

SAME DAY SWITCHING

Disconnect and Grounding Switching Operations Safer with Less Equipment Stress

INTRODUCTION

Same day switching avoids the extended outages and human and equipment costs associated with inoperable and broken switches.

The vast majority of air break disconnect and ground switches in electric power networks typically receive no appreciable maintenance. This invariably results in the inability to operate switches when needed. A pretreatment method is now available that is safe to use on energized switches. It consists of a remote radio-controlled hot stick tool and a non-flammable aerosol fluid engineered to dissolve the corrosion and dried grease deposits that often inhibit switch movement. The method has been shown to reliably restore normal function and operation to previously inoperable air disconnect switches.

During a test phase, the tool was used to apply fluid to a variety of types and voltages of known inoperable switches in varying environmental conditions. Switching functions were successfully restored in a short time to allow same day switching activities. Testing shows that the use of the pretreatment method will reduce

the mechanical force exerted on switch equipment by up to 50 percent during opening, resulting in less stress exerted on switches and insulators. The improved ergonomics of the tool and method also display a positive effect for the switchman, reducing physical impact of striking activity by nearly 40 percent.

This method may help to extend the life of switching equipment and contribute to reduction in work force injury claims related to switching activities.

FIELD SITUATIONS

Studies of switches shows that a main cause of inoperability is built up corrosion or rust in the rotating and moving parts of the device, including contacts, bearings and linkages. As corrosion builds in the cavities that exist in these areas, function is reduced and ultimately the switch becomes inoperable. When failures to operate occur, achieving same day switching may not be possible. Damage to the switch may happen as a result of too much force being exerted or inappropriate tools or methods applied in an attempt to force the switch to move.





This damage is particularly a pattern of aging switches mounted on brown glass insulators, though all insulators are subject to failures. When new, brown glass insulators are rated to withstand up to 2,000-lbs of force. As the glass ages and after the cumulative stress of repeated open and close events, it is not uncommon for hairline fractures in the structure of the insulator to begin to occur. These may not be readily seen and could affect the structural integrity and ability of the insulator to withstand the force required to open or close the switch. When severe enough, catastrophic failure of the insulator may occur, necessitating repair or replacement. Also, the failure potentially results in a rain of sharp glass or the complete separation of the switch from its mounting. The risk of injury to a switchman may increase due to cracked or failed insulators. The human cost from exertion to open an inoperable switch may also include lost time and soft tissue injuries to shoulders, biceps, triceps, back muscles and compressed discs.

Aerosol sprays are commonly applied with a hot stick mounted can holder actuated with a rope or lever. The aerosol can holders are not insulated against electric arc. When loaded with a metal can containing flammable fluids or propellants, an arc may travel to the can and cause an explosion. Rope and lever actuators may collect contaminants that could create a current path to the operator. The fluids and greases available for use in these applicators generally do not have properties suitable to remove corrosion or rust.

If the switch cannot be operated successfully, it may impact the maintenance or construction activity. As a result, another isolation method may be necessary requiring additional time and manpower. In addition, delays to maintenance or construction activities may occur, increasing costs.

TESTING OF IMPROVED HOT STICK TOOL AND FLUIDS High Voltage Withstand Tests

Tests were conducted at the Quality Switch high voltage test facility, Newton Falls, Ohio.

Force Tests

Force tests were conducted by a large electric utility at its test facility. A digital force gauge was mounted in-line on a hot stick below the switch hook. As the switchman exerted pull force to open the switch, force measurements were recorded at the instant of switch opening. Measurements were recorded for current in-use methods, including other lubricant and cleaner sprays. Results were compared to pre-treating with the Stinger and 1FR fluid.

EMG (Electromyography) Ergonomic Testing

<https://www.youtube.com/watch?v=Tlk0eTYlvgQ>

Ergonomic tests were performed by the same electric utility as the force tests. EMG or Electromyography is a measurement of the muscle effort levels required to perform a job or use a particular tool or type of instrument. Applied to muscle groups this technique can be used to measure effort or predict fatigue potential. The testing consists of application of electrodes placed at major muscle groups required to perform a task. During exertion, the electrodes transmit signals to a computer and software engine for interpretation and graphic display and comparison. The software produced visual graphic analysis and comparison of the muscle activity throughout the switchman's range of motion during a switching activity. 4kV and 12kV switches were tested.

ASTM F712 -06 Standard Test Methods and Specifications for Electrically Insulated Plastic Guard Equipment for Protection of Workers

The ASTM F712 test for leakage current was performed by an approved testing facility in Fairfield, CA.

ASTM D3065 Standard Test Methods for Flammability of Aerosol Products

Fluids were tested at an independent laboratory. A Stinger was used for tests.

RESULTS OF TESTS High Voltage Functionality Tests

Withstand tested and functional at 250 kV



Force Test

Force testing revealed that the average force exerted on the switches tested, while using legacy lubrication methods, is 232 lbf. When using the new pretreatment method and Stinger tool, the average force exerted on a switch is 122 lbf, 47% reduction.

EMG (Electromyography) Ergonomic Testing

EMG tests indicate that the improved ergonomics of the new tool and pretreatment method result in approximately 40% reduced overall strain on the body of the operator.

ASTM F712 -06 Electrical Insulation

Two tools were tested. Both passed tests at 30 kV 0.04mA leakage or lower.

ASTM D3065 Tests for Flammability

All Stinger fluids passed ASTM D3065 test for flammability

CONCLUSION: THE STINGER and STINGER FLUIDS ARE SAFE AND EFFECTIVE FOR OPENING OF DISCONNECT AND GROUNDING SWITCHES

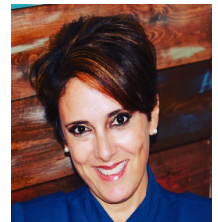
The Stinger tool and fluids are safe for use on energized switches of all types based on above tests:

- The tool is flashover safe, constructed of dielectric resin material. Electronic controls operate to 250 kV.
- The metal aerosol can is fully enclosed with dielectric material. There will be no arcing phase to ground.

- Fluids use nitrogen as propellant. There is no flammable path to the aerosol can that can cause an explosion.
- Fluids are delivered as a stream, not a spray. Sprays have a large surface area that can cause them to be flammable even when the bulk fluid is non-flammable.
- Fluids are dielectric and non-flammable tested
- Opening forces are reduced 50% in tests. Users often report higher force reduction.

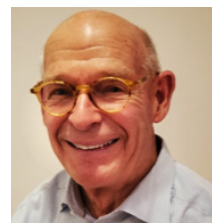
Sarabel Amador-Nelson

Sarabel Amador-Nelson is Sales Engineer at FirstPower Group LLC. Sarabel was born in Ensenada BC Mexico has a degree in Industrial Engineering from the Instituto Tecnológico de Tijuana 20+ years of experience in International Logistics, Productivity in a Manufacturing environment using the 5S foundation, working at companies like General Cable, TE Connectivity, and Eaton.



Jack Harley

Jack Harley is President of FirstPower Group LLC, which provides substation equipment and services to electric utilities and industrial users of electric power. He is active in the IEEE Switchgear Committee, the IEEE Transformers Committee and a member of CIGRE.



**Lube
by Number**



All the Necessities!

Each kit is stocked with industry leading synthetic grease and oil for on-site maintenance of circuit breakers

Created for you!

Created to give your technicians and maintenance people an easy and long-lasting lubrication solution!

Easy to Use!

The included LubeGuide instructions make it easy to know the right lubricant for each component and how to apply it

FIRSTPOWER GROUP LLC
lubenumber.com | 330-963-2050



Stinger[®]

PATENT PENDING

Switching Operations Safer & Easier

Pre-Treat Disconnect Switches Before Operating

- Safe to use on energized switches
- Reduce force required to open a switch by 50% – proven by customer tests
- Radio controlled remote operation
- GoPro[®] camera connects to phone or tablet
- Hook-type, gang-type and motor operated switches



The Stinger Fluid 1FR[®]

- Removes corrosion
- Non-Flammable

FIRSTPOWER GROUP LLC
stingertool.com | 330-963-2050