SEQUOIA® INSURANCE COMPANY

RISK MANAGEMENT GUIDE

# Understanding Risks Associated with FPE Stab-lok® Circuit Breakers

## Overview

Most Federal Pacific (FPE) Stab-lok® circuit breakers and panels manufactured before 1980 are thought to be defective. Industry experts report that they are very likely to fail to trip when needed during current overload and short circuit situations, creating a very high risk of fire.

By some estimates, the failure rate for all models of Stab-lok® circuit breakers is around 60%. The normal rate of failure for circuit breakers in residential electrical panels is less than one percent. FPE Stab-lok® circuit breakers and panels remain in use in more than 20 million properties in the United States.

Visual inspection cannot identify the affected circuit breakers. Many of the panel boxes are poorly designed and constructed, creating a hazard for anyone who opens the box for inspection or repair. Property owners should engage a licensed, qualified electrician to conduct a comprehensive electrical inspection and make recommendations.

Replacing the entire circuit breaker panel may be the safest, easiest, and most cost-effective solution for properties where these circuit breakers and boxes are still in operation. Property owners will need to cover the replacement costs (typically $750 to $3000). This may include coordinating with local utility company to suspend service to the building during replacement.

## Performance History of FPE Stab-lok® Circuit Breakers

Circuit breakers are designed to break, or interrupt, an electrical current when there is too much current for the electrical line to carry safely, or when other unsafe conditions exist. When the circuit breaker fails to trip, uncontrolled current may flow through the system, causing overheating and increasing the risk of fire and damage to electrical equipment and electronic systems, and increasing the risk of injury or death to persons working on the equipment, or present in the building.

Between the 1950s and the mid-1980s, as many as 28 million Stab-lok® circuit breakers and breaker panels manufactured by New Jersey-based Federal Pacific Electric (FPE) were installed in U.S. residential and commercial buildings. In some communities, the product may have been installed in every home.

By the mid-1970s, it became evident that a large number of the FPE Stab-lok® circuit breakers — perhaps more than a third — were failing to function properly, causing circuits to overload and creating a significant fire risk. Rumors circulated among electrical and home inspection professionals about injuries and shocks sustained during inspection and repair of the faulty circuits, due to defective,

unstable panel housings. Many fires were linked anecdotally to Stab-lok® circuit breakers, and engineers, home inspectors, and electricians began to call for the Stab-lok® product to be recalled.

Though investigations by the Consumer Product Safety Commission and the manufacturer showed that the circuit breakers were probably defective, no recall or warning was ever issued, as explained below.

Over time, some of the defective FPE Stab-lok® breakers and/or panels have been identified and replaced (usually during routine renovations or upgrades), but experts estimate that the hazardous equipment *remains in use* in at least 20 million homes in the United States.

The panels may also be present in commercial structures, including older homes that have been converted for commercial or office use.

## Identification of FPE Stab-lok® Circuit Breakers

FPE Stab-lok® products are labeled with various brand names, depending on when they were manufactured and where they were distributed. Look for labels on the outside of the breaker panel box; if there are none, open the door and look inside the cover (Figures 1, 2, and 3).

Look for any of the following names, alone or in combination:

Federal Electric
Federal Pacific Electric
Federal Pioneer (Canada)
FPE
FPE-Stab-Lok
Stab-Lok
Federal NOARC
Federal NOARK
NOARC
NOARK


**Fig. 1. FPE Stab-lok® Small Panel Box**
*Photo courtesy SCM Engineering, © 2012. Used with permission.*


**Fig. 2. FPE Stab-lok® Panel ID Plate**
*Photo courtesy SCM Engineering, © 2012. Used with permission.*

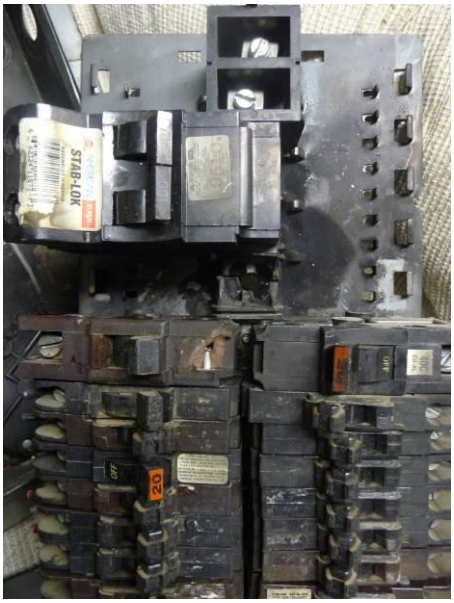


**Fig. 3. Stab-lok® Breakers**
*Photo courtesy SCM Engineering, © 2012. Used with permission.*

## Causes of Performance Problems in FPE Stab-lok® Circuit Breakers

**Fig. 4. Stab-lok® and Conventional Breakers**
*Photo courtesy SCM Engineering, © 2012. Used with permission.*

**Fig. 5. 15 amp Stab-lok® Breaker (Note Smaller Connection Point)**
*Photo courtesy SCM Engineering, © 2012. Used with permission.*

**Fig. 6. 20-amp Stab-lok® Breaker (Note Connection Points)**
*Photo courtesy SCM Engineering, © 2012. Used with permission.*

Several factors contribute to the failure of Stab-lok® circuit breakers, or contribute to their inherently hazardous status.

***Controversial Design.*** According to industry experts, the design of the Stab-lok® breakers and panels is inherently unsafe, and increases the risk of fire, property damage, injury, and death.

The components of well-designed circuit breakers fit together firmly and precisely. Most breaker switches have a set of jaws that fit over the bus bar so that the metal of the jaw is held parallel to the bus bar.

The FPE Stab-lok® breaker has an opposite type of design, with prongs that fit into slots in the bus bar, bringing the two pieces of metal into contact only at their edges, where they touch at a right angle. This precarious connection, which creates a very small contact area, can fail to maintain sufficient contact pressure between the components, which easily can become loose. (Figures 4, 5, 6)

This combination of small contact area, minimal contact pressure, and spontaneous loosening can cause arcing and over-heating, particularly when the circuit is overloaded or approaching overload. Arcing and over-heating can, in turn, cause fires.

***Failure to Meet Established Standards.*** Industry professionals observe that older Stab-lok® breakers and panels do not meet current technical standards for safety and efficacy (Underwriters Laboratories' standard UL489, *Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures*).

Published accounts indicate that when Federal Pacific was manufacturing this product in the 1960s and 1970s, the company used deceptive practices and falsified test results in order to obtain UL listings.

According to court records, Federal Pacific knowingly manufactured and sold millions of defective circuit breakers, marketing them as safe and approved by UL.

Over the years, home inspectors, electricians, and consumers, seeing the familiar UL label, have believed that the Stab-lok® breakers are safe and suitable for the installation. Many of the Stab-lok® products that are still on the market are older, defective stock that was unsold decades ago.

***Manufacturing Defects.*** Inspectors and electricians report poor manufacturing quality in the breaker and in the panel housing, which increases the risk of malfunction. Stab-lok® breakers were designed in accordance with older technical standards, which allowed dangerous crowding of wires and other components within the panel, a feature which is not standard in newer equipment.

Even when standards were revised in 1981, near the time when Federal Pacific ceased manufacture of Stab-lok® panels, FPE found ways to use less space (thereby reducing costs) by installing components at unconventional angles and bending the wires too sharply within the panel space (Figure 7).

Electricians and inspectors have also reported safety issues in the FPE panel boards which house the breakers, where the marginal connections are prone to failure, overheating, and ignition within the panel. Cases of electrical shock and other injury have been reported.

More recent tests conducted on a large number of FPE Stab-lok® breakers in use in homes across the country show continued high failure rates consistent with the tests done around 1980. By some estimates, one third of all FPE Stab-lok® breakers are defective. It is believed that in some manufacturing lots, fully 100% of the units are defective.

There is no indication that circuit breakers from other manufacturers fail at the same rates: indeed, while the known failure rate of SPE Stab-lok® breakers is approximately 60% for all models, the typical failure rate on circuit breakers is less than 1%.

If there has never been a short circuit or current overload situation in the building, then the breaker would never be called on to trip; thus, non-functioning breakers could remain in place for many years without attracting notice.

Stab-lok® circuit breakers are vulnerable to malfunction under the very conditions when their functionality is critical; that is, when there is a current overload or short circuit. Unless the circuit breakers have been tested individually, their latent hazard will not be apparent until they fail to function.

**Fig. 7. Stab-lok® Circuit Box**
*Photo courtesy John Naehring, ©2009. Used with permission.*

**Fig. 8. Burned Panel Front**
*Photo courtesy SCM Engineering, © 2012. Used with permission.*

**Fig. 9. Burned Panel Rear**
*Photo courtesy SCM Engineering, © 2012. Used with permission.*

## Take Action When Stab-lok® Circuit Breakers Are Present

***Arrange for a Careful Inspection by a Licensed Electrician.*** Most Stab-lok® circuit breakers, which are *supposed to function as safety devices*, are believed to be defective.

However, *neither visual inspection or field testing can identify whether breakers are functional or nonfunctional*; thus, leaving them in place may create a latently hazardous condition because they may fail to function during a safety-critical situation.

Potential defects in FPE Stab-lok® circuit breakers are not visually apparent, and a visual inspection will not reveal if the breaker is working correctly or not, even when the panel cover is removed. There may be no sign that overheating, damaged or loosened circuits, or other damage has occurred.

**Fig. 10. Corrosion and "Burn" Marks on a Stab-lok Panel**
*Photo courtesy SCM Engineering, © 2012. Used with permission.*

Obvious signs of overheating (scorch marks, burns, darkened or discolored areas, soot inside the case, melted parts or insulation) indicate that the breakers are not functioning properly and that the situation is imminently hazardous. Figures 8 and 9 show an FPE panel where a breaker malfunction burned a hole through the metal panel box and into the wall.

However, *the absence of burns, scorches, etc., does not imply that the circuit breakers are free from defect and functioning properly*.

Other warning signs that can indicate hazardous conditions that may precede a failure of the breakers and other components may include corrosion or oxidation; poor contacts between components; humming, buzzing, popping, cracking, other abnormal sounds; or strange odors. (Figures 10 and 11)

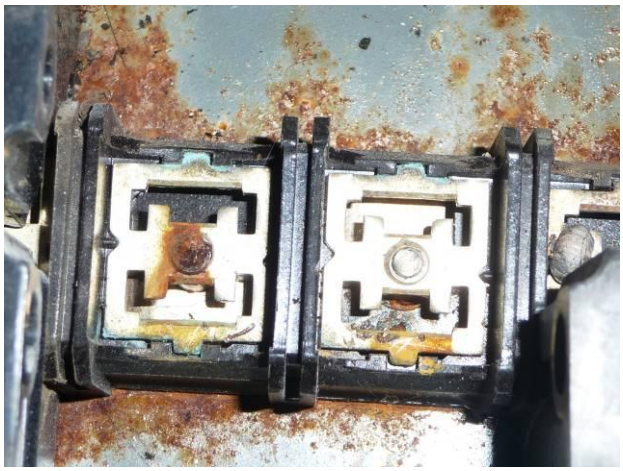

**Fig. 11. Close-Up of Corrosion and "Burn" Marks on a Stab-lok Panel**
*Photo courtesy SCM Engineering, © 2012. Used with permission.*

Toggling the ON-OFF switch does not test the ability of the breaker to function in actual overload or short-circuit conditions and cannot reliably identify which units are functional and which are not.

Only live-current functional tests – evoking overload and short circuit conditions for each breaker (one pole at a time for two-pole breakers) – can determine the operating status of each breaker.

Field electricians, inspectors, and property owners are not generally trained or equipped to do this sort of testing. In addition, the cost of this sort of testing would likely exceed the cost of replacing the entire panel with newer, safer equipment.

The condition of the circuit breakers is best assessed by a qualified, licensed electrician during a comprehensive electrical inspection.

The Electrical Safety Foundation International suggests that an electrical inspection should include more than a simple visual check. A careful inspection might include the items shown in the checklist on the next page.

If FPE Stab-lok® panels are present, ask the electrician to assess their condition and make a recommendation as to how best to ensure the safety and reliability of the electrical system in the building. If the electrician conducts *only* a visual inspection, seek another electrician who will perform a more thorough check.

***Consider Replacing the Circuit Breaker Panel.*** One option is to replace the entire circuit breaker panel with all-new equipment; this may be the safest, easiest, and most cost-effective solution for properties where FPE Stab-lok® circuit breakers and boxes are still in operation, and it is recommended by most electricians. (Figure 12.) However, your electrician may suggest other courses of action.

While many Stab-lok® circuit breakers have performed without incident over the past decades, they are vulnerable to malfunction under certain commonly-occurring conditions, and have been identified as the cause of damaging electrical fires. In an informal survey, half of electricians polled said that they don't bother inspecting or testing FPE panels; they simply recommend that they be replaced. Because there are design problems with the entire assembly, some experts recommend replacing the whole panel box, and not simply replacing individual breakers.

While it may be tempting to replace individual FPE Stab-lok® breakers with "replacement" or "compatible" FPE Stab-lok® breakers, this is *not advised*.

- Do not use "refurbished" or "replacement" FPE Stab-lok® breakers; many of these are salvaged and not safe to use.
- Do not use "new old stock," which is the same as the product that needs to be replaced. *Use only new UL-listed equipment from a reliable manufacturer.*

Property owners who choose replacement will need to cover the costs (typically $750 to $3000). This may include coordinating with local utility company to ensure suspension of service to the building during replacement. The work must be done be a licensed electrician.

***CAUTION!***
*Only a qualified, licensed electrician should attempt to move or remove any of the circuit breakers or other components inside the box, especially a panel on the exterior of the building. If there is no main breaker, then the power supply must be disconnected by the power company before the circuit breakers can be removed for inspection.*

***CAUTION!***
*Live-current functional testing can be extremely hazardous, as it creates dangerous current overload conditions in the building. In addition, running an overload test on* a FPE Stab-lok® *breaker can actually intensify its inherent hazard, as the overload may cause the breaker to jam, increasing the risk that it will fail to trip in the future.*


**Fig. 12. New Replacement Panel**
*Photo courtesy SCM Engineering, © 2012. Used with permission.*

## An Electrical Inspection Involves More Than a Visual Check

- ☐ Check the condition and capacity of the electrical service to the building and perform a load analysis. Is the present service adequate for present and foreseen demands?
- ☐ Inspect and verify proper grounding and bonding of main electrical service.
- ☐ Inspect all outdoor electrical components for "rain proofing" and circuit protection.
- ☐ Inspect entire main electrical service for proper terminations and safety.
- ☐ Check the age and type of various components of the electrical system.
- ☐ Check for appropriate surge suppression equipment; in lightning-prone areas, consider installing a surge arrester.
- ☐ Measure for voltage drop.
- ☐ Identify the type of wiring (aluminum or copper) and check for the proper size of conductors and the presence of over-current protection.
- ☐ Identify the type of insulation (cloth or thermoplastic), assess its condition, and check its temperature rating.
- ☐ Check the quality of the exposed wiring including the service entrance, if it is above ground.
- ☐ Verify that wiring to any detached structure is installed properly and safe.
- ☐ Verify that the main breaker panel is properly labeled.
- ☐ Verify that all junction boxes are properly installed.
- ☐ Inspect the panel box and check that all connections are safely.
- ☐ Inspect any sub-panels for proper terminations and safety.
- ☐ Verify that all branch circuit breakers are sized properly.
- ☐ Verify that required circuits have lock-outs or disconnects installed and accessible.
- ☐ Verify that existing circuits are distributed properly for the required load.
- ☐ Conduct an infrared scan of the circuit breaker panel to identify any hidden problems.
- ☐ Check the wiring of receptacles, switches, and light fixtures, and check for proper lamp wattages.
- ☐ Check polarity and ground wiring at the receptacles.
- ☐ Inspect switches and outlets for signs of overheating, damage, abuse and loose terminations.
- ☐ Check for required ground fault circuit interrupters (GFCIs) and inspect and test each.
- ☐ Verify proper grounding of switches, outlets and lighting fixtures.

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