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HAZARDOUS FPE CIRCUIT BREAKERS AND PANELS

Information for Homeowners, Inspectors, and Electricians

(Updated November 10, 2017)

FPE and replacement brands of Stab-Lok® circuit breakers have a high defect rate. They do not provide the level of circuit protection required by the NEC (National Electrical Code). Homeowners should be alerted to this safety defect and advised to have it corrected. FPE Stab-Lok® circuit breaker panels should be replaced unless the occupants are informed and willing to live with the resulting increased risk of fire and injury.

Visit ***www.fpe-info.org*** for additional information.

CONTENTS

PREFACE to the October 27, 2017 Update 1
INTRODUCTION 2
1. FPE & Other Brand Stab-Lok® Breakers Do Not Meet Code Requirements 4
2. FPE Stab-Lok® Circuit Breaker Test Results 5
A. The CPSC Tests 6
B. FPE Test Results 7
C. Southwest Research Incorporated 7
D. Underwriters Laboratories Inc. 7
E. Test Results: Field Samples From Homes 8
F. Test Results: Field Samples From 63-Apartments in One Building 8
G. Test Results: Field Samples From Condo Complex in San Jose 9
H. Test Results: Used Stab-Lok® Breakers from Electricians' Stock 10
I. Test Results: Stab-Lok® Breakers With Pink Label and White Dot 10
3. Test Results For Other Stab-Lok® Breaker Brands 10
A. FEP Stab-Lok® Breakers 10
B. Additional Stab-Lok® Brands 11
C. UBI Breakers From Condo Complex in Waltham 11
D. Brand New UBI-F Stab-Lok® Replacement Breakers 12
4. FPE Stab-Lok® Combination Breaker/GFI 12
5. FPE Main Breakers..... 13
6. FPE Stab-Lok® Panels 13
7. FPE Stab-Lok® Panels With No Main Breaker 17
8. Hazardous Failure - an Example 18
9. Some Moments in the History of the FPE Problem 19
10. The CPSC Clarifies its 1983 Press Release 22
11. FPE Stab-Lok® Breakers With Pink Label and White Dot 22
12. Fires Associated With Defective Operation of Stab-Lok Circuit Breakers 23
13. Discussion - UBI Replacement Breakers 23
14. Should FPE Panels be Replaced?..... 24
15. Replacement Options 24
REFERENCES 25
Copy of Reference 6 (Business Week Article, "Exxon Buys a Scandal .....") 26
Copy of Reference 14 (Cover page and Note "C" of Reliance Electric Quarterly SEC Filing, March 31, 1982) 27

PREFACE to the November 10, 2017 Update

Test results for more than 3,000 Stab-Lok® breakers -- FPE and other brands -- form the foundation for the conclusions and recommendations presented in this report. Virtually every FPE Stab-Lok® panel installed in homes today contains circuit breakers that are seriously defective, and the panels should be replaced. Replacing only the circuit breakers, for instance with new UBI breakers, is likely to increase the risk of an electrical fire.

This (third) update provides test results for a substantially increased number of Stab-Lok® circuit breaker samples, including FPE and various replacement brands. The test results demonstrate to a very high degree of statistical certainty that FPE and other brand Stab-Lok® breakers do not reliably meet the requirements of the National Electrical Code (NEC) for overcurrent protection. That conclusion includes UBI (Connecticut Electric) replacement breakers that are still being manufactured and sold today. Almost half of the UBI Stab-Lok® type breakers tested to date, including brand new samples, failed to meet the UL489 safety standard performance requirements. This stands as the highest defect rate of any brand of Stab-Lok® type breakers yet tested.

For this update, many changes have been made to incorporate new information and improve clarity. Test results on half-width ("thin") and full-width ("thick") Stab-Lok® breakers are now combined. From an electrical safety standpoint, there is no substantive difference between the two types. Single-pole and double-pole do differ significantly in level of hazard, however. Double-pole Stab-Lok® breakers, both full width and half width, account for almost all of the "critical safety failures" (failure to trip at 200% of rated current).

Newly added is mention of the website ***www.fpe-info.org*** that contains links to some of the referenced documents, TV programs, and other public domain information on the FPE Stab-Lok® circuit breakers and panels. The site also has a downloadable copy of the latest update of this report.

Previous revisions added information on:

1) an explanation of why FPE Stab-Lok® breakers do not meet the requirements of applicable electrical safety codes and standards, including the National Electrical Code (NEC).

2) the Consumer Product Safety Commission's clarification of their original (1983) press release on FPE circuit breakers.

3) an estimate of annual residential electrical fire deaths and injuries associated with defective performance of the FPE breakers.

4) a New Jersey court finding that Federal Pacific Electric Company (FPE) had committed fraud in their testing and (UL) labeling of the Stab-Lok® breakers.

Once again, the author thanks all of those who have contributed circuit breakers and effort on behalf of this electrical safety project.

Jesse Aronstein, Ph.D., P.E.

INTRODUCTION

The underlying reason for the presence of defective Federal Pacific Electric ("FPE") Stab-Lok® circuit breakers in millions of homes today is now public knowledge, mainly due to evidence uncovered in a class action lawsuit in New Jersey. For most of the years that this line of circuit breakers and panels were in production, FPE cheated on its testing, covering up the fact that the product did not reliably meet the applicable UL (Underwriters Laboratories, Inc.) safety standard requirements. Having obtained and maintained its UL listings by fraudulent testing, FPE applied UL labels to the product, falsely certifying that the breakers met the UL requirements. This allowed the defective breakers to get past our electrical safety system's normal checks and balances.

With UL labels on them, the defective breakers were marketed to electricians, installed in millions of homes, and approved by electrical inspectors. Although the company ceased manufacturing these breakers in the mid-1980's, defective FPE circuit breakers remain today in millions of homes, increasing the risk of fire and injury. Replacement Stab-Lok® breakers of various brands also have a high defect rate, including the UBI (Connecticut Electric) brand that is presently on the market.

Suppose that the circuits in your home were fed by a fuse box, with screw-in fuses. You may have seen these in some homes. You may also know about the unsafe practices of over-fusing (installing a higher-amperage fuse than appropriate for the circuit wiring) or putting a penny in the socket behind the fuse itself. These are actions that some people took to deal with the "nuisance" of fuses frequently blowing or to deal with the lack of a spare fuse. If an inspector finds some over-fusing and pennies behind fuses, and warns provides warning of the hazard, all other inspectors, electrical contractors, fire prevention professionals, and real estate agents would agree that they pose an increased risk of fire and injury. They would also agree that the homeowner should be alerted and that the unsafe condition should be corrected immediately. Red-flagging the Federal Pacific Electric ("FPE") Stab-Lok® panel and its breakers - FPE and other brands - is essentially the identical warning; it is the equivalent of having about 1/3 of the circuits over-fused and/or with pennies behind the fuses.

Failure to trip properly under overload and/or short circuit is the basic safety defect of the Stab-Lok® type breakers. For example, if an overload or short circuit occurs in the clothes dryer or the circuit feeding it, the breaker is expected to trip open to minimize the resulting fire hazard. But if it is a Stab-Lok® two-pole breaker it cannot be depended on to trip properly. About 40% of the FPE two-pole Stab-Lok® breakers -- the type that would feed the dryer circuit -- fail to operate properly. About 8% of them jam and will not trip at all, no matter what overload current is applied. FPE Stab-Lok® single-pole breakers and combination breaker/GFIs also have high defect rates. The most recent test results show an even higher defect rate for UBI brand circuit breakers, which are marketed today as replacements for the FPE Stab-Lok®s.

Defective performance of a circuit breaker becomes important if and when there is a short circuit or substantial overload in the circuit that it feeds. Most breakers installed in homes are never called upon to trip, and the homeowner's perception is that "the breakers work fine". The same observation could generally be made if there were no breakers (or fuses) at all in the electrical system. In the event of an electrical malfunction, however, our safety depends on proper operation of the circuit breakers.

In my previous home, only two of the breakers ever tripped during 43 years of our occupancy. I knew nothing about the ability of any of the others to function properly, except that they are a brand and type that was not known to have significant performance problems. There was no data suggesting that I should have been concerned about their ability to function properly. For Stab-Lok® breakers, FPE, UBI and others, however, there is a substantial body of information available that demonstrates a serious problem.

Safety problems also exist in the FPE panels in which the breakers are installed. Some of the most common FPE Stab-Lok® panels are failure-prone due to marginal interconnections between the current-carrying components. Deteriorating interconnections within the panel overheat when current flows, and in the worst case, fire ignites within the panel.[1]

The bottom line is this: based on the information that is available and the testing that has been performed, there is no question but that homeowners need to be alerted to this safety defect and advised to have it corrected. Unless the occupants are informed and willing to live with the increased risk, the FPE Stab-Lok® panels should be replaced.

Details regarding performance of FPE and other brands of Stab-Lok® type circuit breakers, and problems within the FPE panels are provided in the following sections.

<u>FIGURE 1</u> - REPRESENTATIVE SAMPLES OF HALF- AND FULL-WIDTH FPE STAB-LOK® CIRCUIT BREAKERS ***(left to right: 1/2-width double pole, full-width double pole, 1/2-width single-pole, full width single-pole)***
Note that the color and style of the handle varied over the years, and that some FPE Stab-Lok® breakers (type NB) have screw connection to the bussbar instead of the "Stab-Lok" feature.

1. FPE AND OTHER BRANDS OF STAB-LOK® BREAKERS DO NOT MEET CODE REQUIREMENTS

All applicable building codes and standards require operational and properly sized (current rating) circuit protection for the electrical system and equipment in buildings. This is normally accomplished by the installation of either circuit breakers or fuses. Because of their high defect rate, the Stab-lok® type circuit breakers do not meet the functional requirements of the electrical safety codes and standards.

The general requirements for installation of circuit breakers or fuses in buildings are in the National Electrical Code ("NEC"). The NEC is a so-called "model code" that is generally adopted all or in part by State and local jurisdictions. It is maintained and periodically updated by a process that is administered by the National Fire Protection Association (NFPA). The NFPA also publishes the NEC. The NFPA does no testing of the components of the electrical system, nor does it approve (or "certify", or "label", or "list") specific brands of electrical equipment as suitable for use under the requirements of the NEC.

Detailed performance requirements for residential circuit breakers are embodied in Underwriters Laboratories' (UL) Standard UL489. That standard has served for many years to define the boundaries between acceptable and unacceptable circuit breaker performance. Conformance to the standard is generally indicated by a UL (or other testing laboratory's) "label", which is applied to each breaker by the manufacturer as its (the manufacturer's) certification that the breaker meets the requirements of the standard. The testing laboratory allows the manufacturer to do that after "listing" it, having tested and accepted initial samples.

Subsequent to the listing of a product, a periodic inspection program for that product is required to maintain the listing. For the FPE circuit breakers, the periodic inspections were performed by UL, and consisted primarily of a spot check on the manufacturer's own production line and testing. UL was paid by the manufacturer for the listing, labeling, and follow-up inspection services. The manufacturer, FPE, was UL's client. The actual testing required for the UL listing and periodic follow-up testing of the FPE Stab-Lok® circuit breakers was done by FPE personnel at FPE's facilities, monitored by a UL inspector. UL did not itself independently test the FPE breakers for the listing or "follow-up services" program. UL claimed to be unaware of FPE's fraudulent testing practices.[6]

Facilitated by its fraudulent testing, FPE produced and shipped defective Stab-lok® breakers for many years. The company falsely applied the UL labels as their certification that they met the applicable UL standard. Without the UL label on them, the breakers could not have been sold, and would not have been installed by electricians, since electrical inspectors would not accept an installation without (UL) labeled equipment. To the inspectors, the label (and UL "listing") is taken as evidence that the product is "suitable for the purpose" under the provisions of the NEC, meaning that they met the applicable requirements. In the case of FPE's Stab-lok® circuit breakers, however, it was not true.

On the basis of all available test results, it is clear that the Stab-Lok® type circuit breakers do not meet the functional requirements of the NEC, State and local codes, or UL489. Nevertheless, some people in the trade (inspectors, engineers, electricians, electrical contractors, and power company technicians) may claim that the FPE Stab-Lok® breakers are in conformance with applicable code(s) because they are (or were at the time of installation) "listed and labeled", without regard for the actual functionality.

Such statements really say that the electrical distributor did nothing wrong by stocking the FPE breakers for sale, the electricians and contractors did nothing wrong by buying and installing them, and the electrical inspectors did nothing wrong by approving the initial installation. They are not at fault in that regard. They all relied on the UL label. FPE's fraud duped them all, and UL as well.

Electrical safety for the occupants of a building hinges on the actual performance of the breakers. The paper labels on the breakers provide no protection against an electrical malfunction. FPE's testing and labeling fraud left building owners and occupants with an increased risk of fire and injury. The defective performance of the FPE Stab-Lok® breakers is not in actual compliance with the NEC or any other electrical safety code.

The same is true of the various brands of Stab-Lok® replacement breakers. While the underlying reason(s) for substandard performance may be different, the end result is the same. Regardless of the paper labels that certify compliance with the standard, they do not perform as required, they do not comply with the NEC, and they present an increased risk of fire and injury.

2. FPE STAB-LOK® CIRCUIT BREAKER TEST RESULTS

Tests of FPE Stab-Lok® circuit breakers were conducted by at least four companies and one federal government agency in about the 1979 to 1983 period. These included FPE (and its parent company, Reliance Electric), Southwest Research Incorporated, UL (Underwriters Laboratories, Inc.), The CPSC (U.S. Consumer product Safety Commission), and Wright-Malta Corp. (for the CPSC). Of these, only the CPSC/Wright-Malta test results were ever made public.[1,2,3,4] Test results obtained by the others have been shielded from the public by proprietary and confidentiality agreements. While their actual test results remain hidden from view, there is no indication -- and there are no claims -- that their test results differ significantly from those obtained by the CPSC.

Recently, additional tests have been conducted on FPE Stab-Lok® breakers from homes across the country. The sample size, presently more than 2,400 circuit breakers, makes this the largest body of publicly-available test data on the FPE Stab-Lok® circuit breakers. The results are consistent with the test results obtained in about 1980. These new results clearly demonstrate that the serious defects revealed by tests more than 35 years ago are present today in the FPE Stab-Lok® breakers installed in homes. Table 1 summarizes available results for tests on FPE Stab-Lok® circuit breakers.

Tests on FPE Stab-Lok® Circuit Breakers	Number of Breakers Tested	No Trip Failures @135% of Rated Current*	Critical Safety Failures**
CPSC			
Single-Pole	14	4 (28%)	1 (7%)
Double-Pole	27	20 (74%)	5 (19%)
Wright-Malta Corp. (for the CPSC)			
Double Pole	122	62 (51%)	12 (10%)
Independent (J.Aronstein, D.Carrier)			
Single-Pole	1,726	222 (13%)	6 (0.3%)
Single-Pole GFI/Breaker	8	6 (60%)	4 (50%)***
Double Pole	718	285 (42%)	59 (8%)

* *UL test requirement. Includes samples that are also critical safety failures*
** *Failed to trip @200% of rated current, or jammed.*
*** *includes critical failure of breaker and/or GFI function.*

TABLE 1 - SUMMARY OF TEST RESULTS ON FPE STAB-LOK® CIRCUIT BREAKERS (As of 10/27/2017)

A. The CPSC Tests In the 1980 time frame the U.S. Consumer Product Safety Commission (CPSC) investigated the performance of circuit breakers. The CPSC performed its own laboratory tests on some samples of FPE Stab-Lok® single-pole and double-pole breakers. For those samples tested, they found that 85% of the FPE double-pole breakers and 39% of the FPE single-pole breakers failed one or more of the UL test criteria. The double-pole breakers that failed to trip at 200% of rated current were considered to be "critical" (safety) failures. This term was adopted for failure to trip at 200% of rated current. It was based on analysis and testing at the U.S. National Bureau of Standards (NBS, now NIST) sponsored by the CPSC. The NBS tests demonstrated that 200% of rated current is the threshold of fire ignition hazard for residential wiring in an insulated wall.

Additional tests on 122 two-pole FPE Stab-Lok® breakers in ratings from 30 Amp to 80 Amp were conducted for the CPSC by Wright-Malta Corp. These breakers were tested according to the Underwriters Laboratories' (UL) criteria for operation at 135% and 200% of rated current. [2, 3, 4] The breakers should trip (open the circuit) at these currents within a specified time, with the current applied to either one pole or both poles. (Note: The FPE Stab-Lok® two-pole breakers in ratings below 90 amp are essentially two single-pole breakers ganged together with linked handles, and most of them have an internal "common trip" mechanism, which is intended to assure that tripping of one pole causes both poles to open. Older Stab-Lok® two-pole breakers do not have the common trip mechanism.)

For the Wright-Malta tests at 135% of rated current, 51% of the double-pole breakers failed with individual poles tested, and the failure rate was 25% with both poles tested simultaneously. The failure rates increased to 65% and 36%, respectively, after 500 operations of the on/off toggle handle (a shortened version of the UL mechanical endurance test).

Tested at at 200% of rated current, the failure rate was 1% on individual poles tested, and 0% with both poles tested simultaneously. The failure rates increased to 10% and 1%, respectively, after 500 operations of the on/off toggle handle.

From an electrical safety standpoint, the most significant hazard identified in these CPSC-sponsored tests is that many of the two-pole FPE Stab-Lok® breakers may jam when trying to trip from overcurrent on one pole. This is due to mechanical friction in the common trip mechanism. Once the circuit breaker jams, its contacts will remain closed no matter what the current loading. This is serious -- it is a total failure that disables the protective device for that circuit. Essentially, the jammed breaker is exactly analogous to the "penny behind the fuse".

FPE claimed that the jamming was a consequence of the test conditions (toggle operations) and would not occur in actual use. Subsequent testing of samples from homes has disproved that claim. (See Sections 2E, 2F, 2G and 2H, below.) The friction change that causes the mechanism to jam occurs under normal conditions of ageing in residential installations.

The rest of the overcurrent failures are similar to "overfusing". For instance, consider a 30-amp breaker that actually trips at 44 amps. It is normally expected to trip somewhere above 30 amps and below the UL 135% limit of 40.5 amps. This 30-amp breaker functions the way a 40-amp breaker would. Installed in a home, its circuit is essentially "overfused", which is universally considered to be unsafe but not as dangerous as a totally jammed breaker (or penny behind the fuse).

B. FPE Test Results Federal Pacific Electric and/or their parent company Reliance Electric investigated their own circuit breakers and notified the CPSC of problems associated with their full-width two-pole Stab-Lok® residential breakers.[5] They have never made public any test data or technical reports on the 2-pole or any other breakers in their line. About 20 years ago, a homeowner called FPE and was told that the company had performed the same tests as the CPSC, but no details regarding the test results were provided. When the homeowner asked for written reports of the test results, the FPE representative said that they did not have them.

C. Southwest Research Incorporated performed testing under contract to FPE/Challenger regarding the performance of the FPE full-width two-pole residential Stab-Lok® breakers and some of the potential hazards resulting from overcurrent conditions.[5, 6] Their reports have not been made public, but it is known that their test results for the two-pole breakers were consistent with the results obtained by FPE/Reliance, the CPSC, and Wright-Malta as to the nature of the defects. A substantial portion of their testing was devoted to trying to support FPE's claim that there is no hazard associated with the defective performance of their circuit breakers.

D. Underwriters Laboratories Inc. has never made public any of its test data on FPE breakers. It is important to note that UL itself did not actually perform compliance testing on the breakers being manufactured by FPE over the years. Instead, UL's follow-up services inspectors periodically monitored the testing being done by FPE at the factory. This is where a major part of the fraud occurred, and UL was apparently not aware of it for many years. When the FPE Stab-Lok® problems surfaced, in part as a result of the CPSC investigation, UL performed some tests of its own. No UL report of that work has ever been made public. Lacking any information or claims to the contrary, and considering UL's delisting of most of the FPE breaker line in about 1980, it is reasonable to assume that the results of UL's special testing project at that time were consistent with the findings of FPE/Reliance, the CPSC, and Wright-Malta as to the defective performance.

E. Recent Testing of Field Samples From Homes To date (10/27/17) 43 complete sets of Stab-Lok® breakers have been acquired from homeowners in various parts of the United States who had replaced their FPE panels. Table 2A, below, presents a summary of the test results for the breakers in this relatively random set of field samples. A few of the sets contained one or two replacement or added breakers of various other brands (FPE Challenger, American, Pioneer, & etc.)

Type of Breaker	Tested	No-Trip Failures @135% of rated current *	Jammed
FPE Single-Pole	579	96 (17%)	5 (0.9%)
FPE Single-Pole, GFI/Breaker**	8	6 (75%)	2 (25%)
FPE Double Pole***	195	65 (33%)	19 (10%)

** includes those that jammed (did not trip at any overcurrent level tested).*

*** Circuit breaker function. Three of the combined GFI/Breaker units tested failed GFI function test.*

**** 2-pole breakers tested on individual pole overload.*

TABLE 2A - SUMMARY OF RECENT TEST RESULTS FOR 779 STAB-LOK® CIRCUIT BREAKERS FROM 43 HOMES (results as of 10/27/17)

Those listed as "jammed" did not trip at any overcurrent level tested, and the jamming was confirmed in most instances by X-Ray inspection of the mechanism, which showed the trip lever released but the electrical contact points still closed. The double-pole FPE Stab-Lok® breakers have a much higher rate of jamming (failure to trip at any current) than the single-pole. Jamming of the double-pole breakers is caused by friction in the "common trip" mechanism.

These test results show substantial defect rates across the entire FPE Stab-Lok® residential circuit breaker product line, including their combination breaker/GFIs. FPE and others often state or imply that the only problems within the FPE Stab-Lok® circuit breaker line are with the full-width double-pole breakers that FPE/Reliance called to the attention of the CPSC and the industrial/commercial types that were the subject of an FPE recall. That obviously is not correct.

F. Recent Testing of Field Samples From 63-Apartments in One Building In 2008, as a safety-related capital improvement, the management board of a 63-unit high-rise condominium in New Jersey authorized replacement of all of the FPE Stab-Lok® branch circuit panels in the apartments. Information associated with the New Jersey class action lawsuit against FPE/Reliance had been brought before the board. The local jurisdictional electrical inspection department was consulted, and they recommended replacement. The FPE panels in the apartments were replaced over the winter of 2008-9, and the circuit breakers were donated for testing. The results are summarized below in Table 2B.

Type of Breaker	Tested	No-Trip Failures @135% of rated current *	Jammed
FPE Single-Pole, 15A	241	47 (20%)	0
FPE Single-Pole, 20A	211	17 (8%)	0
FPE Double-Pole, 20A**	194	67 (35%)	10 (5%)
FPE Double-Pole, 30A**	77	32 (42%)	6 (8%)
FPE Double Pole, 40A & higher **	107	75 (70%)	8 (7%)

** includes those that jammed (did not trip at any overcurrent level tested).*

*** 2-pole breakers tested on individual pole overload*

TABLE 2B - SUMMARY OF RECENT TEST RESULTS ON 830 FPE STAB-LOK® CIRCUIT BREAKERS FROM A 63 UNIT HIGH-RISE CONDO

After replacing the FPE Stab-Lok® panels in this building, there were reports of breakers tripping for what the occupants thought was no reason. The new breakers were tripping properly under overloads that the FPE Stab-Lok® breakers had not responded to. In several instances, the overload was due to improper installation of additional baseboard heating units beyond the circuit capacity. This clearly demonstrated the defective performance of the FPE breakers that had been removed.

G. Recent Testing of Field Samples From a Condo Complex in San Jose In 2014, the management of a condo complex in San Jose, California, required replacement of all remaining FPE Stab-Lok® branch circuit panels in the homes. The FPE panels were original equipment in a portion of the homes in the complex. Some of the original FPE panels had already been replaced. A total of 392 Stab-Lok® Circuit breakers from this replacement program, mostly FPE brand, were donated for testing. The results (all brands included) are summarized below in Table 2C.

Type of Breaker	Tested	No-Trip Failures @135% of rated current *	Jammed
Single-Pole	364	40 (11%)	0
Double-Pole**	28	7 (25%)	0

** includes those that jammed (did not trip at any overcurrent level tested).*

*** 2-pole breakers tested on individual pole overload*

TABLE 2C - SUMMARY OF RECENT TEST RESULTS ON 392 STAB-LOK® CIRCUIT BREAKERS FROM A CONDO COMPLEX IN SAN JOSE, CALIFORNIA

The sample set from this complex contained a high portion of FPE breakers with pink-colored UL labels and/or a white dot on the on-off toggle. The pink labels and the white dot were applied by the manufacturer in the early 1980s when production resumed after having the UL listings reinstated. Presumably, the previous production and quality control problems had been addressed, so that breakers with these markings would be expected to consistently meet the UL489 standard. The data shows otherwise. Among the 240 pink label breakers from the San Jose complex that were tested, 35 (15%) failed the UL489 135% “must trip” requirement.

H. Recent Testing of Used FPE Stab-Lok® Breakers from Electricians' Stock Many electricians save an assortment of breakers that they have removed, of different brands and ratings, for possible use on emergency service calls. Typically, these were originally in electrical panels that had been replaced. A summary of the test results for these breakers is provided in Table 2D.

Type of Breaker	Tested	No-Trip Failures @135% of rated current *	Jammed
FPE Single-Pole Stab-Lok®	247	20 (8%)	1 (0.4%)
FPE Double-Pole Stab-Lok®**	110	45 (41%)	18 (16%)

* *includes those that jammed (did not trip at any overcurrent level tested).*

** *2-pole breakers tested on individual pole overload*

TABLE 2D - SUMMARY OF RECENT TEST RESULTS
ON 357 USED FPE STAB-LOK® BREAKERS FROM ELECTRICIANS' STOCK
(304 of these samples were obtained and tested by D.W. Carrier, Poughkeepsie, NY)

I. Test Results for FPE Stab-Lok® Breakers with Pink Label and White Dot on the Handle
These breakers were manufactured after production restarted in about 1981 under tighter control. In the past it was assumed that FPE Stab-Lok® breakers with pink UL listing labels and white dots on the handles were likely to perform as required by the UL standard. In all, a total of 428 FPE pink label and white dot breakers have now been tested, with 12% of them failing to meet trip as required at 135% of rating and one sample failing to trip at 200% (probably jammed).

3. TEST RESULTS FOR OTHER STAB-LOK® BREAKER BRANDS

A. FEP Stab-Lok® Breakers FEP (Federal Electric Products) was the predecessor of FPE (Federal Pacific Electric), and the originator of the Stab-Lok® panel and breaker designs. Relatively few of these panels and circuit breakers exist in homes today. There were 68 FEP Stab-Lok® breakers tested from electricians' stocks, the results for which are presented below in Table 3A.

Type of Breaker	Tested	No-Trip Failures @135% of rated current *	Jammed
FEP Single-Pole Stab-Lok®	65	1 (2%)	0
FEP Double-Pole Stab-Lok®**	3	0	0

* *includes those that jammed (did not trip at any overcurrent level tested).*

** *2-pole breakers tested on individual pole overload*

TABLE 3A - SUMMARY OF RECENT TEST RESULTS
FOR 68 USED FEP STAB-LOK® BREAKERS FROM ELECTRICIANS' STOCKS
(All of these samples were obtained and tested by D.W. Carrier, Poughkeepsie, NY)

The FEP breakers are the oldest of the Stab-Lok® types tested, predating the FPE brand. The performance of these FEP breakers, which were at least 60 years old, ranks as the best of all Stab-Lok® brands so far tested. The one failure was just over the limit, tripping at 137% of rated current instead of the required (at or below) 135%.

B. Additional Stab-Lok® Brands

Since the end of manufacturing of circuit breakers under the Federal Pacific Electric (FPE) brand, in the mid 1980s, compatible Stab-Lok® type breakers have appeared under names such as "American", "Federal Pioneer", "Challenger", "Federal Pacific Reliance Electric", "UBI", "Federal Pioneer Limited" (Canada), and some other similar combinations. For the most part, the breakers produced under these names have essentially the same housing and internal mechanism as the FPE breakers. In many instances the new branding consisted of a paper label applied to an FPE breaker. The name changes reflect corporate ownership changes as well as efforts to disassociate the product from the scandal-tarnished FPE brand name for the purposes of marketing and isolation from liability. The test data indicates that they suffer from the same performance problems, however. Table 3B presents the test results for field samples of Stab-Lok® breaker brands marketed subsequent to the demise of FPE. All demonstrate a significant failure rate. The UBI breakers, which are marketed in the USA at this time, have the highest failure rate.

Brand of Stab-Lok® Breaker	Tested	No-Trip Failures @135% of rated current *	Jammed
American FPE, American Pioneer	51	7 (14%)	0
Challenger	26	2 (8%)	0
UBI (Connecticut Electric)	466	194 (42%)	17 (4%)
Federal Pioneer (Canada), Canadian FPE, & Canadian Pioneer	24	9 (38%)	1 (4%)

* *includes those that jammed (did not trip at any overcurrent level tested).*

TABLE 3B - SUMMARY OF RECENT TEST RESULTS ON ADDITIONAL STAB-LOK® TYPE CIRCUIT BREAKER BRANDS

C. Testing of UBI-F (FPE) Type Breakers From a Condo Complex in Waltham, MA

In 2004, all of the original FPE breakers in the more than 300 units of this complex had been replaced with brand new UBI-F breakers. The UBI-F breakers fit the unique Stab-Lok® mounting configurations. They were - and still are - marketed as replacements for the FPE breakers. They are claimed by the manufacturer to be in conformance with the UL489 standard requirement, and are so labeled. This is the label that electricians and inspectors rely on as certification that the breaker performs as required by UL489 and therefore meets the NEC requirement for overcurrent protection.

In 2016, as a result of safety concerns regarding both the UBI breakers and the FPE panels, the Board of Directors of this complex mandated that all remaining FPE panels in the complex must be replaced. A sample of 420 breakers removed from the complex were provided for testing. The dates on the labels show that most of these breakers were produced in 2004. Test results for the samples from this complex (a subset of the 466 UBI breakers listed in Table 3B) are shown in Table 3C.

Type of Breaker	Tested	No-Trip Failures @135% of rated current *	Jammed
UBI-F Single Pole	312	122 (39%)	0
UBI-F Double Pole **	108	55 (51%)	14 (13%)

* *includes those that jammed (did not trip at any overcurrent level tested).*

** *2-pole breakers tested on individual pole overload*

TABLE 3C - SUMMARY OF RECENT TEST RESULTSFOR 420 UBI STAB-LOK® CIRCUIT BREAKERS FROM A CONDO COMPLEX IN WALTHAM, MA

D. Recent Testing of Brand-New UBI-F Breakers, Purchased in 2017 Samples of new UBI-F Stab-Lok® type breakers were recently purchased from sources across the country. All were in the original factory "point of sale" (pegboard display) packages. Test results for the brand-new UBI-F breakers are provided in Table 3D.

Type of Breaker	Tested	No-Trip Failures @135% of rated current *	Jammed
UBI-F Single Pole	2	0	0
UBI-F Double Pole **	15	12 (80%)	1

* *includes those that jammed (did not trip at any overcurrent level tested).*

** *2-pole breakers tested on individual pole overload*

TABLE 3D - SUMMARY OF TEST RESULTS FOR BRAND NEW UBI STAB-LOK® TYPE CIRCUIT BREAKERS

In spite of the small sample size, it is statistically quite certain that a substantial percentage of new UBI-F breakers are substandard and do not meet the UL489 requirements. The samples tested cover several current ratings, they were obtained from a variety of sources, and they were manufactured over a range of dates. The poor performance is not just the result of one bad day at the factory. It is most likely that the UBI breakers from homes that were found in these tests to be defective (see Table 3B above) were that way when they were first installed.

4. FPE STAB-LOK® COMBINATION BREAKER/GFI

Eight FPE Stab-Lok® breaker/GFI combination units were among the field samples tested. Six of them failed. (See Table 2A). The single-pole breaker/GFI has an internal circuit that senses small current differences between the line and neutral conductors passing through it. If the difference exceeds 5 milliamps, it is supposed to trip the breaker and open the circuit. This is a life-safety feature intended to prevent electrocution in the event that a person accidently comes into contact with an electrically live element of the circuit. If the mechanism jams it defeats both the circuit breaker and GFI functions. Two of the units jammed. While the sample size is not large, it is nevertheless significant because it was a truly random sample. The eight units tested were from different panels in different parts of the country.

A previous sample can be added: a field failure in which an FPE Stab-Lok® breaker/GFI "protected" a lighting circuit in which a short circuit occurred between a switch and its grounded metal (brass) cover plate. The event, which resulted in a serious injury, formed a relatively large globule of melted brass at the point of arcing to the grounded coverplate. The melting could not have happened if the GFI function had operated properly. That FPE Stab-Lok® breaker/GFI was subsequently tested and was confirmed to be defective. Altogether, including this previous sample, I have crossed paths with nine FPE Stab-Lok® breaker/GFI units, seven of which were defective.

5. FPE MAIN BREAKERS

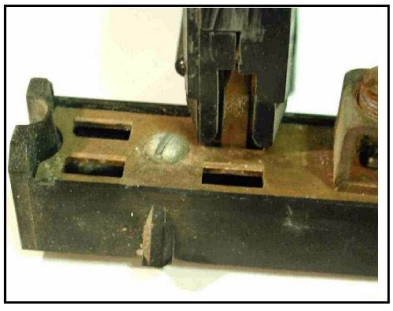
Although there have been incident reports in which FPE main breakers have failed to trip under circumstances in which people thought they should have, there is very little test data available on which to base any conclusion - one way or the other - as to the reliability of the main breakers utilized in FPE Stab-Lok® residential panels. *(Note that FPE panels in many homes do not have a main circuit breaker. See section 7.)*

Ten FPE 90 and 100 Amp two-pole main breakers (such as shown in Figure 6) are included in the results presented in Table 2. Four of the ten failed to trip at 135% of rated current as required.

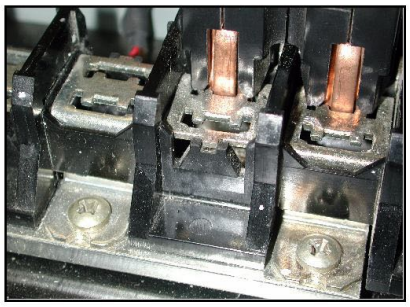
6. FPE STAB-LOK® PANELS

Even if it were possible to replace all of the suspect FPE Stab-Lok® breakers with a more trustworthy type, that would not correct hazardous internal failure modes intrinsic to many of the FPE panels. Nine FPE Stab-Lok® panels in the present study had some damage due to overheating at busbar contacts and connections. The overheating ranged from mild to severe in these failing panels.

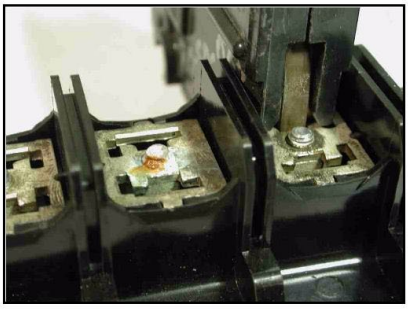
The "panel" is the unit within the enclosure, on which the breakers are mounted. The main electrical service feeders (electrically live, from the meter) are connected at the panel, and the panel has an internal conductor system that distributes the power to the individual circuit breakers. The internal conductor system consists essentially of "bussbars" (thick metal bars) that have sockets incorporated or attached, into which to which the breakers' "stab" contacts are inserted. There are several different bussbar and Stab-Lok® constructions used in FPE panels, three of which are shown in Figure 2.



A. Copper buss bar with punched openings.



B. "Z" clip, clamped to . bussbar with 10-32 screw.



C. Stab socket on a post, attached with an 8-32 steel screw.

FIGURE 2 - THREE DIFFERENT FPE STAB-LOK® SOCKET DESIGNS

Of the three types illustrated above, the one shown in Figure 2-C is known to have a high probability of deteriorating and overheating of the stab socket structures when subjected to significant current flow. Each individual stab socket plate is connected to its bussbar via a post (spacer), and the assembly is held together by an 8-32 steel screw. FPE panels with this construction are prone to overheating failure. Eight of the panels of the present study that showed evidence of serious overheating were constructed this way. One example is shown in Figure 3.

FIGURE 3 - OVERHEATING AT THE CONTACT BETWEEN THE BUSSBAR AND THE STAB SOCKET ASSEMBLY CAUSED THIS DAMAGE TO THE INSULATION. (This view is of the backside of the panel. The damage cannot be seen seen unless the panel is taken out of the enclosure.)

A more serious failure of this type has been documented.[1] In that instance, the failure had been severe enough to ignite a smoldering fire on the plastic insulating material. The fundamental weakness in this design is the use of a single, relatively flimsy 8-32 screw to hold a structure together that can feed up to four half-width breakers with a total "ampacity" (rated circuit capacity) up to about 160 Amps. Figure 4 shows how the stab socket plate and post are attached to the bussbar.

A. Cutaway - Bussbar, Post, and Stab Socket Plate. **B. Bussbar, Screw, and Post**

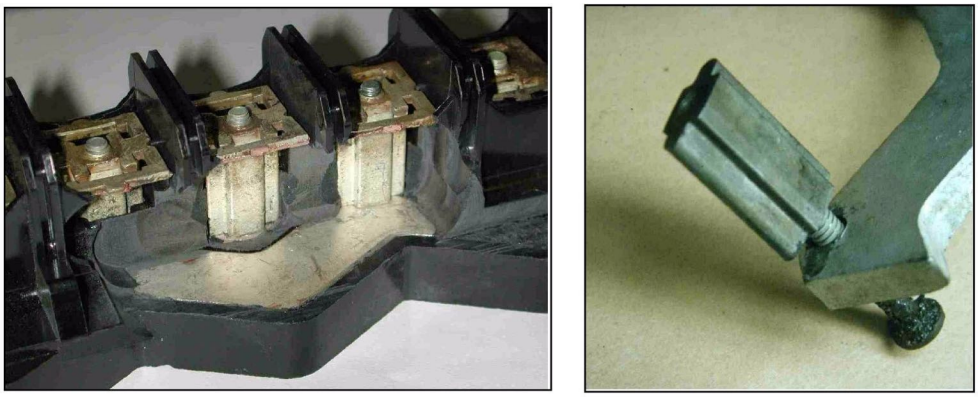
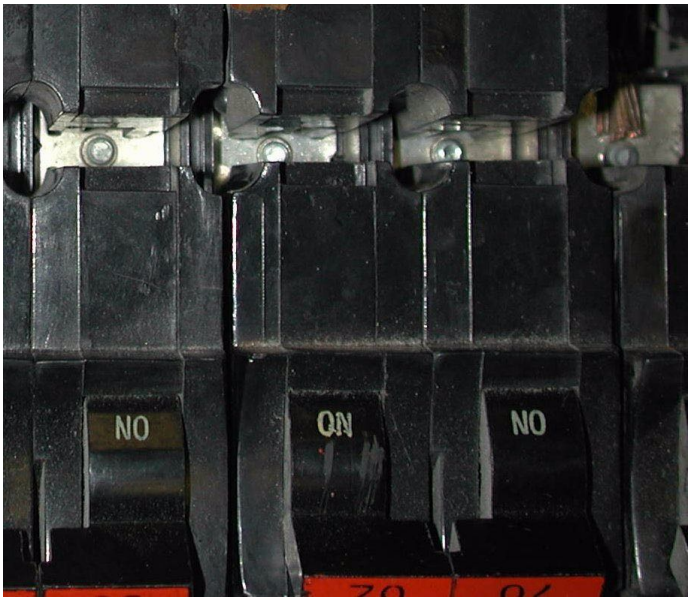


FIGURE 4 - CONDUCTING PATH FROM BUSSBAR TO STAB SOCKET

Various material combinations were utilized by FPE in these assemblies. Some bussbars are copper, others are aluminum. Some posts are copper, others are aluminum. The worst case (most likely to fail) is where both the bussbar and the post are made of aluminum, and the best case (least likely to fail) is where both are made of copper. Inspectors (or homeowners, or electricians) have no way of knowing which materials are utilized in any particular FPE panel with this type of construction.

Inspectors can, however, determine if a particular FPE panel has this type of construction, and, to a limited extent, whether it has failing bussbar interconnections that have previously overheated. With the panel cover off, for this type of panel, the inspector can see the ends of the screws that attach the stab socket plates, as shown in Figure 5. (Note: If there are slotted screwheads visible, that is a different type of panel construction.) The stab socket plates and the visible ends of the screws should have a bright metallic look. Darkening, discoloration, or signs of corrosion most likely indicate past episodes of abnormal overheating.



<u>FIGURE 5</u> - THE ENDS OF THE SCREWS HOLDING THE STAB SOCKET PLATES ARE VISIBLE BETWEEN THE TWO ROWS OF BREAKERS. THIS IDENTIFIES IT AS A PANEL OF THE TYPE SHOWN IN FIGURE 2-C

Some FPE Stab-Lok® panels have 100-amp main breakers that feed into the bussbars through the same plate and post system. In this design, the two main breaker output terminals do not have the stab type contact. Instead, each one is screwed down to a plate the same size as the stab socket plate, but which has a threaded hole in it instead of the stab openings. As with the plate and post assembly, the screws clamping the main breaker to the busbar assembly are size 8-32, which is absurdly small for a 100-amp main breaker connection, and this is another common point of overheating failure.

To put the diameter of the 8-32 screw in perspective, it is the same size as used on common receptacles for connecting #14 or #12 copper wire (for 15- and 20-amp circuits), with a diameter of only about 5/32". An FPE panel and main breaker of this type is shown in Figure 6. The main breaker's output terminal mounting screws and the tiny Allen-wrench that fits them are shown in Figure 7.

FIGURE 6 - FPE 100-AMP MAIN BREAKER CONNECTS TO THE BUSBARS THROUGH THE PLATE & POST CONFIGURATION, USING ONE SOCKET-HEAD 8-32 SCREW FOR EACH POLE TO ATTACH TO ITS CONTACT PLATE.
(The heads of the 8-32 clamping screws are seen at right, above and below the "LOAD" label.)

FIGURE 7 - ONE LOAD-SIDE CONTACT AND ITS 8-32 CLAMPING SCREW, ON THE FPE 100-AMP MAIN BREAKER OF FIG. 6. THE SCREW-HEAD TAKES A 3/32" ALLEN WRENCH, WHICH IS ONLY SLIGHTLY LARGER THAN THE LEAD OF THE PENCIL.
(The larger hole next to the clamping screw provides clearance for the end of the screw that protrudes from mating contact plate)

7. FPE STAB-LOK® PANELS WITH NO MAIN BREAKER

Many of the FPE Stab-Lok® panels that are in homes today do not have any main breaker. This was allowed under the so-called "Rule of Six" in the National Electrical Code (NEC), which states, typically, that "The service disconnecting means ... for each set of service entrance conductors ... shall consist of not more than six switches or six circuit breakers ..." (NEC 1981, section 230-71a, for example.) This reduced the cost of the panel at the time of initial installation, but its nasty side effect is to totally eliminate the safety factor provided by having a main breaker. In the event that a branch circuit breaker jams on an electrical fault, a main breaker would still provide a measure of circuit protection at a higher current trip point. Without the main breaker, there is no circuit protection at all if certain breakers jam. An FPE Stab-Lok® panel with the "rule of six" configuration, normally called a "split bus" type, is shown in Figure 8.

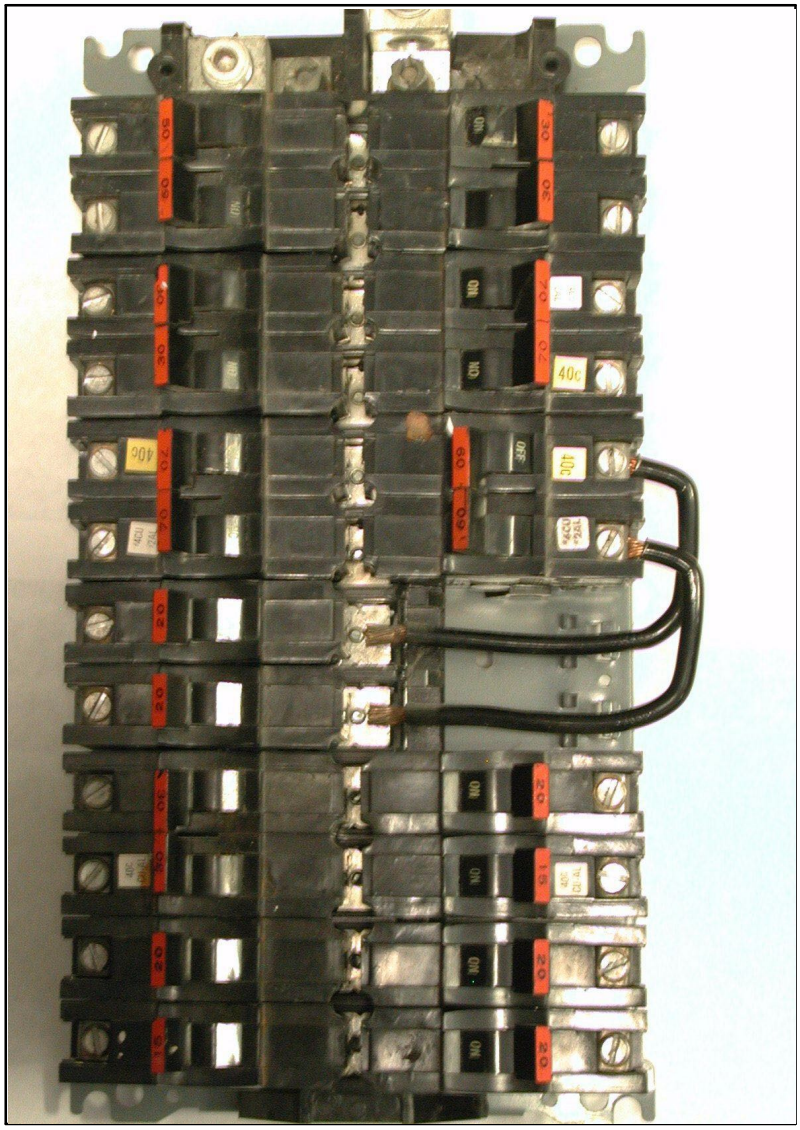


FIGURE 8 - FPE STAB-LOK® "RULE-OF-SIX" (SPLIT-BUS) PANEL WITH NO MAIN BREAKER. THE JUMPER CABLES ON THE RIGHT SIDE FEED THE LOWER SECTION.

There are many different design variations, but the essential element is that in these "rule of six" panels there is no main breaker, and, typically, the lower section of the panel is fed from jumpers coming from the output of one of up to six double-pole breakers in the upper section. The FPE Stab-Lok® double pole breakers in the upper section have a relatively high probability of jamming when called on to trip, however, as previously demonstrated by the test results presented in Section 2. That means that the home with an FPE "rule-of-six" panel has an unacceptably high probability of having one or more circuits that are totally unprotected, in which the maximum current flow is only limited by what the transformer on the pole can deliver.

8. HAZARDOUS FAILURE - AN EXAMPLE

On first glance, the FPE Stab-Lok® panel previously shown in Figure 8 looks normal. In fact, however, it clearly demonstrates several of the hazardous failure modes discussed in the previous sections. It is one of those collected for the recent testing. It is from a home built in 1974, whose new owners had determined in 1999 that it should be replaced. Their decision to replace it was in part prompted by information available on the internet regarding FPE breaker problems.[7] According to the homeowner, who sent it to me for examination and testing, *"We recently had it replaced and found the breaker to the dryer fried in just the way described. Our electrician was astonished. Two others we had bids from dismissed our concerns with contempt."*[8]

Viewing the panel in Fig. 8 from the front, some signs of overheating (as previously discussed) are evident. These are subtle compared to the view looking down at the top right (dryer) breaker, as in Figure 9. The main service cable connector has been rotated out of the way for better visibility of the damage. The plastic insulator is burnt and cracked. The breaker's internal mechanism can be seen through the hole burned through its side.

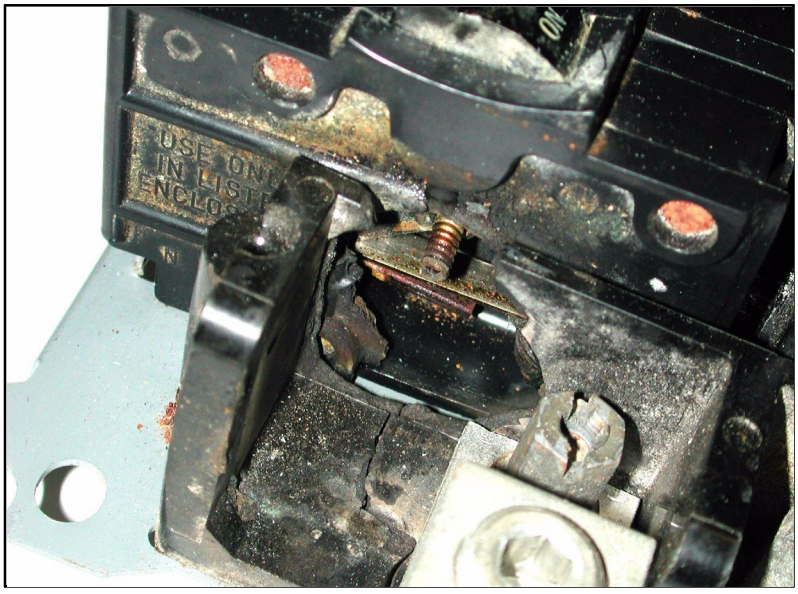


FIGURE 9 - VIEW DOWN TOWARD UPPER RIGHT OF PANEL SHOWN IN FIG. 8. THIS FPE STAB-LOK® TWO-POLE 30-AMP BREAKER FED THE CLOTHES DRYER.

The damage to the breaker, from some previous high current event, is exactly as had been demonstrated in the tests done for the CPSC.[2, 3, 4] Those tests demonstrated that, when an FPE breaker jammed and the current exceeded about 300% of the breaker's rating, the side of the breaker disintegrated and/or ignited from the heat being generated within the breaker. This is due to resistive heating of the breaker's internal current-carrying components, mainly the bimetal element and the flexible copper braid that connects to it. This is not an arcing failure, although the damage to the insulating materials of the breaker and panel sets the stage for an arcing fault to occur.

There are additional problems in this panel. Overheating damage occurred to the insulation on the backside of the panel. Further, in addition to the dryer breaker that failed (jammed) in the home, two other two-pole breakers from this same panel failed in the lab testing. All this in a panel that looked OK from the front!

Everything in the home was functioning. The dryer worked. Why wouldn't it, since the circuit breaker was jammed with its contacts closed? Keep in mind that this panel is one of the "rule-of-six" configuration. Before they replaced this panel, the homeowners unknowingly had a situation where, essentially, the clothes dryer was wired straight through to the power line transformer on the pole, with no functional circuit protection at all.

9. SOME MOMENTS IN THE HISTORY OF THE FPE PROBLEM

In about 1978, the Consumer Product Safety Commission started a project on circuit breakers. The CPSC worked together with the National Bureau of Standards (NBS, now NIST), to develop equipment that would allow the testing of breakers in place in a home. Some in-home measurements on various brands, including FPE, were made prior to mid-1980.

In mid-1980, Reliance Electric Company, FPE's parent company, notified the CPSC of problems with the FPE two-pole Stab-Lok® circuit breakers. Shortly thereafter, a complex legal tangle began involving several companies, including Exxon, Reliance, UV Industries, and Sharon Steel, centering on allegations of corporate misrepresentations by FPE. See Reference 6 (copy attached) for some of the details as reported at the time. It is reported that, according to Reliance Electric, UL "delisted" virtually the entire line of FPE circuit breakers. Reliance, FPE's "parent" company, reported problems with the full-size FPE two-pole Stab-Lok® breakers to the CPSC. They did not report known problems in the rest of the Stab-Lok® line of residential breakers.

In 1981 the CPSC initiated a specific investigation of FPE's full-size two-pole Stab-Lok® breakers. The results clearly demonstrated that a significant number failed the UL standard tests, and that some would jam with the contacts closed on individual pole overcurrent conditions. There was no basis for disagreement by FPE/Reliance as to the nature of the defects, but they claimed that there was no safety hazard associated with the defective circuit breakers and that the jamming was a result of the applied test and would not occur in normal service.

Initially somewhat cooperative with the CPSC, FPE/Reliance eventually refused to take any voluntary action toward recall or warning the public. They challenged the validity of virtually everything that the CPSC had done in their investigation, and they took legal action to block the CPSC's ability to respond to requests (under the Freedom Of Information Act) for the test results and other documentation related to their FPE Stab-Lok® investigation.

In early 1983, the CPSC closed its investigation of FPE breakers, and issued a press release to that effect.[9] The Commission's press release indicates that it was "unable at this time to link these failures to the development of a hazardous situation," that "The Commission staff believes that it currently has insufficient data to accept or refute Reliance's position," and that they did not have the money to develop the required data. The press release provides no information as to the performance defects that the CPSC found in their tests, and no information on the possible hazardous consequences.

The CPSC did not have the data necessary to rigorously prove a direct relationship between the defective breakers and specific incidents of fire, injury and death. A rigorous connection between defects and injury was required, since the manufacturer of the defective breakers steadfastly refused to cooperate with the CPSC toward any recall or consumer safety advisory, claiming that there was no hazard associated with their breakers. The manufacturer essentially forced the agency to develop the data required to a level that could prevail in court, or drop the issue. The CPSC did not have sufficient resources to support the multi-million dollar program that would have been required at that time to develop the data connecting breaker malfunction to injury, and it closed its investigation of the defective breakers.[9]

The CPSC's inability to "connect the dots" between FPE Stab-Lok® circuit breaker malfunction and fire/injury incidents stems primarily from the fact that fire investigation and reporting is focused on the cause (ignition source) and its origin (location in the structure). Conventional fire investigation and reporting seldom goes to the depth required to prove with hard evidence that a circuit breaker did or did not function properly. As an example, a fire might start in a bedroom as a result of a short circuit in a table lamp. A fire investigator may suspect that circuit breaker malfunction was a contributing cause, but the ability to prove it is generally lacking. For the CPSC, the cost of developing the required methodology, protocols, investigator training, and equipment, and then implementing a program to develop the required data was beyond the reasonable reach of the agency's budget.

Two important events had occurred prior to the Commission's vote that no doubt influenced their decision. In 1981, President Reagan took office. The political climate under the new administration was very much pro-industry, and the CPSC was on the chopping block from a budget standpoint. The Commission did not have - and was not likely to get - the funds required for a protracted technical and legal battle with FPE/Reliance.

Equally important as background is that in early 1982 the CPSC lost a major battle in court on another electrical product - aluminum wiring. Kaiser Aluminum had challenged the CPSC's jurisdiction over house wiring, claiming that it was not a consumer product. After a seesaw series of court decisions and appeals, Kaiser ultimately prevailed. Irrespective of any demonstrated hazard, the final ruling was that the CPSC did not have jurisdiction unless it could prove that a substantial percentage of new home buyers contracted directly with the electricians for the installation of the wiring system. That is generally not the case. It is much more common to have the electrician working under contract to the builder or general contractor. After spending a significant portion of its energy and budget on that project over a period of about eight years, the CPSC had to abandon its case on aluminum wiring hazards due to that ruling.

In terms of the contractual relationships in home construction, the service entrance panel is somewhat analogous to the aluminum wiring. Although other aspects are quite different, the Kaiser appeal could serve as a model for FPE. No matter what level of hazard the CPSC might be able to demonstrate associated with the defective Stab-Lok® breakers, they had some chance of losing if FPE chose to challenge their jurisdiction over the product. A precedent of a sort had been set in the aluminum wiring case.

Although a clarification of their 1983 press release has recently been made, the CPSC has not been seriously active in the FPE circuit breaker issues since their original investigation. Some of their technical documentation is available through the CPSC Freedom of Information Act Office.

The legal tangle involving Exxon, Reliance, FPE, etc., was eventually settled, with very little information made public. Most of the court records from that case are sealed. FPE was out of the circuit breaker manufacturing business by 1986, and the company may continue today in the United States only as a legal entity. The last contact address was an attorney's office.[10]

In Canada, Federal Pioneer (Schneider Canada) manufactures Stab-Lok® circuit breakers and panels. A recall was announced (by Schneider and The Ontario New Home Warranty Program) of two of their 15-Amp models manufactured between mid-1996 and mid-1997. The announcement states that *"In some circumstances these breakers may not trip. ... If the circuit breaker does not perform as intended, there is potential for property damage and/or personal injury."* (Note: I have included this item because of the quote, which reflects a proper concern for electrical safety, and it is not intended to imply any broader problem with the Federal Pioneer Stab-Lok® line.)

In the 1990's, the emergence of the Internet as a practical means of information retrieval and exchange resulted in renewed attention to the FPE Stab-Lok® breaker performance problems. As a positive result of Internet communications, information on the problem has been made widely available, failure reports have been accumulated, and samples from homes were made available for testing. As a negative result, a marketplace for used FPE Stab-Lok® breakers and breaker/gfi's emerged. Given the data presented in the previous sections of this report, the purchase of used FPE Stab-Lok® equipment is risky.

In 1999, attempting to counter adverse information posted on the Internet regarding the FPE Stab-Lok® breakers, an article was written for the IAEI News (the monthly publication of the International Association of Electrical Inspectors).[10] The author of the article is not identified except as "the former quality manager of FPE, who is a consultant to the company ...", and the article contains a disclaimer that the information that it contains "is neither approved nor disapproved by the International Association of Electrical Inspectors."

The IAEI article does not provide any details regarding the nature of the circuit breaker performance defects and malfunctions that had been uncovered by FPE, the CPSC, and others; it only points to UL "listing and labeling" as indicating that they are OK. In its summary, it says, "The gist of this article is that FPE Stab-Lok® load centers and circuit breakers are listed and labeled, and suitable for the usage intended." The article does not mention the fact that UL essentially de-listed virtually the entire FPE line of circuit breakers for a period of time, nor does it deal with the question of the fraudulent testing practices employed by FPE in obtaining and maintaining their UL listings and labels.[6, 11, 14]

Many electrical inspectors, having read the article in their own professional organization's publication, are likely to reflect the article's position when dealing with inquiries on this subject. Considering the New Jersey Court's finding of fraud on the part of FPE, the article that FPE/Reliance provided to IAEI news may be viewed as an extension of the fraud -- an effort to "whitewash" a serious breach of corporate and individual ethics and help protect the companies involved. (Note: IAEI recently removed the article from its on-line archives, but it still lives on through other internet sites and in the mind of many electrical inspectors.)

In a relatively recent class action lawsuit against FPE/Reliance in New Jersey, the court ruled in 2002 that FPE committed fraud under the NJ Consumer Protection act by FPE) misrepresented to the public that their circuit breakers met the applicable (UL) standards when, in fact, they did not.[11]

Most recently (Feb. 18, 2011), the CPSC revised its 1983 press release on FPE Breakers, making it clear that the Commission did not make any finding as to their safety.

10. THE CPSC REVISES ITS 1983 PRESS RELEASE

The CPSC has clarified the meaning of its 1983 press release on FPE breakers. Until this time, the first paragraph of that press release was most often incorrectly interpreted to mean that the agency had found the FPE breakers to be safe. The following clarification has now been added at the top of the original text:

> **Note: CPSC staff advises electricians, homeowners, home inspectors and real estate agents to read and interpret the following press release carefully. The press release announces that the Commission closed the matter without making a determination as to the safety of FPE circuit breakers or the accuracy of the manufacturer's position on the matter. ...**

The original version of the press release may still be on the CPSC website, and if so it has a note at the top that reads: *"This is the original of a document that has been modified. To see the modified version, click here."* Clicking on the link will access the updated version with the above message.

With the new message from the CPSC, it is clear that there is no validity to any statement that the CPSC found the breakers to be safe.

11. FPE STAB-LOK® BREAKERS WITH PINK LABEL AND WHITE DOT

The question often arises as to whether there are any years or models of FPE Stab-Lok® circuit breakers that meet the standard performance requirements. In previous versions of this report it was stated that FPE Stab-Lok® breakers with pink UL listing labels and white dots on the handles were likely to perform as required by the UL standard, since they were produced under more stringent quality controlprocedures and UL oversight when production resumed in the early 1980s. Recent test results demonstrate that to be incorrect (See Sections 2G and 2I of this report for test results for FPE pink label and white dot breakers.) Updating the answer to the question, there are no known years or models of FPE Stab-Lok® breakers that can be depended on with confidence that they will operate properly in the event of an electrical overload or short circuit.

12. FIRES ASSOCIATED WITH DEFECTIVE OPERATION OF FPE STAB-LOK® CIRCUIT BREAKERS

The CPSC investigation of the early 1980s was halted in part due to its (budgetary) inability to connect the laboratory evidence of defective operation of the FPE Stab-Lok® breakers to electrical fire losses. Additional data developed since that time allows estimates to be made of the number of electrical fires attributable to defective operation of these breakers. The method employs extensive electrical fire data compiled by the CPSC and test results on samples of FPE Stab-Lok® breakers from homes. A recent technical paper describing the method in detail has been published. [13] By that method, it is estimated that there are about 2,800 electrical fires each year associated with defective operation of the FPE Stab-Lok® breakers. (A "fire" in this set of data is an event reported as a fire and required an emergency services response to a residence.) These fires result in an estimated 116 injuries, 13 deaths and $40 million in property loss. The estimates are not exact, but are considered to be of the correct magnitude.

The estimated 2,800 electrical fires per year associated with defective FPE Stab-Lok® breakers is more than 2% of the reported residential electrical fires. These are fires that would not occur if the breakers operated properly. For homes equipped with these breakers it amounts to about one fire per 6,000 homes per year in excess of the average, or about a 20% increased rate of electrical fires relative to the average for homes with properly operating breakers.

13. DISCUSSION - UBI REPLACEMENT BREAKERS

Replacing the FPE breakers with UBI-F breakers is definitely not recommended, as it is likely to result in an increased level of hazard. The UBI-F breakers, marketed by Connecticut Electric Products, are the only new breakers commonly marketed today in the U.S.A. as replacements for the FPE Stab-Lok® breakers. The UBI breaker housings look different, but internally the breakers are essentially the same design as the FPE breakers, as can be seen in Figure 10. The test results for UBI breakers are poor.

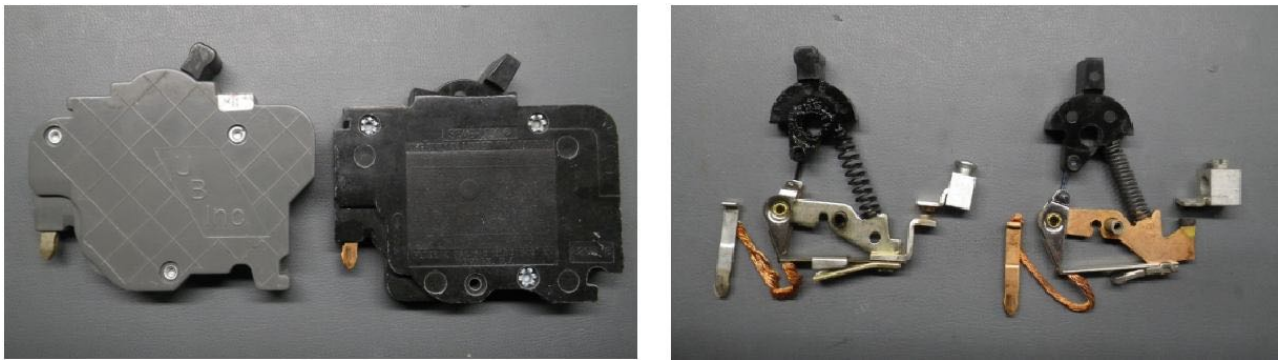


FIGURE 10 - UBI-F BREAKER AND FPE BREAKER, OUTSIDE AND INSIDE
(UBI on left, FPE on right in both photos)

Brand new UBI-F breakers are currently being tested. The results to date are presented in Section 3.D of this report. The findings so far demonstrate that the brand new UBI breakers and used UBI breakers from homes (Sections 3.B and 3.C) have a higher failure rate than the FPE that they are intended to replace. Replacing FPE breakers with UBI breakers is a step backward in electrical safety.

14. SHOULD FPE STAB-LOK® PANELS BE REPLACED?

If you inspected your own home and found that it had a fuse box with 1/3 of the circuits over-fused and with pennies behind some fuses, how long would it be before you had it corrected? Would you sleep tight without it being corrected? Would the fact that your house had not burned down yet because of the over-fusing and pennies influence your decision as to whether to take corrective action?

Unlike over-fusing and pennies behind the fuses, defective FPE Stab-Lok® breakers cannot be spotted by an inspector or tested by an electrician or homeowner. Without doing a functional test (at overload and short-circuit conditions) on each breaker, one pole at a time for the two-pole breakers, one cannot actually determine the present operating characteristics of a breaker. Which of the 20-Amp breakers really have the trip characteristics of 30-Amp breakers (same as over-fusing)? Which will not trip at all (same as a penny behind a fuse)?

Most electricians or electrical inspectors can only look at the breakers ("they look OK to me"), and operate the toggle ("they click on and off OK"). But without doing live-current functional testing on all of the breakers, to determine the minimum tripping current, it is impossible to determine which of the breakers in the panel are defective. Will they all trip safely and properly on electrical overload or short circuit? Electrical contractors and inspectors are generally not equipped to do that type of testing, and homeowners or potential purchasers are not likely to have the budget required for specialized testing. In fact, thorough testing would most likely cost far more than changing the panel.

The presence of an FPE panel in a home should be classified as a “Safety Defect”. The FPE Stab-Lok® breakers are primary safety devices of questionable operating reliability. It is not quite correct to call the non-tripping breaker a “fire hazard”. That term should be reserved for the electrical failure that causes ignition. The breaker’s function is to stop certain electrical sequences that could, if allowed to proceed, lead to fire in the building. If an electrical fire hazard involving excess current develops somewhere in the building, the breaker is supposed to trip and minimize the possibility of fire ignition. If the breaker is defective, fire is more likely to result.

There is no question but that the FPE Stab-Lok® load center panels should be replaced. There is no practical and safe alternative. Other types of FPE distribution equipment may be in a building. There is no information at this time as to performance or safety problems (other than FPE recalls) that would support a recommendation to replace anything but the Stab-Lok® panels. It would be prudent, however, to have the additional FPE equipment in the building inspected annually for any signs of overheating at interconnections and cable terminals.

15. REPLACEMENT OPTIONS

There are two options for replacement of the FPE Stab-Lok® panel. If it is not required to increase the service to higher amperage capacity, Eaton makes replacement panel inserts that install in the existing FPE enclosure.

If it is necessary to increase the amperage capacity of the service, then a new enclosure and panel inside it must be installed. Eaton, Square D, and General Electric circuit breakers have performed well in tests of new breakers and breakers from homes. Recent test results for Siemens and Murray breakers, and their predecessor ITE show a high failure rate for the 135% trip requirement, and these brands are not recommended. Test results on several brands of circuit breakers, purcased new in 2016 and 2017, are shown in Figure 11.

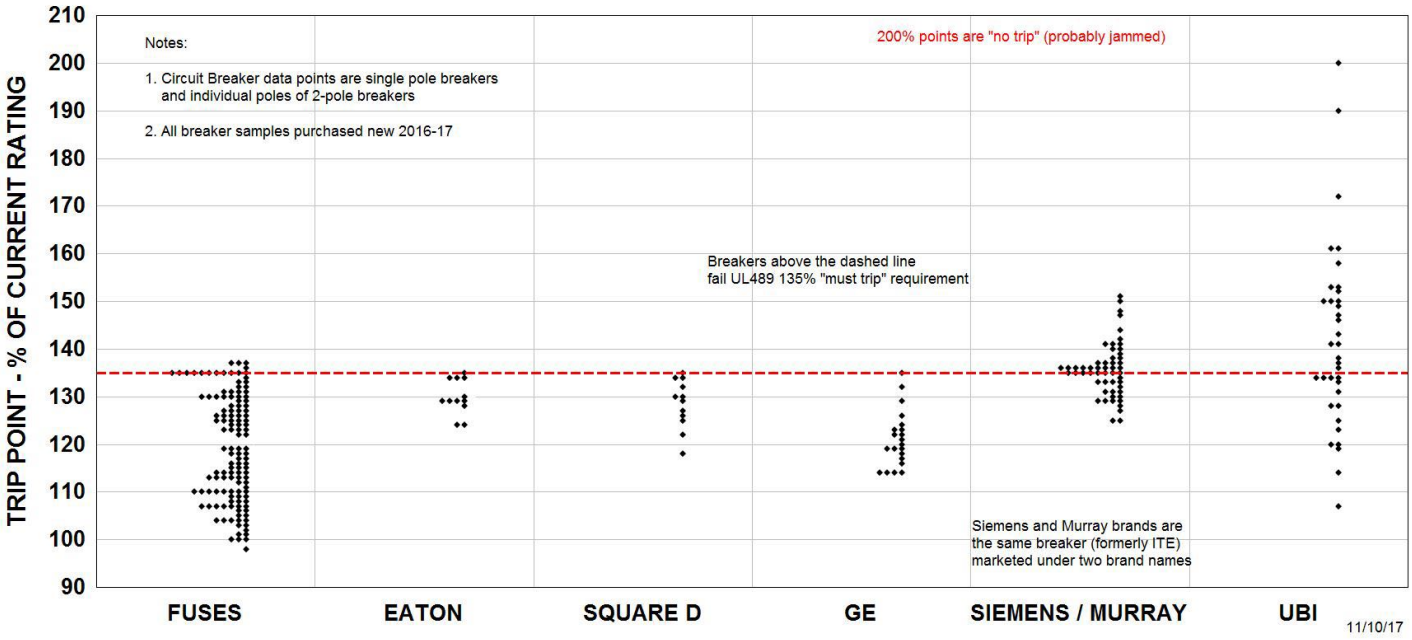


FIGURE 11 - TEST RESULTS: FUSES AND NEW CIRCUIT BREAKERS

REFERENCES

1. "Failure Analysis of Residential Circuit Breaker Panel", Wright-Malta Corp., (by J. Aronstein, for U.S. Consumer product Safety Commission, Project #CPSC-C-81-1455), May 20, 1982 (Contains failure analysis of FPE Stab-Lok® panel that ignited, due to failure of buss-bar interconnections in the backside of the panel.)

2. "Final Report: Calibration and Condition Tests of Molded Case Circuit Breakers", Wright-Malta Corp., (by J. Aronstein, for U.S. Consumer product Safety Commission, Project #CPSC-C-81-1429), December 30, 1982 (Calibration and functional testing of FPE breakers. Substantial percent failures to trip on overload.).

3. "Status Report - Evaluation of Residential Molded Case Circuit Breakers", Wright-Malta Corp., (by J. Aronstein, for U.S. Consumer product Safety Commission, Project #CPSC-C-81-1455), August 10, 1982 (Contains analysis of mechanism of failure of FPE two-pole Stab-Lok® breakers.)

4. "Phase II Report, Evaluation of Residential Molded Case Circuit Breakers", Wright-Malta Corp., (by J. Aronstein, for U.S. Consumer product Safety Commission, Project #CPSC-C-81-1455), March 10, 1984 (Analysis of materials, construction, and performance of molded case circuit breakers, including FPE.)

5. Reliance Electric Company press release re: FPE Breakers, July 5, 1980

6. "Exxon Buys a Scandal Along With A Company", Business Week, July 21, 1980, p. 66 (copy attached)

7. http://www.inspect-ny.com/fpe/fpepanel.htm

8. EMail to D. Friedman (manager of site of Reference 7)

9. CPSC press release, March 3, 1983

10. "Federal Pacific Electric Co. Stab-Lok® Update", IAEI News, May/June 1999 p. 16

11. Paritial Summary Judgement decision dated 8/15/02 by Judge Bryan D. Garruto, J.S.C., Superior Court of New Jersey, Law Division: Middlesex County, Docket No. L-2904-97

12. U.S. Consumer Product Safety Commission Press Release # 83-008, March 3, 1983, Revised February 18, 2011, http://www.cpsc.gov/CPSCPUB/PREREL/prhtml83/83008.html

13. J.Aronstein and R. Lowry, "Estimating Fire Losses Associated With Circuit Breaker Malfunction", IEEE Transactions on Industry Applications, Vol. 48, No.1, Jan/Feb 2012, p. 45 *(Note: The FPE Stab-Lok® breakers are identified as "Brand X" in this paper due to IEEE editorial rules regarding use of brand names.)*

14. Note “C” in Reliance Electric's Quarterly SEC Filing, March 31, 1982

66 BUSINESS WEEK: July 21, 1980

Exxon buys a scandal along with a company

Exxon Corp.'s $1.2 billion purchase of Cleveland's Reliance Electric Co. last year was designed to give Exxon a base for developing a new energy-saving technology to improve the efficiency of electric motors. What the purchase seems to have bought as well, however, is custody over a burgeoning scandal that involves the charge that defective electrical equipment may have been installed in perhaps 10% of all homes built or renovated over the past decade or more.

The charge, startlingly enough, is being made by Reliance itself. In a little-noticed suit filed in U. S. District Court in Cleveland on June 26, the company accused its own subsidiary, Federal Pacific Electric Co., of having employed "materially deceptive and improper manufacturing, testing, and certification practices" in the production of one of the nation's most widely used lines of circuit breakers. The suit asked the court either to rescind Reliance's March, 1979, purchase of Federal Pacific from UV Industries Inc. or to order UV to repay the $345 million purchase price, plus damages.

A week later Reliance notified the Consumer Product Safety Commission (CPSC) that in-house testing of its Stab-Lok line of two-pole, 220-volt circuit breakers indicates that some are prone to failure after repeated use "at relatively low over-current conditions." Reliance says it has not yet determined whether there is a significant hazard in using the device, and there have been few public complaints against it. But the company has stopped shipment of the product and requested distributors to halt further sales until tests are completed. Other unspecified problems also have been identified on three-pole Stab-Lok and molded-case circuit breakers. Says Reliance President B. Charles Ames: "The circuit breaker business at Federal Pacific has virtually ground to a halt."

Who is responsible? That may be only the beginning. The items involved cost only $16.60 apiece. But if the CPSC determines that they should be recalled, the outlay could be enormous since it would require the services of professional electricians. The cost per house could be as much as $100, trade sources say.

The underlying question in the Cleveland case is who bears the responsibility for this substantial potential liability. The principal defendant is UV Industries, which, after its sale of Federal Pacific, profitably liquidated itself last year over the strong objections of its major stockholder, Sharon Steel Corp. Following the liquidation, Sharon, controlled by Miami financier Victor Posner, bought the remaining assets—and presumably the liabilities—of UV for $518 million in cash and debentures. Distribution of the proceeds was scheduled to take place on July 21, but Reliance is asking for the imposition of a "constructive trust" to prevent "dissipation" of UV's assets. Aside from Sharon's 22% interest in UV's liquidating trust, most of the company's shares are now in the hands of Wall Street arbitrageurs.

Procedural delays. UV Chairman Martin Horwitz strongly denies that he knew anything about Federal Pacific's alleged problems and says the case will be contested. A hearing on a motion to dismiss or transfer the case to New York was set for July 11, probably only the first of a long series of procedural maneuvering.

The Reliance complaint is vague in its allegations of what went on at Federal Pacific. Reliance charges that the company's financial success "was due substantially, if not entirely, to a pattern of materially deceptive and improper practices in the manufacture, testing, and sale" of its circuit breakers. Specifically, the suit claims Federal Pacific used such practices to obtain certification for its equipment from Underwriters Laboratories (UL), whose label is usually required for a product to meet local electrical codes. The CPSC has not yet been told details of the alleged deceptive practices, but a commission staff engineer who once worked for UL suggests that the practices may have involved rigging equipment at Federal Pacific's own test facilities in a way that would mislead UL's on-site inspectors.

Exxon's new company is suing its own subsidiary for 'deceptive' practices

UL professes surprise at the charge that its inspectors were somehow duped, and its general counsel, David Hoffman, insists that "there is no evidence to support the conclusion that products out in the field pose a substantial hazard to the user." Hoffman further says that because relationships between UL and its client, Federal Pacific, are "proprietary," he cannot even publicly confirm Reliance's open statements that its subsidiary's circuit breaker products were delisted after failing various tests.

The delisting occurred after UL changed testing procedures for circuit breakers following CPSC concern that the product might pose fire hazards. The commission last year asked the National Bureau of Standards to design new test equipment to determine performance under actual conditions in the home. The Reliance case could thus turn into an inquiry affecting the entire $600 million circuit breaker industry.

It was apparently UL's action last fall in delisting nearly 400 circuit breaker labels that started the whole legal process. Reliance says it was originally told that such delisting was routine. But sales had slid so much by early May that it was obvious that the real problem was not the failure of circuit breakers to gain UL approval but "deception" in obtaining certification over a long period of years.

Reliance has suspended with pay Federal Pacific President Harry E. Knudson Jr. and four other key executives. "The men are long-term employees and their integrity is not being called into question," Reliance said in a statement distributed on July 1 to all Federal Pacific employees. Contacted at his home in Watchung, N. J., Knudson refused comment. ■

Cover Page & p. 5 of Reliance Electric Quarterly SEC Filing, Quarter Ending March 31, 1982

R 327600

ORIGINAL
N 69-257

FORM 10-Q

SECURITIES AND EXCHANGE COMMISSION
Washington, D.C. 20549

Quarterly Report Under Section 13 or 15(d)
of the Securities Exchange Act of 1934

For Quarter Ended: March 31, 1982 Commission File Number 1-5903

RELIANCE ELECTRIC COMPANY

Delaware	13-6095242
(State of Incorporation)	(IRS Employer Identification No.)

29325 Chagrin Boulevard
Cleveland, Ohio 44122
(Address of Principal Executive Offices)

Registrant's telephone number including area code: (216) 266-7000

THE REGISTRANT MEETS THE CONDITIONS SET FORTH IN GENERAL INSTRUCTIONS G(a) (1) and (2) of FORM 10-Q AND IS THEREFORE FILING THIS FORM WITH THE REDUCED DISCLOSURE FORMAT AS PERMITTED BY SAID GENERAL INSTRUCTIONS.

Indicated by check mark whether the registrant (1) has filed all reports required to be filed by Section 13 or 15(d) of the Securities Exchange Act of 1934 during the preceeding 12 months (or for such shorter period that the registrant was required to file such reports), and (2) has been subject to such filing requirements for the past 90 days.

Yes X No ____

Indicate the number of shares outstanding of each of the issuer's classes of common stock, as of the close of the period covered by the report.

Common Stock (without par value)	107 shares outstanding March 31, 1982

Cover Page & p. 5 of Reliance Electric Quarterly SEC Filing, Quarter Ending March 31, 1982

RELIANCE ELECTRIC COMPANY AND SUBSIDIARIES

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS

MARCH 31, 1982

Note A - Basis of Presentation

The accompanying unaudited consolidated condensed financial statements include all adjustments which in the opinion of management are necessary to a fair statement of the results of operations and changes in financial position for the interim periods presented. Such adjustments consist only of normal recurring accruals. Certain 1981 income and expense accounts have been reclassified to conform to December 31, 1981 reporting classifications. The results of operations for the three months ended March 31, 1982 and 1981, are not necessarily indicative of the results to be shown for the years ended December 31, 1982 and 1981.

Note B - Inventories

Components of inventory were as follows:

	As of March 31, 1982	As of December 31, 1981
Raw materials	$164,393	$192,732
Work in process	254,945	251,267
Finished goods	187,000	165,014
	$606,338	$609,013

Note C - Contingencies

Matters Regarding Federal Pacific Electric Company

Since the acquisition of Federal Pacific Electric Company ("Federal Pacific") from UV Industries, Inc. ("UV") in 1979, the Company has learned that the Underwriters Laboratories, Inc. ("UL") listings on circuit breakers made by Federal Pacific had previously been obtained through the use of deceptive and improper practices. Such improper test practices were terminated after the acquisition and, as a result, most of the circuit protective products manufactured by Federal Pacific, at some point thereafter, lost their UL listing. The Company is in the process of correcting product deficiencies in order to regain the lost listings and continues to submit such circuit protective products for UL listing. Sales of circuit protective systems amounted to approximately $100,000,000 in 1979. The Company has suspended the sale of certain models until the results of tests can be evaluated, and production and sale of certain other models have been suspended until such time as the UL listing for such models is regained. Circuit protective products bearing UL listings currently being manufactured by Federal Pacific meet the requirements of UL tests. In addition, tests conducted in-house by the Company indicated a possible defect in some of the past production of the Stab-Lok line of two-pole, 220 volt circuit breakers. The Company retained an independent testing laboratory to conduct additional tests to determine whether a significant hazard exists with regard to these devices. The Company also notified the Consumer Product Safety Commission ("CPSC") of its