The nature of ultimate failure of the contacts depends upon upon such factors as the type of metal used, rate of opening, contact bounce, atmosphere, temperature, steady state and rush currents, and AC or DC operation. Perhaps most important is the amount of energy dissipated in each operation of the contacts.

The actual breaking of current by a set of contacts is a complex operation. The ultimate break occurs at a microscopic bridge of metal which due to the inductive load, is forced to carry nearly all the original steady state current. Ohmic heating of this bridge causes it to form a plasma, which will conduct current between the contacts when supplied with a current and voltage above a certain threshold. The inductor, of course is more than happy to supply adequate voltage. (V=Ldi/dt). As the contacts separate and the current decreases, a threshold is reached, and the current stops abruptly ("chopping"). Inductor current then charges stray capacitances up to the breakdown voltage of the atmosphere between the contacts. (For air, this occurs at about 300V.) The capacitance discharges and recharges repeatedly until all the energy is dissipated.
This arc causes sufficient contact heating to melt, oxidize ,or "burn" the metal, and when the contacts close again, the contacts may form a poorer connection. If they "bounce", or are closed soon after arcing, the contacts may be sufficiently molten to weld closed. Welding can also occur as a result of high in rush currents passing through the initially formed bridges upon closing.

On AC power lines, surges are generated by utility switching, correction of a brownout, or lightning. But there are dozens of surge sources right inside your office, factory or home. The simple act of starting an office machine can cause a surge.

And every solid state circuit is a target, whether it's a mainframe computer or a microwave oven. As little as 450 volts can be destructive, and routine surge activity ranges from 250 to 3000 volts.

Noise causes more aggravation. Picked up from fluorescent lighting, broadcast transmissions, power tools, even static electricity, it upsets the operation of computers, office machines and telecommunications equipment. And it can garble or completely destroy valuable stored data.

Most suppressors ignore noise, but high performance units reduce destructive interference by 40 to 60 dB. Noise reduction performance, like clamping level and response time, is also a part of the units specifications.

Lightning is the biggest cause of surges from outside a building. We're excluding, "direct hit" lightning damage from this discussion. Lightning surges are the result of induced voltage on the power lines caused by lightning strikes in the vicinity of the lines. The surges ride the lines into the buildings through the service entrance conductors.

Good suppression techniques can significantly reduce the amount of energy dissipated at the contacts, with a proportional increase in operating life. Suppression can also reduce the noise generated by this arcing. Voltage limiting devices are particularly suited to preventing the noisy high voltage "showering" arc described above.

Transient over voltages can cause breakdown of insulation, resulting in either a temporary disturbance of device operation or instantaneous failure. The insulating level in the former case will be weakened leading to premature failure.

The severity of the breakdown varies with the type of insulation, air, liquid, or solid. The first two tend to be self healing, while breakdown of solid insulation (generally organic materials) is generally a permanent condition.

Air clearances between metal and electrical devices and power wiring constitute air gaps,which behave according to the usual physics of gap breakdown (pressure, humidity, shape of electrodes, spacing). The International Electrotechnical Commission Working Group on Low Voltage Insulation Coordination has developed a table listing the minimum clearances in air for optimum and worst case electric field conditions existing between electrodes. Breakdown of the clearance between metal parts can be viewed as a form of protection, limiting the overvoltage on the rest of the circuit. However, this protection is dependent upon the likelihood of AC line current that may follow during the arc breakdown. Normally, follow on current should cause the system fuse or breaker to function. If the follow on current is limited by circuit impedance then the system fusing may not operate. In that case sufficient heat could be generated to cause a fire. Experience with power wiring has shown that metal clearances flash over regularly and harmlessly under transient voltage conditions, and power follow on problems are rare but can occur.

In liquid dielectrics, an impulse breakdown not followed by a power current can be quite innocuous. However, this type of breakdown is of limited interest in low voltage systems, where liquid insulation systems are seldom used, except in combination with some degree of solid insulation.

Breakdown of solid insulation generally results in local carbonization of an organic material. Inorganic insulation materials are generally mechanically or permanently damaged. When no power follow on current takes place, the system can recover and continue operating. However, the degrading insulating characteristics of the material leads to breakdown at progressively lower levels until a mild overvoltage, even within AC line overvoltage tolerances, brings about the ultimate permanent short circuit. Since the final failure can occur when no transients are present, the real cause of the problem may be concealed.

Breakdown along the surface of insulation is the concern of creepage specifications. The working group of IEC cited above is also generating recommendations on creepage distances. The behavior of the system where creepage is concerned is less predictable than is the breakdown of insulation in the bulk because the environment (dust, humidity) will determine the withstand capability of the creepage surface.

When considering the withstand capabilities of any insulation system, two fundamental facts must be remembered. The first is that breakdown of insulation is not instantaneous but is governed by the statistics of avalanche ionization. Hence there is a "volt time" characteristic, which challenges the designer to coordinate protection systems as a function of the impinging wave shape. The second is that the distribution of voltages across insulation is rarely linear. For example, a steep wave front produces a piling up of

voltage in the first few turns of a motor winding, often with reflections inside the winding. Also, the breakdown in the gap between the electrodes, initiating at the surface, is considerably dependent upon the overall field geometry, as well as on macroscopic surface condition.

In our parallel choke there are two air gaps. The purpose of the air gap in these magnetic chokes is to prevent the core from being saturated. The introduction of an air gap (or nonmagnetic gap) into the magnetic circuit introduces an action called fringing. Since the flux lines naturally tend to spread apart from each other and the permeability of the surrounding air is the same as the gap itself, the lines of force will tend to spread apart. Fringing causes the flux density in the air gap to be slightly less than the flux density of the iron sections of the magnetic circuit. This air gap, less current being used, and crossing parallel choke lines through the opposite choke results in a reduction of eddy currents, hysteresis losses, and counter EMF for all type of inductive equipment and also act as an improved filter.

Not only do the units help to correct and improve all the above conditions mentioned in the description. It also takes care of electrical transients induced internally in the building and externally of the building, which are prevalent to electrical supply systems. It also changes the angle of volts, current, amperage, etc., so everything is in line. It also balances loads between phases so it balances out the lines. The lines are fairly close to being within balance so the neutral is not being loaded to the full maximum. It also decreases RF noise pollution as stated above and takes care of spikes and surges. Each unit varies upon its own electrical characteristics, so it will improve on all these items if not eliminate a great deal of them. It uses capacitor run type capacitors, type AC below 400 hertz with frequencies below 60 hertz normal. These are the type that give us the best savings with our crossing choke configuration. This type of capacitor and choke configuration should net us approximately 10 percent savings. With this configuration the voltage and load stays the same. Also this choke configuration is a communitive add to the savings for each unit put in circuit or parallel to the same circuit or bus load circuit or to the circuit that is implied on the same panel provided it does not go through a transformer. A transformer will block the frequency and will cause us not to be able to communitively add boxes which don't add 1 to 1 but add on roughly a square root of 2 or a fraction of a square root of 2 every time. The most you can probably get is 1.4. As stated above it also takes care of I^2R losses and corrects power factor. It can either be installed way down the line or at the main panel. You have to weigh the decision as to where each box would be installed.

It will not help pure resistive loads or electric heat loads. The other things that it does with all the things that it is already doing is lower kW hours, usage, and lowers demand rate, acts as a surge suppressor, and eliminates transients, improves power factor, balances the load, reduces the I^2R losses, supplies minimum power during brownouts, and acts as a filter for noise. It will protect fluorescent lights, motors. Anything that is of inductive load last longer and it also cuts down on the maintenance of the building quite drastically.

The uses savings unit was designed to cut demand and save money on your electric bills. Demand is what determines a commercial customers rate on his bill. Our unit also acts as a surge suppressor, as we had to incorporate a suppressor into our unit to protect our product.

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The unit will also protect their televisions and microwaves, which are very easily damaged by spikes and brown outs. Saving an appliance such as these would make the purchase of a unit worthwhile. The unit is also very helpful if one lives in a trailer park or as a boat at a dock as their power supply is usually below standard.

More common and more frequent are transient surges caused by inductive load devices such as motors, transformers, relay coils, and fluorescent ballasts. These are known as internally generated surges.

Turn on the copier you've got a surge. On AC power lines, surges are generated by utility switching, correction of a brown out, or lightning. There are dozens of surge sources right inside your office, factory or home. The simple act of starting an office machine can cause a surge.

Every solid state circuit is a target, whether it's in a mainframe computer or a microwave oven. As little as 450volts can be destructive, and routine surge activity ranges from 250 to 3000 volts.

Noise generated by fluorescent lighting, broadcast transmissions, power tools, even static electricity upsets the operation of computers, office machines, telecommunications equipment and can garble or completely destroy valuable stored data.

In a commercial application, not only would the unit save on the bill, but it will protect the air conditioning, heat pump and any other large motors from surges. The motors will run cooler, more efficient and would require less maintenance. We have not even tried to calculate the savings achieved by reducing the maintenance on motors, replacement of fluorescent bulbs and ballasts. In most applications the savings could be very substantial.

USES, Inc. has sixteen models to conform to any size service. The units are wired to a receptacle no more than 10' (feet) from a panel. USES manufactures models for residential, Boats, RV's, commercial applications and remote motors or units.

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DESCRIPTION OF USES® SHUNT EFFICIENCY SYSTEMS

USES® is a solid state power correction device which offers protection from transient surges, spikes and lightning strikes and kilowatt savings by improving power factor, balancing loads, reducing the top peak portion of the current wave, etc.

The **USES®** approach to saving electrical energy focuses on providing more efficient electrical power to inductive equipment so it does not waste energy.

The escalating cost of primary fuels used in the production of electrical power (coal, oil, natural gas) effects us all. **USES®** can help conserve these important nonrenewable resources.

PROTECTION

A transient surge is a prolonged burst of excessive electrical current. A transient spike is a rapid burst of excessive electrical current. Surges and spikes may be caused externally by:

- Lightning;
- Irregularities at the power generating plant or along transmission lines;
- Inductive loads operated by other electrical customers on the same transmission line in proximity to a facility.

And internally by:

- Inductive loads (motors, pumps, computers, fluorescent lights) operated within a facility.

The **USES® Shunt Efficiency System** is designed to absorb and attenuate major surges and spikes before damage can occur to equipment. **USES®** dissipates excess transient voltage through conversion to and release of heat.

Benefits derived from **USES® protection** include:

- Extended life for inductive electrical equipment;
- Lower maintenance expense;
- Fewer losses of stored computer information;
- Less likelihood of fire caused by electric motor overheating, short circuits, etc.

Kilowatt SAVINGS

Motors, pumps, transformers, fluorescent light ballasts and other inductive equipment require a magnetic field to operate. Magnetism causes the phase relationship between voltage and current supplied by the utility to change. Such phase shifting reduces the efficiency of the equipment, resulting in increased power consumption.

The phase angle between voltage and current is called power factor. Through the application of magnetic chokes, **USES®** tends to make the angle between voltage and current approach zero, which allows for the most efficient utilization of the power distribution system.

Additionally, when connected to inductive loads, **USES®** improves the balance of current on each hot leg and lowers the current on the neutral. Along with balancing the current, **USES®** reduces the peak portion of the current wave.

Benefits from **USES® Kilowatt savings** include:

- Lower electric bills;
- Better performance of motors and computers which are adversely affected by magnetic fields;
- Less wear and tear (maintenance expense) and longer equipment life resulting from efficient and effective use of generated electrical power;
- Conservation of nonrenewable natural resources.

ADDITIONAL INFORMATION ABOUT USES® Shunt Efficiency System

- **USES®** is U.S. Patent Office protected for it's surge and spike protection and energy savings.
- **USES®** is approved by Underwriters Laboratories Inc. as a power factor correction unit with surge suppression. Further, UL retains the on-going right to supervise manufacturing of **USES®** products.
- **USES®** comes with a three year warranty against defects in materials and workmanship. Models are designed for application from single family homes to large commercial and industrial businesses.
- Several property/casualty insurers recognize the increased safety afforded when **USES®** products are in place and have lowered premiums to policyholders accordingly.

USES MFG INC. PO Box 156, 152 Old Colchester Road, Quaker Hill, Connecticut, USA 06375 • Telephone(860)443-8737 Fax(860)439-1515

THE ELECTRICAL WATCH DOG
USES®

USES MFG INC.

CORPORATE BACKGROUND

Description: USES MFG INC. is the manufacturer and marketer of a line of electrical energy conservation and power conditioning products. It is a licensee of USES, Inc., developer of the product's technologies.

Products: The company's principal product is the **USES® Shunt Efficiency System**, a solid state, power conditioning device which reduces the electrical energy that must be supplied by the utility company to operate inductive electrical loads. It also offers protection from voltage transient surges and spikes and from secondary lightning effects.

Technology: **USES®** technology consists of parallel, wrap-around magnetic chokes oriented to couple magnetic forces generated across each electrical phase by the current. On the basis of the magnetic fields sensed, a signal is generated that enhances the AC wave form and matches it to the requirements of the inductive load. The peak portion of the current wave on the line side is decreased and electrical system inefficiencies that originate in the supplying transformer are reduced. The complementary winding technique, used with chokes and capacitors, lowers kilowatt-hour (KWH) consumption, energy usage and demand rate, when connected to inductive loads.

Benefits: **USES®** systems lessen electrical energy waste by: matching voltage and current phases in inductive systems; converting harmonics, spikes and noise to useful energy; reducing I^2R losses; and balancing loads across all phases. The immediate benefit is verifiable reduction of electric utility bills. Additionally, equipment life is increased while maintenance and down time are reduced. The average return on investment is 6 to 36 months.
It has been found that the unique arrangement of chokes provides substantial reductions in power usage, particularly for inductive loads in industrial applications.

Applications: **USES®** units are installed at electrical panels supplying inductive loads and at the disconnect links for large motors. Units also are installed at any panel for which surge protection is needed.

Validation: USES, Inc. was granted U.S. patent 5,105,327 on April 14, 1992; patents are pending in foreign countries. **USES®** products are UL and CSA listed and NYC approved. USES MFG INC. is a member of the Alliance to Save Energy and is an EPA Green Lights Ally. **USES®** products have been evaluated by the State of Connecticut Advisory Committee on Standards for Electrical Hardware and Supplies and approved for installation in state facilities.

Distribution: The **USES® Shunt Efficiency System** is sold through a national network of authorized dealers. Seventeen models are available for residential, commercial, industrial, and recreational applications.

History: The corporation's lineage is traced to establishment, in 1980, of a Connecticut-based, electronic design and electrical contracting company. The shunt efficiency system has evolved, in part, from a lightning surge protector specifically designed and built for a client. Based upon the success of that design, USES, Inc. was formed in 1990 to further pursue development of electrical energy conservation and power conditioning products. USES MFG INC. was formed in 1993 to concentrate on manufacturing and marketing the **USES®** products along with other research and development efforts focused on further applications of the **USES®** technology.

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THE ELECTRICAL WATCH DOG

USES®

What USES® Does...

Electrical Characteristics	Currently Available Equipment
✪ Power Factor Improvement	Capacitors
✪ Harmonics (non-linear wave forms)	Shunt Filters
✪ Voltage Surge / Droop Protection	Voltage Regulator
✪ Voltage Spike Protection	Lightning Arrestor
✪ Electromagnetism	**USES® ONLY**
✪ Reduce KW Demand	Timers, Energy Management Systems
✪ Reduce KW Usage	Timers, Energy Management Systems
Reduce Line Noise	Filters or Line Strips
✪ Improve Unbalanced Loads Across Phases	**USES® ONLY**
✪ Reduce I^2R Losses	Capacitors

✪ USES® accomplishes ALL of the above!!!!!!!

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USES®

The **USES®** Product has a new Patent Technology, which makes the product a sole source. The product also has the following listing; UL, CSA, and NYC. USES MFG INC. is a member of the Alliance To Save Energy, and is an EPA Green Lights Ally.

USES® is a power conditioning device, which reduces the electrical energy that is supplied by the Utility Company to operate inductive electrical loads.

The product offers protection from voltage transient surges and spikes, and protection from secondary lightning effects.

USES® consists of parallel wrap-around magnetic chokes oriented to couple magnetic forces generated across each electrical phase by current complimentary winding technique, used with chokes and compactors lowers KiloWatt-Hour (KWH) consumption, energy usage, and demand rate when connected to inductive loads.

Energy savings are achieved for all inductive loads including motorized quipment; air conditioning units, elevators, pumps, refrigerators, manufacturing machinery, etc.... **USES®** also ensures protection of the A.C. electrical system and surge-sensitive electronics, along with electrical appliances, personal computers, consumer electronics, and appliances from power line transients, surges, spikes, and secondary lightning.

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THE ELECTRICAL WATCH DOG

USES®

USES® Technology for Economical, ...ffective Energy Conservation

The rising costs of coal, oil and natural gas, the three primary fuels used in the production of electrical energy, have made the conservation of electricity a major concern. The extensive use of the basic fuels in the production of electrical power has made saving electricity synonymous with saving important non-renewable natural resources.

Most efforts to conserve electrical energy emphasize the more efficient use and effective management of available electrical energy-- improved insulation and efficient lighting systems, staggered loading to minimize peak demand, or elimination of unnecessary use of electrical energy. However, problems arise because programs focused in these ares are not always sufficiently cost-effective to merit implementation or are too dependent on public cooperation. **USES®** technology provides highly cost-effective solutions which help prevent electrical waste.

USES® technology works on inductive loads to improve the efficiency of the electrical system. Virtually any setting can be accommodated-- industrial sites, commercial buildings, hospitals, stores, supermarkets, apartment buildings, or private dwellings. Rather than lower the demand of the system, the **USES®** system raises the percentage of billed energy that is readily usable. By maximizing the amount of billed energy that is usable, **USES®** reduces the energy required to do the same amount of work.

USES® focuses on providing more efficient and effective use of electrical power. Not all energy supplied and billed to the customer is used or usable, even in the most efficient systems. The raw, or "dirty", power supplied by the power plant contains surges, spikes, harmonics, line noise and other natural electrical phenomena which are not only usable but in many cases are ...nful to equipment. The **USES®** units work as a power conditioner and a filter to "clean" the ...ergy before it enters the system.

USES® further reduces the amount of energy required by improving the system's power factor. Some devices, primarily motors, interact with the power supplied such that the equipment automatically draws a surplus of energy, wasting the energy and damaging the motor. Power factor measures this waste. Improving the power factor reduces the overdraw of wasted energy, preventing the wear and tear damage the excess voltage causes.

The **USES®** units enhance the AC wave form, matching it to the requirements of the inductive load. The peak portion of the current wave on the line side are deceased and electrical inefficiencies that originate in the supplying transformer are reduced. This, combined with **USES®'** power factor correction capabilities, reduces wasted electricity, maximizing the amount of usable billed energy. Effectively, **USES®** provides more electricity per capital dollar.

USES® units provide a number of other benefits, including surge and spike protection and the reduction of harmful magnetic fields. Spikes, surges, and magnetic fields are naturally produced by electrical energy. Using electrical equipment causes these electrical anomalies to occur more frequently, exacerbating the situation. **USES®** units are designed to absorb and attenuate major transients before damage is done. The units respond to spikes and surges in less than 5 nanoseconds. This feature extends the life of the equipment as well as reduces the power required.

USES® technology reduces electrical waste, conserves valuable natural resources, and saves money, generally paying for itself in electrical saving and reduced maintenance costs in 1-3 years. ... dwindling resources and the eventuality of stricter environmental and conservation policies, U...S® is the environmentally and economically responsible choice.

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THE ELECTRICAL WATCH DOG

USES®

NEWS RELEASE

FOR IMMEDIATE RELEASE

NOT JUST A BIG FISH STORY

Cambridge, MD.—Between October of 1993 and July of 1994, the Coldwater Seafood Corporation of Cambridge, MD, bought 11 **USES® Shunt Efficiency System** units and had them installed on the north end of their plant. After November 26, 1994, they wished they had installed the **USES®** system in the southern end of the plant as well.

On Saturday, November 26, 1994, something happened to the Coldwater plant. Sifting through the evidence, they believe there was a major voltage sag. Although the voltage sag lasted only a few seconds, it caused the plant considerable electrical damage, knocking out two of the three transformers that supplied electricity to the the plant's south end freezers. The phase protection on that set of transformers, designed to protect against single-phasing, never tripped; its magnetic coil melted. Two of the transformers were knocked out, after which, single-phasing did occur, causing the refrigeration units' motors to burn out. On that circuit, the coils on the 480 volt and 110 volt motor starter were cooked and the contacts were welded together. Consequently, the refrigeration units failed.

No damage was sustained in the north end of the plant, even though all of the transformers wned by Coldwater were wired in parallel, with the north end of the plant generally drawing 10 to 20 times the power used by the south end during a normal weekend. A conservative estimate of the damage that would have occurred in the north end was over six to eight million dollars, or roughly 200 times the total cost of the **USES®** units.

According to a news release prepared by Coldwater, "All these north end loads have been protected by **USES®** units which evidently do stabilize voltage as claimed. These units not only saved the motors from damage, preventing a loss of temperature in the freezers which contain 5 to 6 million pounds of fish, but they protected the transformers which are up line. The investment in the **USES®** units has certainly been repaid, particularly since they have also dropped the Kw demand in the north end by 40 to 50 Kw."

USES® units save money in a number of ways. According to E. Brian Wohlforth, **USES®** inventor, and many satisfied customers, the **USES®** system improves equipment reliability, including computer and electronic systems, reduce life-cycle maintenance, repair and replacement costs. In an average industrial setting, the **USES®** system generally provides an average return on investment in 6 to 36 months; in cases like the Coldwater plant, the system can pay for itself overnight.

For more information or the name of a dealer in your area, contact:

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THE ELECTRICAL WATCH DOG

USES®

NEWS RELEASE
OR IMMEDIATE RELEASE

BUT HOW DOES IT WORK?

"With two **USES®** units on line, ... we are now saving an average 285 KWH per day, over 2000 KWH per week. I don't know what is in those boxes, but I am more than happy with the results." -Dan Ruggles, Durgin & Crowell Lumber Co., Inc., New London, New Hampshire

What is in those boxes is **USES®**' patented technology, consisting of parallel, wrap-around magnetic chokes oriented to couple magnetic forces generated across each electrical phase by the current. On the basis of the magnetic fields sensed, a signal is generated that enhances the AC wave form and matches it to the requirements of the inductive load. The peak portion of the current wave on the line side is decreased and electrical system inefficiencies originating in the supplying transformer are reduced. The complementary winding technique, used with chokes and capacitors, lowers kilowatt-hour (KWH) consumption, energy usage and demand rate, when connected to inductive loads.

USES® systems lessen electrical energy waste by: 1) matching voltage and current phases in inductive systems; 2) reducing harmonics, spikes and noise; 3) reducing I^2R losses; and 4) balancing loads across all phases. It has been found that the unique arrangement of chokes provides substantial reductions in power usage, particularly for inductive loads in industrial application. The immediate benefit is a verifiable reduction of electric utility bills. Additionally, equipment life is increased while maintenance and down time are reduced.

The benefits derived from **USES®** units include:

- improved equipment reliability, including computer and electronic systems,
- reduced life cycle maintenance, repair, and replacement costs,
- an average return on investment in 6 to 36 months.

The maintenance-free units are easily installed at service panels or distribution panels or they can be connected locally to equipment on the line side of any controllers, depending on the facility's equipment and electrical distribution system. Each unit comes with a three-year warranty covering the repair or replacement of the **USES®** unit. If the unit fails during use, USES MFG INC. will repair the unit at no charge.

Unlike the "black boxes" of the 1980s, **USES®** technology really works The energy savings are proven by their many satisfied customers.

Current users of the **USES®** systems include:

- U. S. Navy
- U. S. Marine Corps
- U. S. Army Corps of Engineers
- Washington National Airport
- Xerox Corp.
- J. C. Penney
- St. Francis Hospital
- Federal Die Casting Inc.
- Unilever
- Reebok International
- Nabisco
- Cargill
- Sheraton Hotels Corp.
- National Tire Corp.
- Ethan Allen Furniture
- Marlin Firearms

USES® is a UL (Underwriters Laboratory) listed product, and is manufactured under a UL program that calls for unannounced inspections. The **USES®** system is made entirely out of UL approved, recognized, or listed components. **USES®** is also Canadian Standards Association (CSA) listed and approved. **USES®** products also are listed in the General Services Administration catalog.

For further information or the dealer nearest you, contact:

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THE ELECTRICAL WATCH DOG

USES®

NEWS RELEASE

FOR IMMEDIATE RELEASE

HELPING SHRINK A GIANT

In business, it's generally a good thing to be the biggest, to be a giant in your field. But this is not always true. Giant facilities generally mean giant electricity bills. That was one part of being a giant that the world's largest ground wood pulp manufacturer, Canadian-based Abitibi-Price, decided it could do without. They are doing it with new breakthrough technology from USES MFG INC.

Counting the two mills in the U.S., Abitibi-Price's 10 facilities consume the equivalent of 1% of all the electricity generated in Canada. In fact, even though it produces 40% of their energy needs internally, in many of Abitibi-Price's plants, electricity is the second most expensive raw material.

Because the company consumes literally billions of kilowatt hours of electricity annually, John Reinsborough, Senior Engineer at Abitibi-Price's Sheridan Park Technology Centre in Mississauga, Ontario, Canada, naturally was interested in new technology which could deliver substantial reductions in energy consumption.

In October of 1993, such technology came to Reinsborough's attention. An American product, the **USES® Shunt Efficiency System**, promised to solve a myriad of electrical problems and provide a plethora of other benefits as well. It promised to reduce wattage, reduce current levels, reduce the total harmonic current content, balance loads, improve power factor, suppress voltage spikes and surges, and much more.

It sounded too good to be true. Reinsborough was skeptical himself, but decided to study the **USES®** technology further. He wanted to understand what made the system work, what allowed it to do all those different things. After some deliberation and discussion, it was decided that the **USES®** system would be installed at the Sheridan Park facility at no cost to Abitibi-Price, for a one-month trial.

When the electric bill one month later showed a savings in both consumption and the demand peak level, it was decided to extend the trial over several months, to lessen the impact of month-to-month variations caused by the changing levels of activities at the Centre.

For 14 months the Centre's utility bills were tracked and then compared to the same calendar month for the previous three years. It was no fluke. The Centre's utility costs had been reduced an estimated 10% while its power factor, which had previously been under 0.9 before the **USES®** units were installed, had risen to 0.99.

These results led to further testing, this time at the company's mill in Iroquois Fall, Ont. Similar testing was performed at their plant in Augusta, GA. In the Iroquois Fall test, the **USES®** units were connected to the 600 volt feeder lines to three motor control centers fed by a transformer substation. Readings were then taken with the units switched on and off. The test results indicated a reduction in both amps and wattage (see graph). Power factor improvement was also noted in all but one set of test results which were disregarded in light of the consistency of the other sets of test results.

The final computed results determined that the USES® units had:

- **reduced kW 13.4%**
- **reduced kvar 33.1%**
- **reduced kVA 20.3%**
- **improved the power factor from .78 to .85.**

Based on these results, Abitibi-Price's research team estimated that installing the **USES® Shunt Efficiency System** can reduce power consumption 10-15% when properly applied. They also estimated a projected payback period of approximately 15 months or less, depending on the plant load.

Reinsborough concluded, based on his analysis of the system's technology along with the test results, that the **USES®** product also works as a power factor correction device, a surge suppressor, and a harmonic filter. In a recent article, Reinsborough said, "**[USES®** units] have demonstrated that they are capable of reducing both demand and electrical energy on an inductive circuit, while improving power factor."

Abitibi-Price is also interested in the higher voltage models, which according to USES MFG INC. are currently being developed. To date, the highest voltage model is the 600 volt model used in Abitibi-Price's testings.

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Friendly Pizza House and Restaurant
Route 32
Uncasville, CT 06382

USES Manufacturing INC.
PO Box 156
Old Colchester Rd.
Quaker Hill, CT 06375

May 1995

Dear USES:

Well the verdict is in and it is good! I originally had a couple of problems at my restaurant. My utility bills were higher than I had expected, but aren't everybody's? I was constantly blowing main fuses and I wanted to be able to add new equipment without having problems. After the USES system was installed my problems disappeared. I no longer have a problem with blown main fuses. As a matter of fact, I have not had to replace one main fuse since the system was installed! My electric bills have gone down considerably. The air-conditioning system has never run better and I swear my freezers and refrigerators are cooler. USES did everything they advertised they would. I wish everybody at USES good luck with your future endeavors and hope more people take advantage of this break-through technology!

Many thanks,

Steve Kedioglou

Family Pizza
Main Street
Niantic, CT 06357

USES Manufacturing INC.
PO Box 156
Old Colchester Rd.
Quaker Hill, CT 06375

August 27, 1995

Dear Gentlemen:

I just wanted to take a minute and tell you how pleased I am with the USES unit I purchased from you. USES technology works! Not only am I seeing the hard dollar savings of 6 - 18% reduction on my monthly bill, I am also seeing the soft dollars too. Maintenance on my freezer and refrigerators has gone down, saving me a considerable amount of money on service calls. My air-conditioning system has never run cooler and more efficient than it is right now; resulting in lower summer electric bills. I have not had a problem with harmful outside surges and spikes that cause frustrating downtime on my computer and cash register. All in all, the soda is colder and the pizza is hotter! I do not know how those little gray boxes work, but I can definitely see the results of them! Keep up the good work.

Thanks again,

Tony