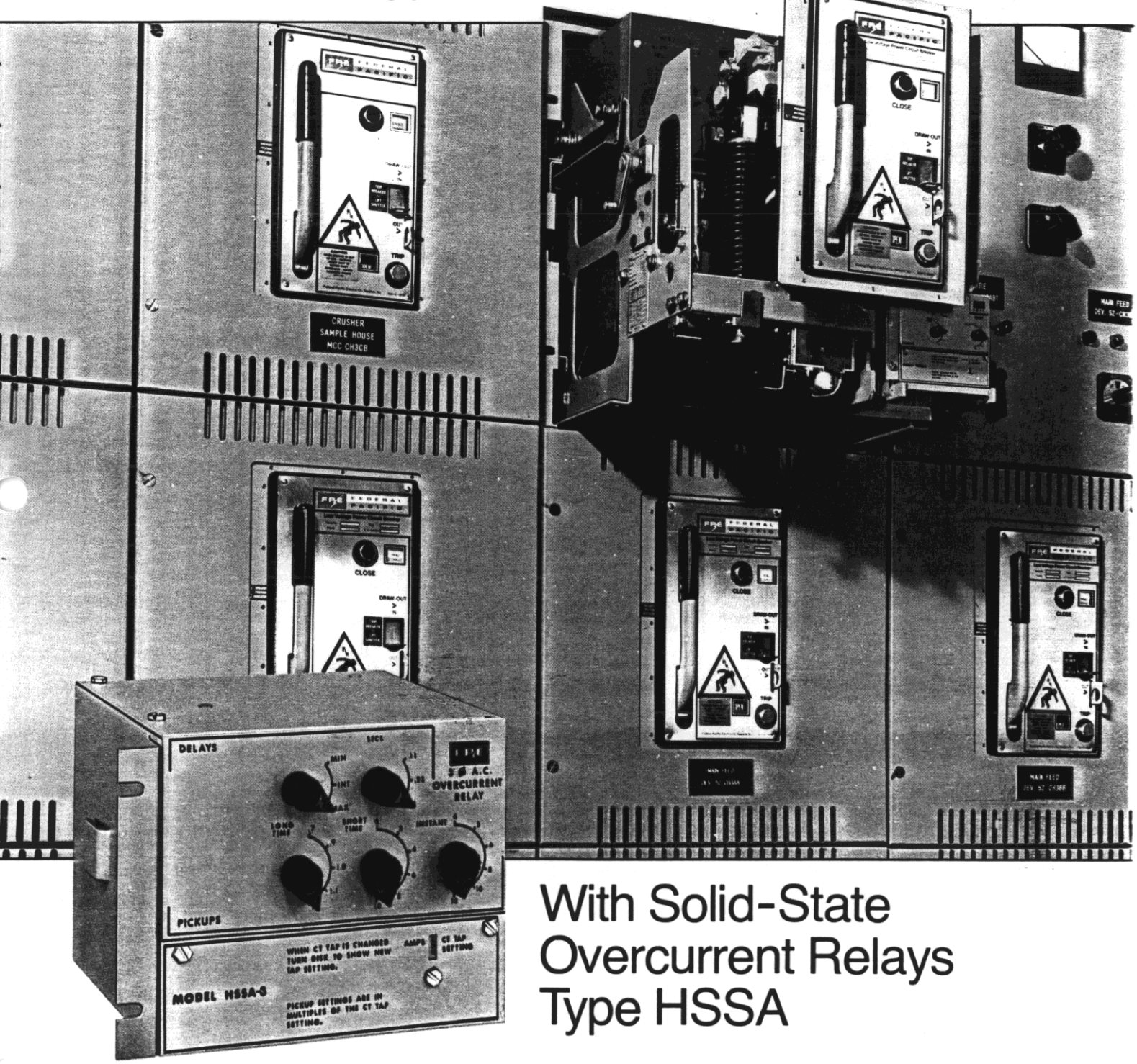
# Low-Voltage AC Power Circuit Breakers

## Type FPS4




## With Solid-State Overcurrent Relays Type HSSA

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# Features

- Advanced "Power-Grip" contact design.
- Energy conserving operating mechanism.
- Adjustable solid-state trip device.
- Integral ground fault protection available.
- Multi-range current sensors.
- Closed door three-position racking.
- Frame size — 800, 1600, 2000, and 3200 amperes.
- Current ratings — 70 to 3200 amperes.
- Voltage range — 240 to 600 volts.
- Standard accessories available, including integrally-mounted, current-limiting fuses that increase the interrupting rating of the unit to 200,000 amperes.

# General Description

The FPS4 breaker is designed to be reliable, simple to operate, and easy to maintain.

Technological advances incorporated in Federal Pacific's new FPS4 low-voltage circuit breakers include a unique "Power-Grip" contact design. Contact structures provide high-pressure, low-resistance, long-wearing characteristics ideally suited for power applications.

A proven type HSSA solid-state overcurrent trip device incorporated into each breaker can be furnished with integral ground fault protection. Adjustable pickup and sensor settings permit a wide range of breaker trip characteristics to meet load requirements.

Breaker frames are ruggedly designed to maintain proper contact and mechanism alignment during shipment, handling, and interruption of high fault currents with attendant strong electromagnetic forces.

The spring-driven, stored-energy mechanism furnished with all FPS4 breakers is mechanically trip-free in any position of the closing cycle.

Closed door racking of FPS4 drawout breakers protects the operator. The FPS4 drawout mechanism permits the operator to move the breaker to the "connected," "test," or "disconnected" position with the enclosure door closed. Breakers may be moved from "disconnect" position onto telescoping guide rails for removal from the cell only after drawout safety latches have been released.

# Operating Mechanism

Every FPS4 breaker has a spring driven, stored-energy mechanism which is mechanically trip-free in any position of the closing cycle. Energy is stored in the mechanism by charging the main closing spring through a pawl-driven ratchet wheel. Breakers are available for operation either manually or electrically.

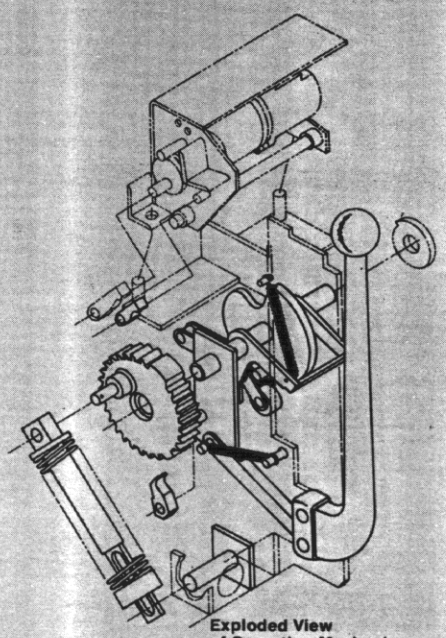
In the manually-operated breaker, the closing spring is charged by manual operation of the charging lever on the breaker faceplate.

In the electrically-operated FPS4, a fractional horsepower motor charges the stored-energy mechanism. This motor drive, with intergral gear box, is mounted on its own strong frame. This motor drive subassembly frame is mounted on spring-loaded supports on the main breaker frame. Electrically-operated breaker mechanisms can also be charged manually by operation of the charging lever on the breaker faceplate.

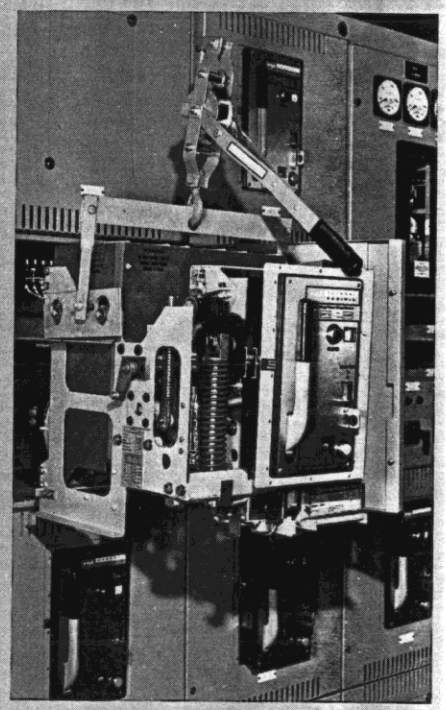
During breaker closing, energy is delivered to the ratchet wheel by the closing spring. Any residual energy in the ratchet wheel after the breaker contacts are closed is redelivered (flywheel effect) to the closing spring. This partially recharges the spring. Reabsorption of excess closing energy by the closing spring (maximum after a trip-free operation) reduces mechanical shock on the mechanism and conserves energy for use in subsequent closing operations.

To enhance trouble-free operation and long life, hardened stainless steel pins, operating in solid bronze bearings, are used throughout the mechanism linkage. High quality compression springs have been selected for the closing, opening, and contact pressure springs. Compression-type springs are used because of their proven reliability and freedom from fatigue failures.

The mechanism design permits slow-closing of the main contact system for maintenance and inspection purposes. Slow closing is achieved by means of a simple spring blocking arrangement and operation of the manual closing lever.

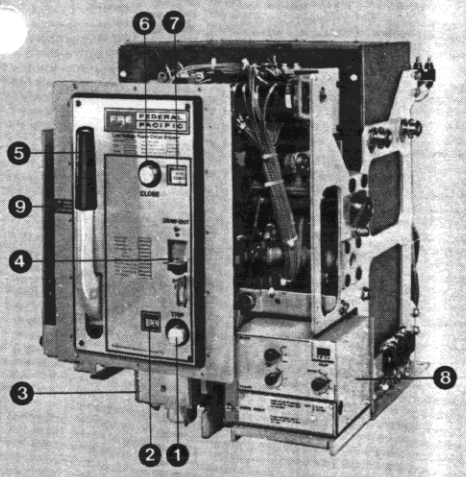


Exploded View of Operating Mechanism



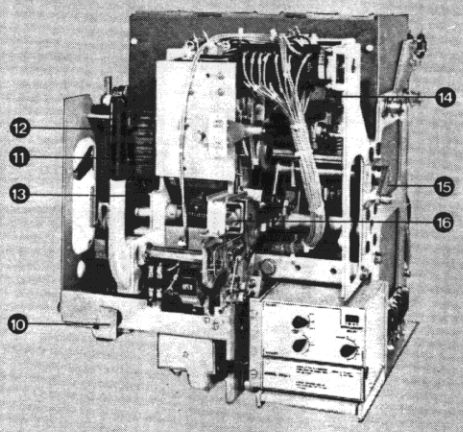
Operating Mechanism

# Breaker Assembly



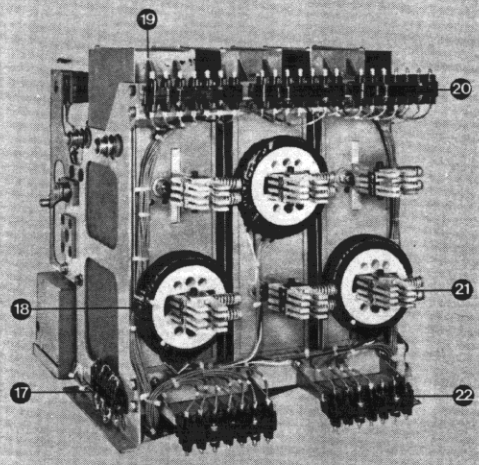

**FRONT VIEW OF FPS4-30-800**

1. Manual Trip Button
2. Open-Close Indicator
3. Flux Trip Device
4. Draw-out Shutter
5. Manual Charge and Slow Close Handle
6. Manual Close Button
7. Spring Charge Indicator
8. Overcurrent Relay
9. Breaker Position Indicator




**FRONT VIEW OF FPS4-30-800 WITH ESCUTCHEON REMOVED**

10. Slow Close Pin Interlock
11. Ratchet
12. Opening Spring
13. Closing Spring
14. Charging Motor
15. Racking Crank
16. Racking Screw

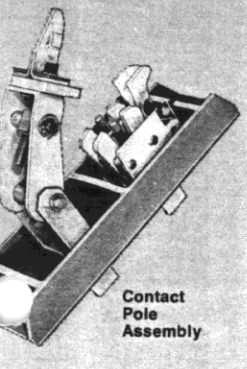



**REAR VIEW OF FPS4-30-800**

17. Terminal Board
18. Current Sensor
19. Arc Chute
20. Secondary Disconnects
21. Primary Disconnects
22. Additional Secondary Disconnects

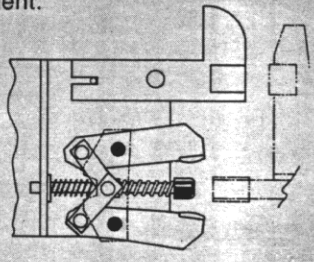
# Contact System

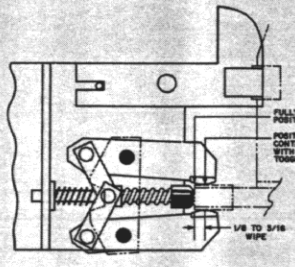
The contact system of the FPS4 circuit breaker consists of arcing contacts and unique "Power-Grip" main contacts. As the main contacts close, an insulated drive rod forces the stationary main contact jaws to "grip" mechanically against the sides of the movable main contact. The design also utilizes electromagnetic forces to create a "blow-on" effect and increase main contact pressure (grip) as current flow increases. This increases the contact structure's capability to carry high momentary currents. Sliding action between movable and main contacts during closing effectively maintains low contact resistance (without accelerating mechanical wear) and results in cooler contact operation. During interruption, the arc from the main contacts is transferred to the arcing contacts and transferred into the arc chutes, where it is quickly extended, deionized, and cooled. Interruption is fast and efficient.



Contact Pole Assembly

Contact Structure (Contacts Open)



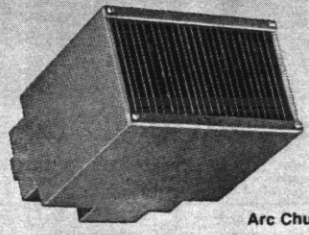



Contact Structure (Contacts Closed)

# Arc Chute

The arc chute consists of a molded housing of polyester-glass insulating material containing a number of V-notched steel plates. Sheets of hard fiber are bolted above the plates. During the opening cycle the current is transferred to the arc-chute path after the main contacts have parted. The steel plates draw the arc into the chute and interrupt it by their quick cooling deionizing action. The fiber plates help to diffuse the hot gases and prevent electrical breakdown over the top of the arc chute or to ground.

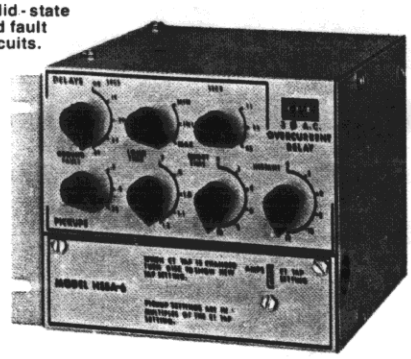
The arc chute fits well down over the arcing contacts so the arc is confined inside the chute for all values of current. Contact inspection is easily accomplished by simple removal of the arc chutes.



Arc Chute

# Solid-State Overcurrent Relay

Model HSSA-6 dual solid-state trip unit with ground fault 4-wire or 3-wire circuits.



## General Description

Federal Pacific type HSSA overcurrent trip devices are completely solid-state. Components such as semi-conductors, capacitors, and transformers are designed with conservative loading for long life.

Solid-state overcurrent trip devices operate to open the circuit breaker when the circuit current exceeds a preset value for a predetermined time. This operation is accomplished by providing an electrical signal that operates the breaker's flux-trip device. Depending upon the selected settings, tripping may be instantaneous or delayed. Energy to operate the tripping system is obtained solely from current sensors in the circuit being protected. Batteries or other power sources are not needed.

## Types of Trip Devices

Six types of solid-state trip devices are available. Similar in many respects, they differ only in functions provided. All devices use identical current sensor inputs and provide the output signal to the flux trip device. The functions performed by the various trip device models are shown in the following table.

| FUNCTION | MODEL | | | | | |
|---|---|---|---|---|---|---|
| | HSSA-1 | HSSA-2 | HSSA-3 | HSSA-4 | HSSA-5 | HSSA-6 |
| Long Delay | X | X | X | X | X | X |
| Short Delay | | X | X | | X | X |
| Instantaneous | X | | X | X | | X |
| Ground Fault | | | | X | X | X |

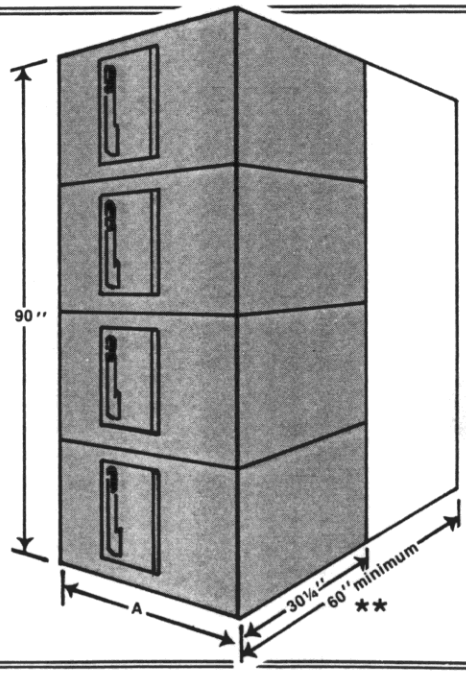
# Breaker Dimensions

The type FPS4 breaker is a compact device which permits stacking as many as four type FPS4-30, four type FPS4-50, or three type FPS4-75 breakers in a 90-inch-high column.

## Accessories

The following accessories are available with FPS4 breakers:

- Integrally-mounted, current-limiting fuses.
- Shunt trip device. • Bell alarm switch.
- Shunt close device. • Auxiliary switch.
- Undervoltage device.




| AIR CIRCUIT BREAKER — 3-POLE | | | |
|---|---|---|---|
| Type | Frame Size | Dim. A(in.) | Max. No. of Units/Section* |
| FPS4-30 | 800 | 21½ | 4 |
| FPS4-50 | 1600 | 21½ | 4 |
| FPS4-50 | 2000 | 21½ | 4 |
| FPS4-75 | 3200 | 27 | 3 |

*Per ANSI Std. C37.

**Basic unit. Individual user requirements may increase dimension shown.

# FPS4 Standard Breaker Ratings

| AC VOLTAGE RATING 60 HERTZ | BREAKER TYPE | MAXIMUM BREAKER RATING IN AMPERES | SHORT-CIRCUIT RATING (rms symmetrical amperes) | |
|---|---|---|---|---|
| | | | INSTANTANEOUS TRIP | SHORT-DELAY TRIP |
| 600V | FPS4-30 | 800A | 30,000 | 30,000 |
| | FPS4-50 | 1600A | 50,000 | 50,000 |
| | FPS4-50 | 2000A | 50,000 | 50,000 |
| | FPS4-75 | 3200A | 65,000 | 65,000 |
| 480V | FPS4-30 | 800A | 30,000 | 30,000 |
| | FPS4-50 | 1600A | 50,000 | 50,000 |
| | FPS4-50 | 2000A | 50,000 | 50,000 |
| | FPS4-75 | 3200A | 65,000 | 65,000 |
| 240V | FPS4-30 | 800A | 42,000 | 30,000 |
| | FPS4-50 | 1600A | 65,000 | 50,000 |
| | FPS4-50 | 2000A | 65,000 | 50,000 |
| | FPS4-75 | 3200A | 85,000 | 65,000 |


FEDERAL PACIFIC
RELIANCE ELECTRIC
Executive Offices: 150 Avenue L,
Newark, N.J. 07101 ■ (201) 589-7500