Workplace Health and Safety
Bulletin

Manually Energizing Power Systems after an Unplanned Outage: An Alberta Electric Utility Best Practice

Purpose

The purpose of this Best Practice is to standardize, to the extent possible, the minimum steps that an electric utility must include in its own practices for manually energizing a power system after an unplanned outage. This Best Practice is not meant to eliminate all manual recloses. It is intended to balance the risks to public safety resulting from a loss of power versus the potential risk of injury to non-utility workers or members of the public as a result of a manual reclose.

Because of the diverse and evolving nature of electrical transmission and distribution systems, this Best Practice cannot deal with every factor that needs to be assessed prior to a reclose. It remains the responsibility of the utility and its management to implement this Best Practice in the context of its own specific operations. In performing a risk assessment of its reclosing activities, the utility must consider both the hazards and probabilities of unexpected consequences associated with manual reclosing.

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Data submitted to the Electrical Utility Worker Safety Rules Committee by Alberta's major utilities indicate that in 2004, 2005, and 2006 there were, respectively, 27,718, 24,195, and 28,196 unplanned, sustained interruptions. There have never been any recorded injuries or fatalities involving workers or members of the public resulting from manual reclosing.

The first safety principles

Limits of approach

The primary means of protecting non-utility workers from contact with electrical power lines at a work site is to have the workers maintain a safe distance from energized electrical conductors. This safe distance depends on the conductor's voltage and is known as the "limit of approach".

Safe limit of approach distances are prescribed in Alberta's Occupational Health and Safety (OHS) Code and Alberta's Electrical Utility Code. If work is done within 7 metres of an energized overhead power line for example, the OHS Code requires the employer to call the power line operator to determine the voltage of the power line. Until this is done, workers must stay at least 7 metres away from the power line. Once the voltage is known, a lesser separation distance may be acceptable depending on the voltage.

Public education

Alberta's utility companies are committed to educating workers and members of the public about preventing contact with overhead power lines and other electrical equipment. This education is done through public service announcements, company web sites, safety seminars, classroom training sessions and other media coverage. Utility companies continue to provide funding and personnel to educate workers and members of the public. Education efforts focus on keeping people away from all power lines at all times, respecting the safe limit of approach distances.

Manual reclosing

What is manual reclosing?

The term “manual reclosing” means that an electric utility “operator-in-charge” manually energizes an electrical circuit in an attempt to restore the supply of electricity after an unplanned outage. The term “operator-in-charge” refers to the employee designated by the electric utility to be in charge of the system at that time. This could be an operator in a central control room or an employee in the field.

What is the concern regarding manual reclosing?

The operator-in-charge collects and assesses information about the likely cause of the outage. Based on this information, the operator-in-charge uses his or her professional judgment to decide whether or not to perform a manual reclose. Despite this best effort, non-utility workers and members of the public may still be unintentionally exposed to the possibility of injury or electrocution. One purpose of this Best Practice is to further reduce this possibility by elevating the standard of care followed by all utilities in the province.

Without some external information, it is virtually impossible for the operator-in-charge to be fully aware of the circumstances that caused the outage. All reasonable steps must be taken to identify and eliminate potential hazards caused by fault conditions prior to attempting to energize circuits. This Best Practice identifies the minimum steps that need to be taken. It is based on practices presently being used by electric utilities in Alberta and guidelines published in New Zealand (1) and Australia (2, 3).

Allowing a power outage to continue may itself result in or create hazards that carry with them the risk of injury or death to non-utility workers and members of the public. Examples include hazards due to the failure of medical equipment, traffic control system failure, lack of lighting, elevator failures, automated door failures, etc.

Unplanned outages and the potential hazards they create

The majority of unplanned outages are due to weather-related causes such as lightning strikes and trees falling on power lines, and animal contacts. Other causes include insulator contamination, equipment failure, and non-utility contacts such as a mobile crane touching a power line.

Even though protective devices within the electrical system normally cut the power off in such situations, non-utility workers and members of the public could still be exposed to a contact hazard. Two examples are:

(1) *reduced clearance* – conductors may have dropped in height from their pole, substantially reducing their clearance to other structures, equipment and persons passing beneath the conductors. If the conductors are energized, they can pose a hazard to workers working near them and to members of the public in the immediate vicinity; and

(2) *possible electrocution hazard* – reclosing a circuit without knowing that all persons at the scene of the incident are clear of the conductors. This applies to
   (a) workers who caused the initial fault,
   (b) bystanders and other workers unknowingly entering an area that is now hazardous because conductors have been energized, or
   (c) emergency services personnel attending to an incident during which time conductors are energized.

Utility options

When the cause of an outage is unknown, the operator-in-charge typically has the following options:
(1) go through the risk assessment checklist of this Best Practice and then using his or her professional judgment to assess the results, attempt a manual reclose;
(2) restore power section by section, where applicable, to the affected electrical system; or
(3) restore power after a visual line patrol of the possible fault area to determine that no safety hazards are apparent.

Assessing the risk of a manual reclose

When this Best Practice must be followed

The operator-in-charge must follow this Best Practice
(a) prior to attempting to energize those power system elements that were tripped out by protective devices, and
(b) after the auto-reclosing cycle for transmission lines and distribution feeders has completed operation.

Substation alarms associated with the tripping must be reviewed and, if appropriate, inspected on-site to confirm the integrity of any affected power system elements. “Power system elements” is the term used to describe components such as power transformers, regulators, transmission lines, distribution feeders, circuit breakers, capacitors, reactors, bus-work, generators, synchronous condensers and static var controllers.

Two initial steps

The practice at most electric utilities is for the operator-in-charge to make a manual reclose attempt. However, prior to the initial attempt or before making additional attempts, the operator-in-charge must take the following steps:

Step 1: Before attempting a manual reclose, the operator-in-charge must disable the automatic reclose function where possible or necessary; and

Step 2: If the electrical system experiencing the outage is connected to another utility system, the operator-in-charge must coordinate the restoration of power with the operator or employee in charge of the other system.

Risk assessment checklist

Having taken these initial steps, the operator-in-charge must then assess the risk of performing a manual reclose by answering the questions listed in Table 1.

Depending on the answers to these questions, the operator-in-charge may choose not to reclose. A line patrol, to visually confirm that no safety hazards are apparent and to potentially determine the cause of the outage, is normally requested at this point.

Table 1 Summary checklist for assessing the risk of a manual reclose

Category of factors to consider	Factors
Utility personnel in vicinity	Are any utility personnel working on or near energized power system elements? ▪ operator-in-charge to check logs, permits, orders or other records to confirm that no utility personnel are working on the affected system
Possible third party contact	Is there any known third party contact e.g. vehicle accidents, kite in power line, high load, excavator shovel striking underground conductors, etc. that could have caused the outage? ▪ operator-in-charge to confirm that no related trouble calls have come in
Weather and environmental conditions	Could the outage be due to environmental conditions such as snow, wind, lightning, flooding, forest fires, road salt, etc.?
Possible impact on public safety	How is the public affected? What could be the impact of this outage? Are any critical loads such as emergency service providers, control centres, or health care facilities affected by the outage? Is public infrastructure being significantly affected by the outage e.g. traffic control systems and elevators not functioning properly? Is there potential for a breakdown in civil order?
Damage to utility equipment	Is reclosing likely to damage utility equipment? ▪ reclosing may be restricted on certain types of equipment until a physical inspection is completed Are there any utility-specific special considerations that need to be considered? ▪ circuit construction i.e. underbuilt, double-circuit, underground, etc. ▪ age of equipment, type of construction, and conductor size

Cascading outage	Will a sustained loss of a power system element cause a cascading effect that will affect a larger area i.e. a loss of power to a greater geographical area? What is the impact of the next outage? What is the impact on major generation in the area?
Other factors	Are there considerations with respect to population density, location and time of day?

Utility to annually contact emergency services agencies

The operator-in-charge relies on trouble reports from various emergency services agencies such as police, fire and ambulance services to establish the possible cause(s) of an unplanned outage. To ensure that emergency services agencies have the correct contact information for the utility, the utility must

(1) annually contact each emergency services agency in its service area (and other appropriate agencies as necessary) to confirm that the agency has the most current and up-to-date contact information for notifying the utility of an incident involving the utility's electrical power lines or equipment, and

(2) keep a written record of this contact for a period of at least two years.

As part of its on-going electrical safety education program, the utility must ensure that each agency is aware of the circumstances under which the utility is to be called and why it is important to do so.

References

(1) Electricity Engineers' Association of New Zealand (Inc). *Guide for the Reclosing of Feeder Circuit Breakers Following a Fault*. October 2001, updated September 3, 2002.

(2) Electricity Council of New South Wales. *Guide to the Manual Reclosing of Overhead Lines*. February 1992.

(3) Electricity Supply Association of Australia Limited (ESAA). *National Guidelines for Manual Reclosing of High Voltage Electrical Apparatus Following a Fault Operation (Manual Reclose Guideline).* ESAA NENS 07-2003

Disclaimer

This Best Practice was prepared by representatives of the Electrical Utility Worker Safety Rules Committee to provide guidance on safe practices for use by the industry.

Although this Best Practice is recommended by Alberta electrical industry representatives, it should not be relied upon as a substitute for legislative requirements. This Best Practice should always be used in conjunction with applicable legislated requirements. If there is uncertainty as to what requirements apply in any particular situation, specialist advice should be sought. The Alberta electrical industry representatives involved in preparing this Best Practice accept no liability or responsibility for any error in, or omission from, this document, or any injury, loss, damage (including indirect or consequential loss or damage) or any other claims whatsoever caused by or resulting from any reliance on, or failure to rely on, this document.

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