RONK NOTES

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Role of the Ronk Blocker®

A magnetic core saturating reactor in prevention of stray voltage

Agricultural specialists have known for some time that low non-lethal voltages accessed to dairy animals can cause mastitis, affect animal behavior and materially reduce milk production. More recently, the same voltages have been known to cause problems in swine parlors, poultry houses, water fountains, swimming pools and homes.

Various studies have shown that voltages about 0.5 volts can be detected by animals that are very wet as is a dairy cow being washed down prior to milking. There is some evidence that humans are susceptible to a threshold voltage of approximately 1 volt when they are wet. Thus voltage below 10 volts, which previously the electrical industry has largely ignored as a non-problem, now, has a much greater interest and appreciation.

Since these low voltages may now have many sources, they have been variously called "tingle voltage", extraneous voltage, or more generically called Stray Voltage. A number of studies and findings have identified methodical and logical methods for identifying the sources of the problems and eliminating them.

ON-SITE

On-site voltages caused by on-site wiring problems and electrical equipment defects can readily be isolated by turning the service entrance switch off. Then operation of individual circuits and pieces of equipment can identify specific problems. Examples would be failed water heater elements, defective electric motors and pumps, broken or damaged wiring insulations, etc.
The portion of the voltage that remains on the ground system after the service entrance main is turned off is obviously off-site in origin. However, neutral-to-earth voltage which increases with on-site load may also be considered off-site in nature if it is due to the increased load on the primary neutral. This phenomenon can lead to confusion when attempting to resolve the overall problem. Basically, all on-site problems can be eliminated with proper wiring and associated good wiring and equipment practices.

OFF-SITE

There can be several sources of voltages that originate off-site. Regardless of the sources, the stray voltage must be identified and eliminated. Common off-site sources include power supplier neutral, telephone ground, cable television, cathodic protection on buried pipelines and even faulty electrical equipment on another site. By far the most common off-site source is the power supplier neutral. It is often the entire source of stray voltage, in other instances; it may be contributing only a portion of the stray voltage. However, this neutral primary current caused contribution may well be above the 0.5 volt threshold and must be eliminated by appropriate safe and cost effective methods.

SOURCE OF POWER SUPPLIER NEUTRAL-TO-EARTH VOLTAGE

It seems to be common practice that electric power suppliers utilize a multi-grounded distribution system. Both three and single-phase power lines are equipped with a neutral to return current back to their substation. Even three-phase lines cannot be balanced to eliminate all current flow on the neutral. Even if they were expertly balanced, the addition of single-phase load would cause an imbalance. Electric current requires a change in voltage commonly called voltage drop in order to push it along a conductor. As load on the line builds, there will be a proportional increase in voltage. Thus there is a small voltage usually present on power line neutrals. While is does not normally represent any lethal hazard, it may cause problems in highly sensitive situations like a dairy parlor or a swimming pool.

Since the power line neutrals are grounded at every service, every transformer, and at least four times per mile, it becomes quite evident that voltage on the primary neutral will vary as the load varies and as the electrical resistance of the grounding electrodes change. The resistances of the grounds change as soil moisture changes. An example is the grounds lose their conductivity as the ground dries out in dry weather and regains it as moisture is added during rainy conditions.

The greatest electrical loads occur in severe temperature conditions, typically on a hot dry summer day. This is just the time the neutral grounding system has its lowest current carrying capacity thereby increasing the voltage on the neutral. The result is that voltage problems from power line neutrals can appear and go away in a seemingly mystical fashion. Also, load on the line almost always varies with time-

RONK NOTES

Role of the Ronk Blocker®

of-day also adding to the confusion. Although it may go away, there can be no assurance that it will cause it. A loose neutral connection can cause a stray voltage or even a fault at another service may cause it. In many cases, a poor primary neutral connection is masked by the grounding system of the customer, giving no obvious signs of a problem even existing unless a stray voltage check is made. This is a neutral-to-earth voltage and can easily be measured with any volt meter and a remote ground

THE INTERCONNECTION PROBLEM

Electric Power distribution systems normally require the primary neutral and the secondary neutral to be interconnected for two reasons.

1. The interconnect provides an alternate path for current flow in the event there is a failure in the transformer. This alternate path assures that the primary fuse will blow if for example, the primary should drop into the secondary.
2. The interconnect also provides access to site grounding to help dissipate lightning.

However, the interconnect applies any voltage on the primary neutral to the secondary neutral. The voltage will follow the secondary neutral into the service entrance panel neutral bar, through the bonding jumper required by the NEC, to the equipment grounding bar and from there to every piece of grounded electrical equipment in the facility. We shouldn't be surprised to find primary neutral-to-earth voltage in our buildings, because we go to great lengths to put it there.

ISOLATION OF NEUTRALS

The electrical system would be fine if the interconnection of the primary and secondary neutrals were removed. This would eliminate any voltage entering from the primary neutral. But this is not permitted, since it would allow a potentially dangerous situation.

THE RONK BLOCKER®

The BLOCKER®, a neutral isolation device, is placed in the interconnection of the primary and secondary neutral. It has about 2000 ohms resistance to about 6 volts and drops to about 1500 ohms at 9 volts. At 11 volts its resistance drops dramatically to less than 1 ohm. The resistance change acts like a switch that has closed.

Since a normally configured and properly wired distribution system almost never has neutral-to-earth voltages in excess of 6 to 8 volts, the BLOCKER® is virtually an open circuit, "blocking" the neutral-to-earth voltage from entering a customer's service. If the neutral-to-earth voltage is over 11 volts, either a fault or other failure has occurred and the BLOCKER® acts as a short circuit, connecting the neutral for safety with the BLOCKER® in the "shorted" mode.

With years of field experience and hundreds installed throughout the U.S. and Canada these units have proven to be extremely durable and reliable.

ADDITIONAL GROUND OF LITTLE HELP

A typical response when encountering –off-site stray voltage is to drive an additional ground or grounds on the premises. Please consider the numerous grounds along the multi-grounded distribution system; the addition of even a few additional grounds is not likely to materially reduce the voltage. In actuality, if the entire grounding complex were duplicated the voltage would only be reduced by a magnitude of one-half.

The equipotential plane has been used in dairy parlors for protection within a small confined area. It does nothing to eliminate source and corrects nothing in the milk parlor – waterers – outside electric heaters, etc. Neutral sources can be safely guarded against by installation of the BLOCKER®. This will cost much less than a single problem as can occur when a wire on the equipotential plane becomes loose. On balance, the BLOCKER® represents a very sound choice for a cost –effective device which retains system safety and reliability while eliminating troublesome neutral-to-earth "Stray Voltage".

SUMMARY:

The RONK BLOCKER® has proven to be an effective and economical device to eliminate stray voltage problems originating on the power suppliers primary neutral while providing secondary fault protection access to secondary grounding system for dispersal of lightning. Protection is provided for dairies, homes, swimming pools, fountains, swine parlors and poultry installations.

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