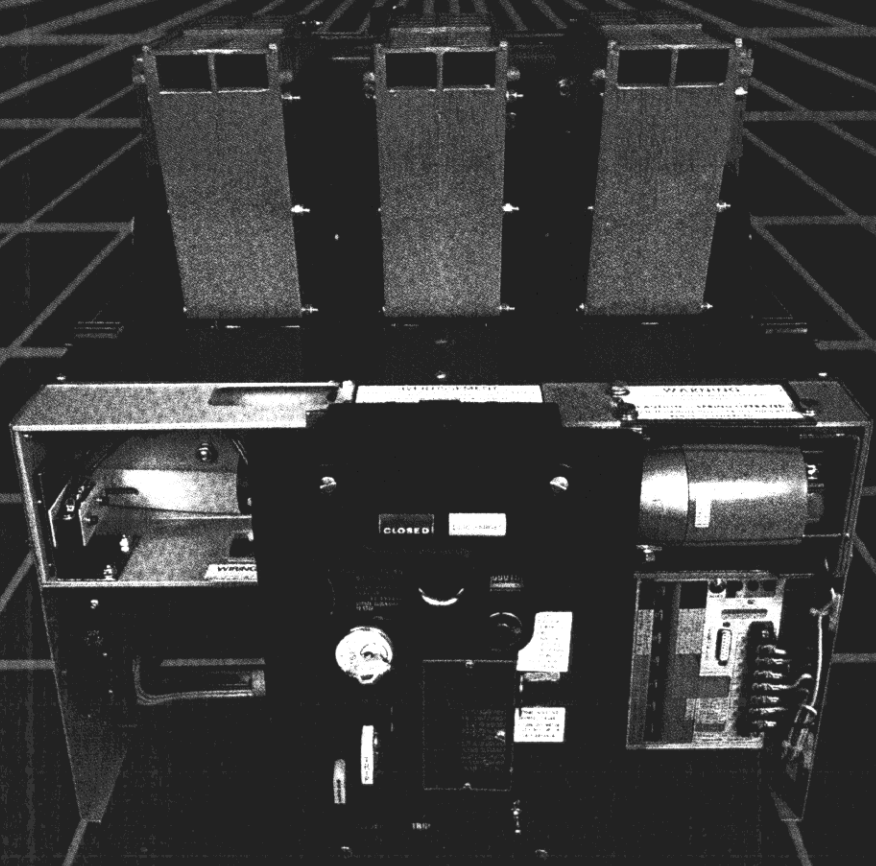
C-3-222
December 1986

TYPE H-3, HL-3 LOW VOLTAGE POWER AIR CIRCUIT BREAKERS



FPL FEDERAL PIONEER

Federal Pioneer Limited

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DETAILED CONSTRUCTION

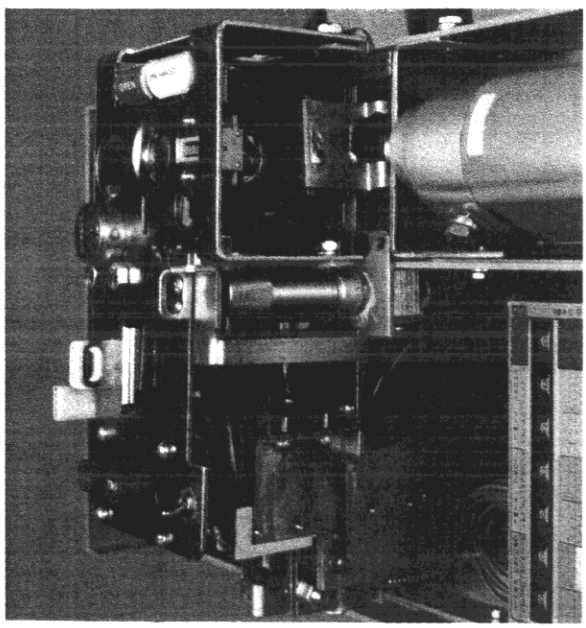
SUPPORTING FRAME

The type H-3 and HL-3 breakers are assembled on a moulded base of high strength polyester-glass compound using individual pole pieces carefully interlocked together and supported by a stainless steel frame. The use of stainless steel prevents magnetic heating. The mouldings are deeply ribbed to provide large creepage distances between adjacent current carrying parts. These ribs also serve as stiffeners to resist bending and distortion under conditions of maximum stress.

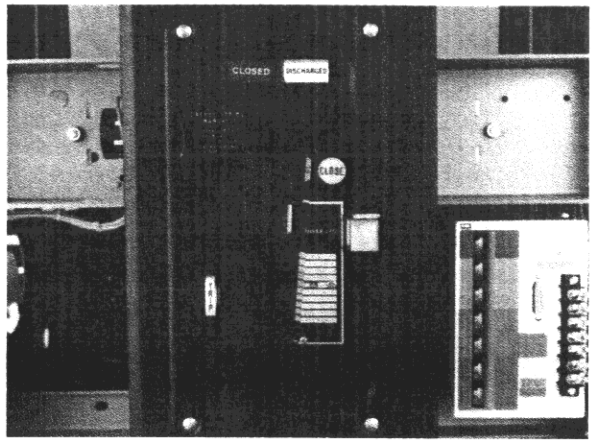
The circuit breaker frame is manufactured to close tolerances and jig-assembled to ensure accurate alignment of all parts. Close control is maintained over dimensional stability to ensure complete uniformity and interchangeability of finished breakers of each frame size.

OPERATING MECHANISM

Two types of operating mechanisms are available on the complete range of type H-3 and HL-3 circuit breakers; manual for local control and electrical for both local and remote operation. A high strength compression type closing spring is employed in all operating mechanisms to give positive control of closing speed and force, independent of the operator.



Electric motor charged operating mechanism (faceplate box removed)

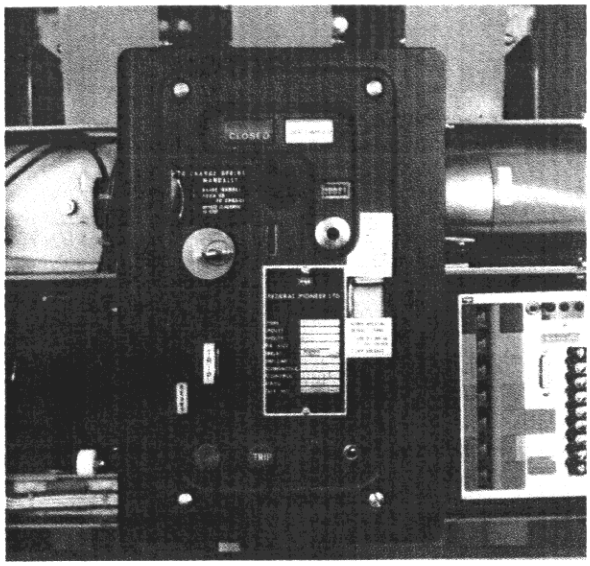


Manually operated H-3 breaker

Manual Operation

For manual operation the charging handle, located centrally on the breaker faceplate, is first rotated counter-clockwise and then pressed in to engage a clutch mechanism. Rotating the handle clockwise approximately 180° will fully charge the closing spring. A positive ratchet wheel mechanism allows a pause anywhere during the charging stroke without handle fly-back. The breaker can then be closed by pressing a direct acting manual close button on the breaker faceplate. The closing spring can also be charged manually when the breaker is open and left in the charged position, to be released from a remote position.

The manually operated mechanism includes provision for padlocking the handle. On frame sizes 1600 amperes and above, the handle has a pull-out extension for ease of operation.



Electrically operated H-3 breaker

Electrical Operation

For electrical operation a universal series-wound gear motor, suitable for operation on a.c. or d.c. current is provided. The motor is available in voltage ratings of 48, 120, 250V d.c. and 120, 240V a.c.

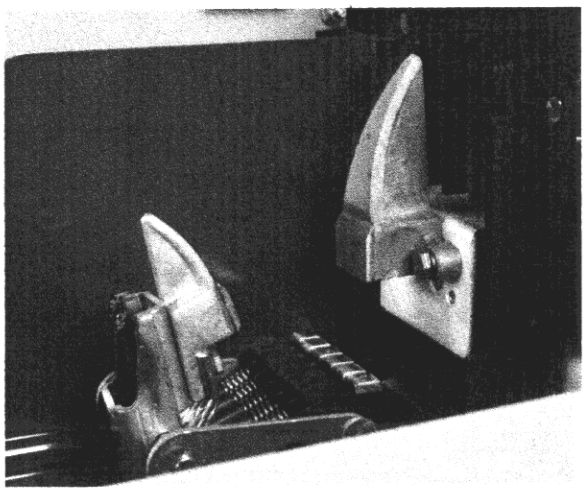
A toggle switch mounted on the faceplate permits the motor to be deenergized during maintenance or inspection. A spring limit switch stops the motor when the closing spring is fully charged. After the motor has charged the closing spring, the breaker can be closed remotely using a shunt close device.

The motor operates to charge the spring immediately after the breaker opens so it is ready to close as soon as the electrical close button is pressed. A latch check switch prevents any attempted electrical close until the trip shaft is completely reset in readiness to close. As an option, the motor may be connected to charge the spring, after the breaker closes to provide one immediate reclosure after opening. The electrically operated mechanism includes provision for a manual spring charging handle for emergency use. A shunt trip for remote tripping of the breaker is provided on all electrically operated breakers in addition to the dedicated tripping solenoid operated by the USD overcurrent relay.

An electrical trip button is provided on the faceplate and will operate in both "connected" and "test" positions. A manual trip button is also provided and operates in all breaker positions.

In addition to the electrical "close" and "trip" buttons one additional electrical button can be provided on the faceplate for special purpose controls such as electrical reset of lockout devices.

The faceplates of both operating mechanisms, include CLOSED-OPEN and CHARGED-DISCHARGED indicators and provision for key interlocks and/or operation counter.



H-3 breaker main and arcing contacts

MAIN CONTACTS

Type H-3 and HL-3 breakers have silver tungsten double-break bridge type main contacts, with wedge contact surfaces. The angular configuration minimizes the "blow-off" forces produced by short circuit currents.

Individual segments of the main moving contacts are fully insulated from each other and the carrying arm and are also self-aligning. Two compression springs per contact produce high contact pressures to ensure the breakdown of corrosive films and dirt. The design was optimized utilizing extensive computer studies, to control current flow through the segments while minimizing temperature rise.

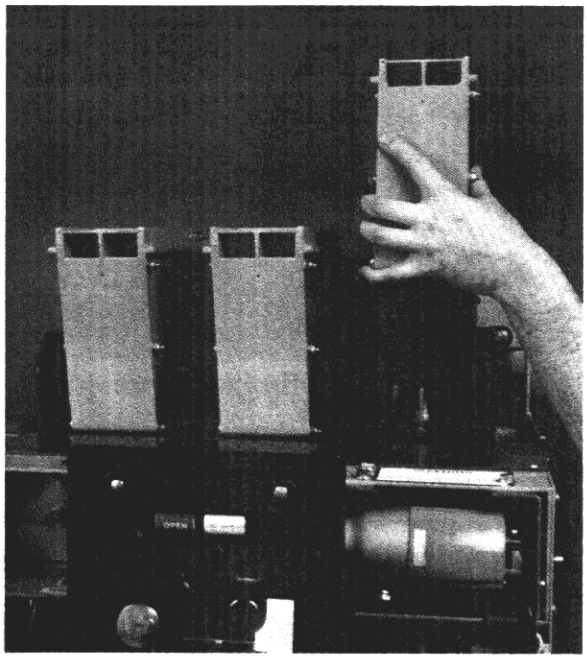
DETAILED CONSTRUCTION

ARC CONTROL

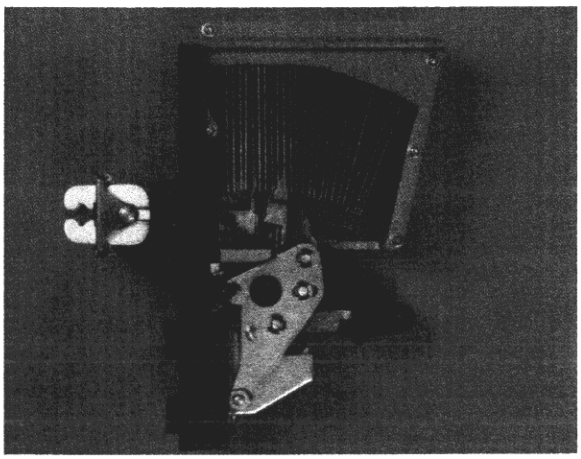
When the breaker opens under loads or short circuits, the main contacts part first and the double break contacts quickly establish a wide air gap. The current-flow is transferred to the arcing contacts, through a heavy copper braid. At no time are hinge pins relied on for carrying current in the Federal Pioneer H-3 and HL-3 breakers.

The arcing contacts part and an arc is established and the magnetic field produced forces the arc up into the arc chute. The arc chutes are made of fibre reinforced polyester and contain the steel arc chute plates and de-ionizing plates. The action of the arc-quenching and de-ionizing plates pulls the arc still further inside the arc chute, where it is cooled and broken into many small series arcs. The arc is thus extended, cooled and quickly extinguished, without arcing on the main contacts.

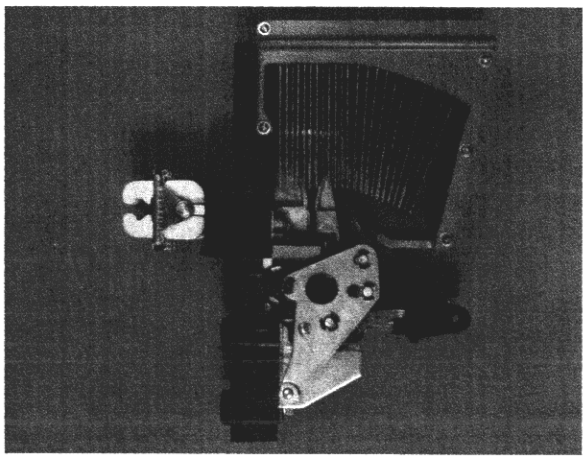
During interruption, the main contacts are further protected from the arcing by a shield located below the stationary arcing contact. An insulating barrier, fixed in the switchgear compartment above the arc chutes, completes the arc control system.



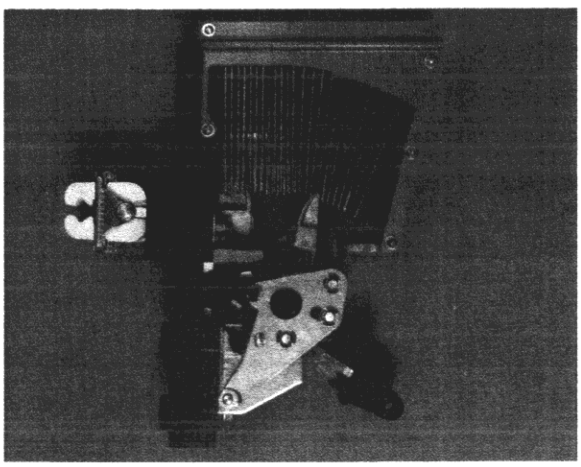
Arc chutes are easily removable for contact inspection



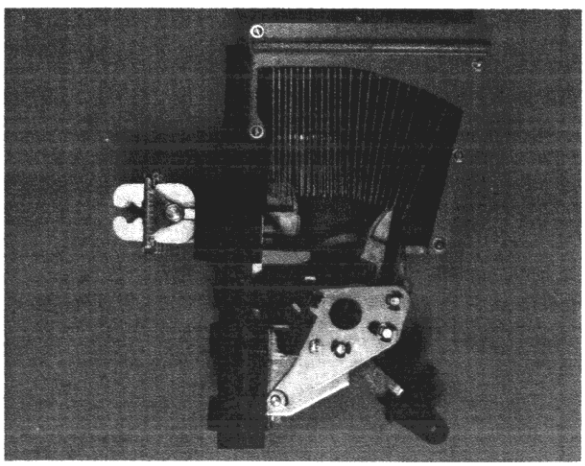
Contacts closed



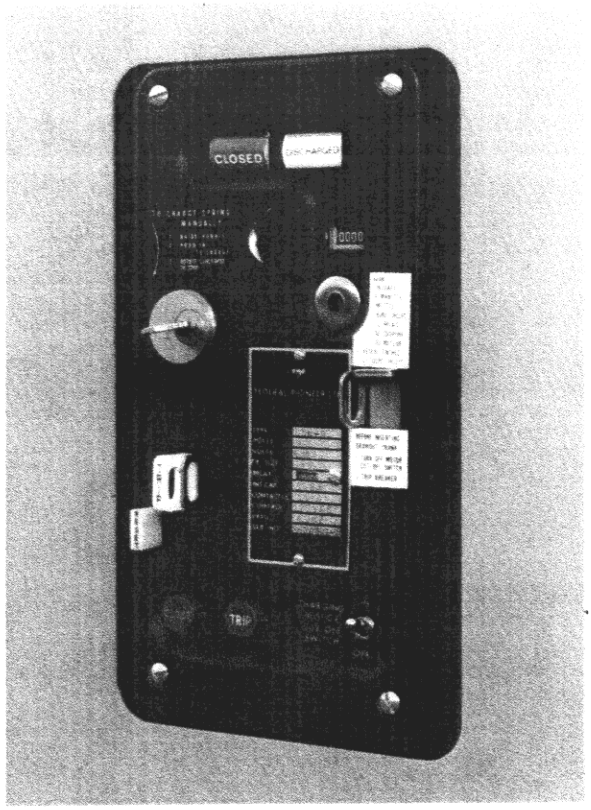
Main contacts parted



Arcing contacts parted

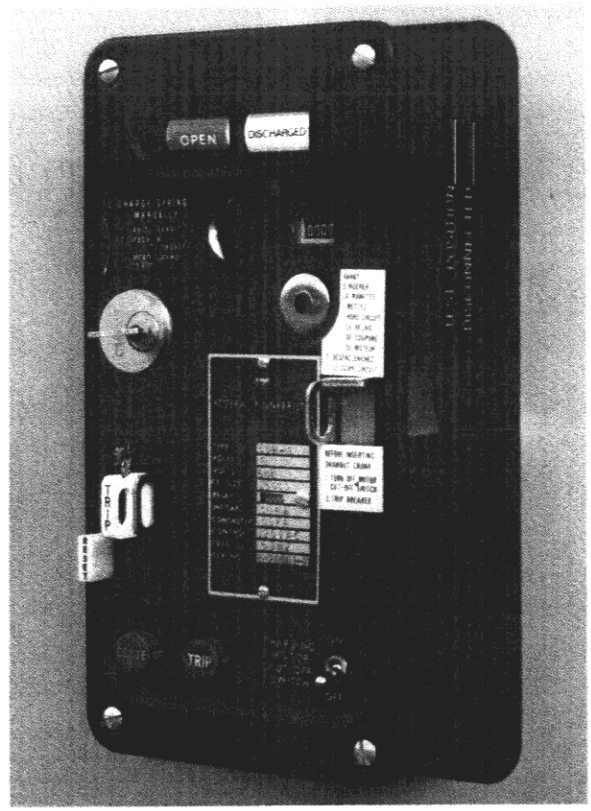


Arc extinguished



CONNECTED position

TEST position



DISCONNECTED position

DRAWOUT CONSTRUCTION

The drawout mechanism provides three positions for the breaker with the door closed.

CONNECTED — Primary and secondary contacts energized

TEST — Primary contacts isolated; secondary contacts energized

DISCONNECTED — Primary and secondary contacts isolated

A positive gear drive can be operated from the breaker faceplate even when the enclosure door is closed and operates a cam lever on each side of the draw-out cradle to move the breaker through its positions. Normally, the door can be opened with the breaker in any position. An optional door interlock can be provided to trip the breaker if the door is opened.

DETAILED CONSTRUCTION

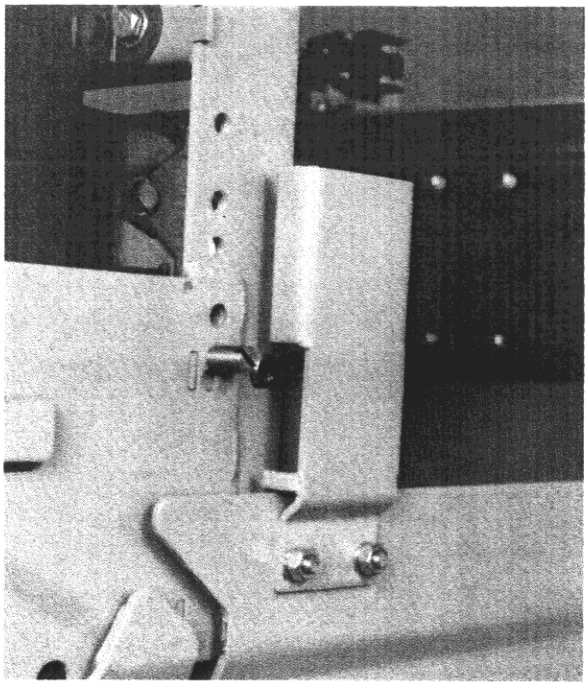
The breaker is guided accurately on grooved steel wheels fitted to the outside of the breaker frame. As the breaker is moved in from the "disconnected" position, the grounding contact is engaged first. This is a sturdy phosphor bronze to copper contact which ensures a positive ground connection to the breaker frame. The secondary or control contacts make next, as the breaker reaches the "test" position. Finally the main contacts are made as the breaker reaches the "connected" position. A positive stop on the mechansim ensures that the breaker is fully connected before it can be closed. Breaker position is also clearly shown by indicators on the side of the faceplate box.

Whenever the breaker is moved out the reverse sequence takes place. After the breaker reaches the "disconnected" position and the enclosure door is opened, rugged folding tracks can be pulled down to roll the breaker by hand fully clear of the enclosure, exposing all the plug-in contacts for examination. Safety shutters are available as an option to cover the main plug-in contacts of the enclosure.

Safety Interlock

The drawout mechanism is provided with a safety interlock as standard to ensure that the breaker is open and the closing spring is discharged before the breaker is either withdrawn from the cell or connected into the cell.

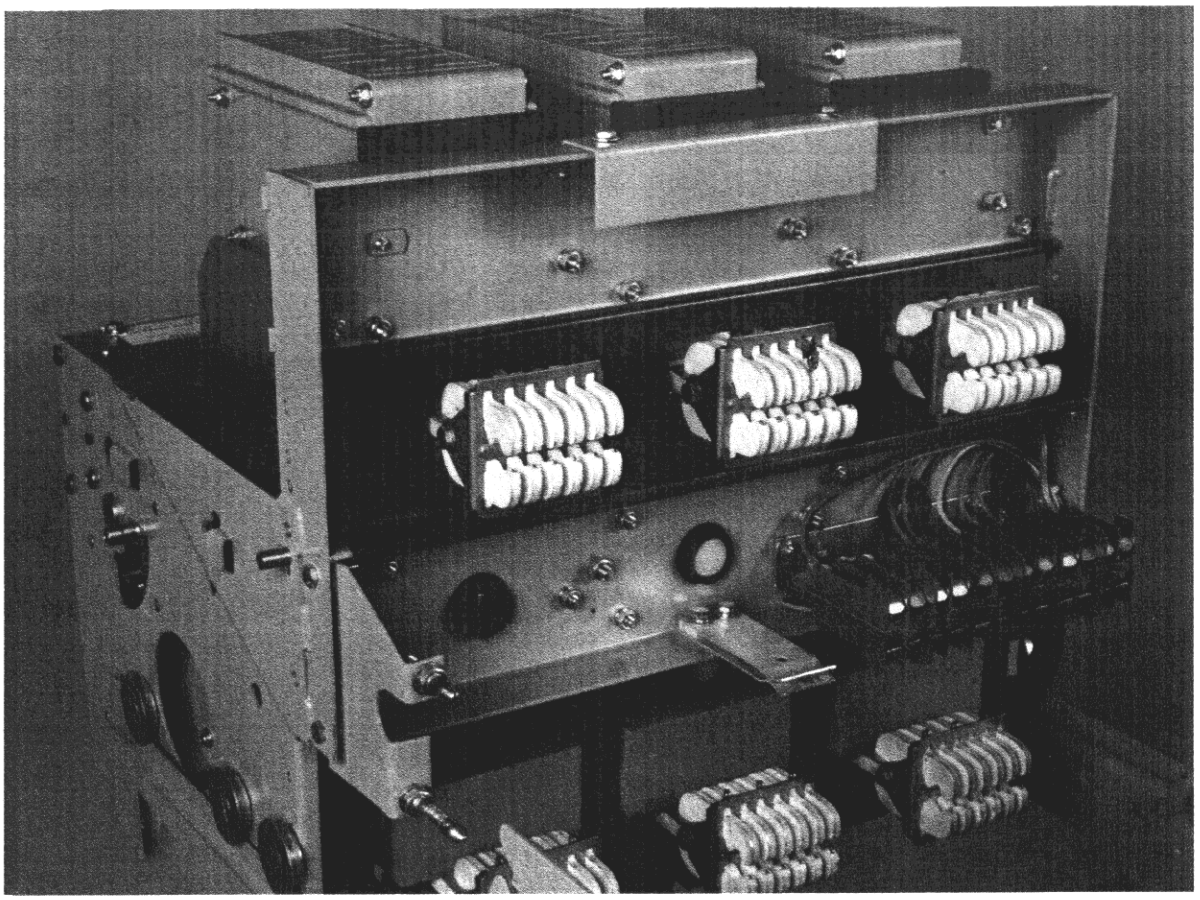
The drawout mechanism operating shaft is located behind a padlockable sliding gate interlock on the breaker faceplace. Lowering the gate to insert the drawout handle trips the air circuit breaker if it is closed, and then discharges the closing spring if it is charged. As long as the handle is inserted, the breaker cannot be closed.



Rejection Feature

Rejection Safety Feature

A rejection feature is standard on all frame sizes and prevents entry of a breaker into an enclosure intended for a different frame size. Pins on both sides of the breaker frame must match slots cut in brackets mounted on both sides of the cradle. If the cradle is a different frame size than the breaker, the breaker pins will not match the slots cut in the cradle brackets.



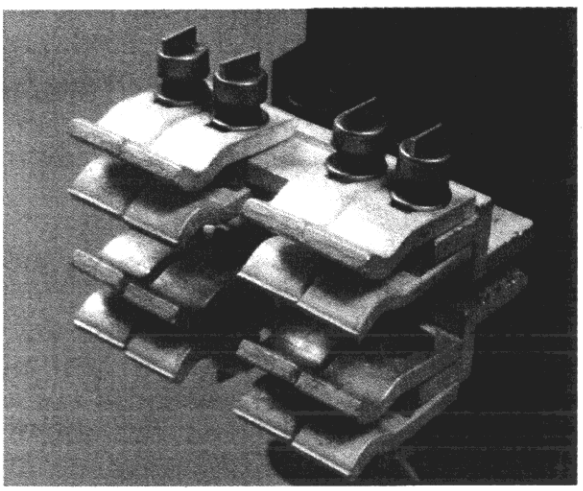
Main Drawout Contacts - 1600A H-3

Main Drawout Contacts

Main drawout contacts utilize electro-magnetic force to create a "blow-on" effect to increase contact pressure as current flow increases. This high pressure gripping action, along with a wiping-action as contacts are first engaged, maintains low contact resistance and operating temperatures.

These contacts are pre-loaded with individual springs for each pair of contacts to provide a reliable self-aligning connection. The 600 and 800 ampere breaker contacts utilize 4 pairs of segments, each 1/8" (3.18mm) thick. The 1600 ampere breaker contacts use 6 pairs of segments, each 1/4" (6.35 mm) thick. The 3000 and 3200 ampere breaker use two sets of 1600 ampere contacts.

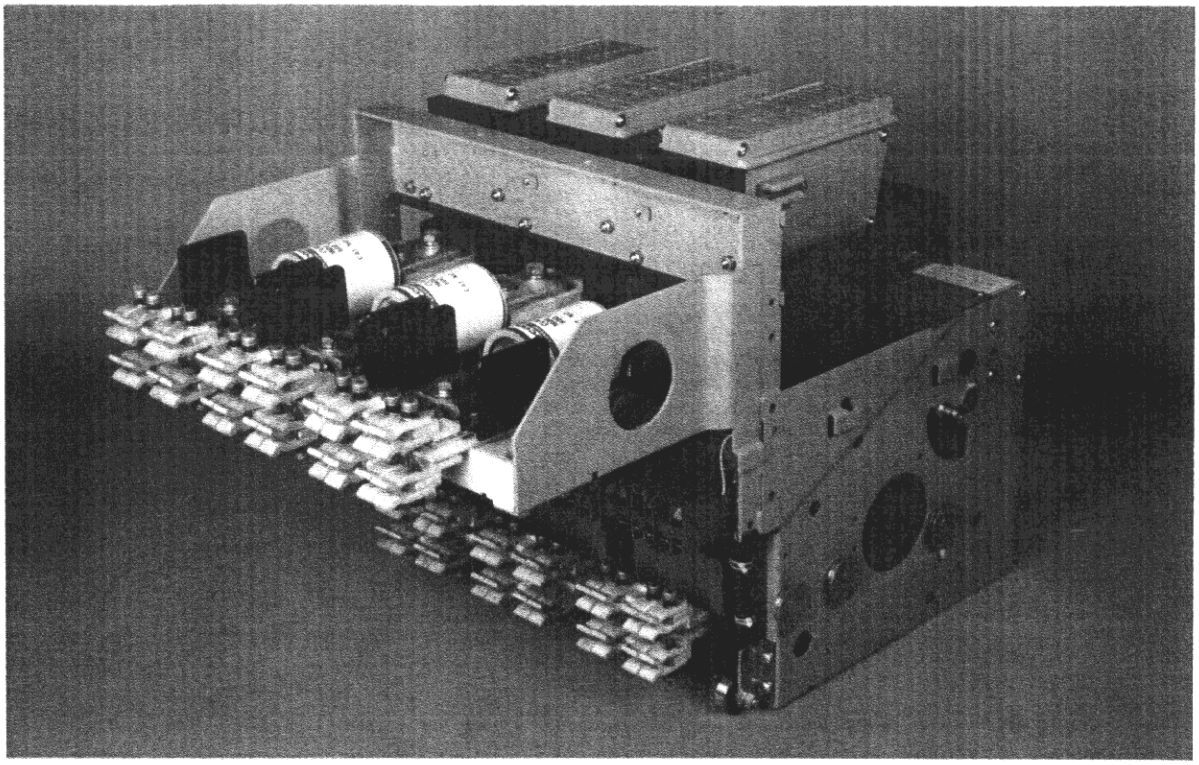
The 2000 and 4000 ampere breakers utilize rows of contact segments designed to give "line-contact" for maximum conductivity in minimum space; individual springs are again used. Two rows of these contacts are used on the 2000 ampere breaker, and four such rows arranged in a compact box are used on the 4000 ampere breaker.



Main Drawout Contacts - 2000A H3

All main drawout contacts are silver plated for maximum efficiency and low temperature rise as a standard feature.

TYPE HL-3 FUSED AIR CIRCUIT BREAKERS



Type HL-3 Fused Air Circuit Breaker

The use of HRC fuses increases the interrupting capacity of the fused breaker to 200,000 amperes. The air circuit breaker alone retains the interrupting rating for its frame size, which ranges from 30,000 amperes symmetrical at 600 volts with a 600 ampere frame size, to 85,000 amperes symmetrical at 600 volts with a 4000 ampere frame size.

Overcurrent Protection

When a short circuit occurs the magnitude of the current and the co-ordination between the fuse and the breaker overcurrent relay will determine whether the breaker or the fuse will clear the fault. Co-ordination must be such that the breaker will not attempt to clear faults beyond its ratings. As breaker contacts must withstand the peak let-through of the fuse there is a maximum size fuse which can be supplied with each breaker frame size. Co-ordination between the breaker relay and the fuse is such that the breaker will operate to clear overloads and faults up to its interrupting rating and the fuse will clear faults above the breaker rating.

HRC Fuse Protection

Fault current damage is a result of the excessive heat energy released and the mechanical distortion produced by magnetic forces. Both these destructive elements are proportional to the square of the short circuit current. The heat energy is also directly proportional to the time that the short circuit current flows. Since HRC fuses have the precise qualities of limiting both the current and the time through which it acts, fault damage can be considerably reduced. HRC fuses operate silently and safely without expelling any ionized gas.

Selection of Ratings & Co-ordination

The frame size and trip ratings for fused breakers are selected in the same manner as for a conventional air circuit breaker. To achieve the best protection from the HRC fuse, the smallest rating which can co-ordinate with the relay should be chosen.

Where fused breakers are used in series, co-ordination between the fuses must also be considered. With reference to the I^2t curves for the fuses in question, one must ensure that the total clearing I^2t of the load side fuse does not exceed the melting I^2t of the supply side fuse.

Where the HRC fuse must protect equipment by virtue of its current limiting abilities, the maximum peak withstand current for the equipment to be protected must be determined. For the circuit breaker, the maximum peak withstand current is 2.3 times the symmetrical short-circuit rating. At the available short circuit current in RMS symmetrical amperes, the peak let-through current of the fuse selected should not exceed the maximum peak withstand current for the equipment to be protected.

For further information on breaker-fuse co-ordination contact Federal Pioneer.

Fuse Truck

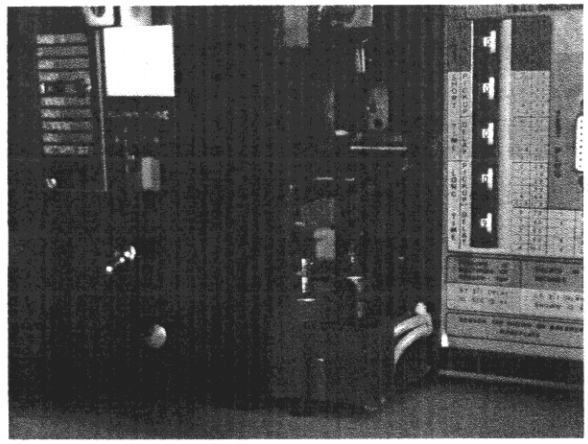
In ratings of 2000, 3000 and 4000 amperes, a separate fuse truck is available to be used in conjunction with an H-3 breaker. Key interlocking is provided to ensure that the circuit breaker is open before the fuse unit is withdrawn. The fuse unit is equipped with a rejection feature which prevents entry of the fuse unit into the breaker cell.

TYPE HL-3 FUSED AIR CIRCUIT BREAKER

The type HL-3 circuit breaker is available in 600 to 4000 amperes frame sizes. The HL-3 breaker is similar to a drawout Type H-3 with the addition of a provision for mounting NEMA HRC fuses. Optional accessories available for the H-3 breaker are also available for the fused breaker. These fuses are mounted on the line side on a frame extension at the rear of the breaker and are accessible for replacement when the breaker is fully withdrawn.

The following maximum fuse sizes may be used:

HL-3 FRAME RATING (AMPERES)	RELAY RATING (AMPERES)	MAXIMUM FUSE RATING (AMPERES)
600	600	1600 NEMA L
800	800	1600 NEMA L
1600	1600	3000 NEMA L
2000	2000	3000 NEMA L
3000	3000	4000 NEMA L
4000	4000	5000 NEMA L



Single Phase Protection and Blown Fuse Indicator

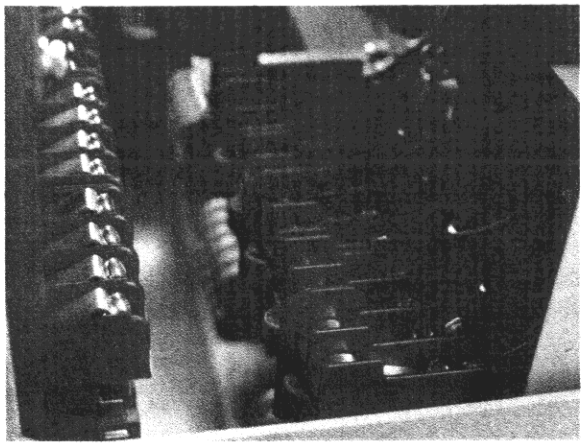
Single Phase Protection

Protection against single phasing cause by breaker fuse interruption is a standard feature on Type HL-3 fused air circuit breakers. Three solenoid coils (one per phase) are connected in parallel with the HRC fuses. They are provided with plungers which act directly on the common trip shaft. The coils are rated so that should a fuse blow on short circuit, the coil will provide sufficient power to trip the breaker, even though the line voltage may be reduced.

Blown Fuse Indicator

An indicator is provided which is actuated by the single phase protection coils. Should one fuse blow, the corresponding coil will trip the breaker and project an indicating bar through the faceplate. The three indicators are coloured red, yellow and blue and correspond to left, centre and right side fuses. When the fuse has been replaced the linkage can be reset by pushing in the indicator. The breaker can then be reclosed.

ACCESSORIES FOR H-3 AND HL-3 CIRCUIT BREAKERS

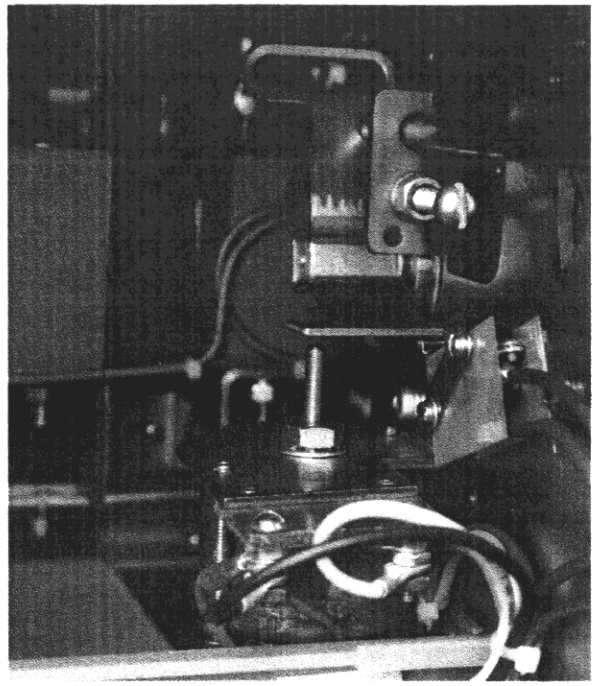


Secondary Control Contacts

Secondary Control Contacts
Secondary control contacts are provided on drawout units to automatically connect or disconnect control circuits, as the circuit breaker moves through its positions in the cradle. The contacts are designed so that the control circuit can be energized or isolated in the test position. These connections can be altered in the field, when required, by means of jumpers between contacts of the stationary block.

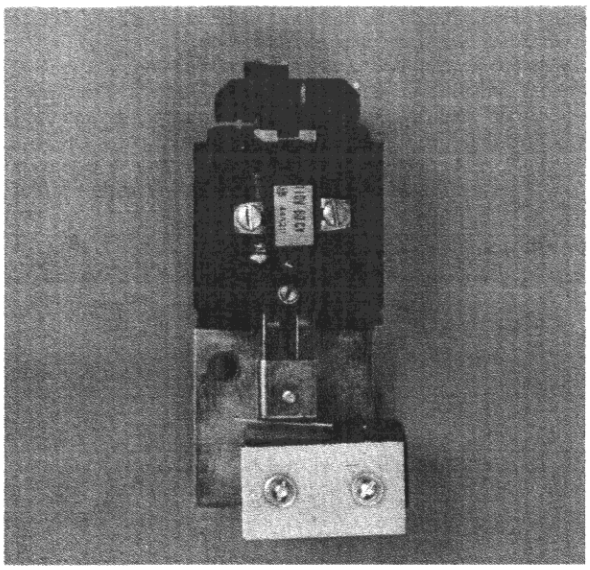
Supplied in multiples of 8 contacts, a total of 48 can be provided, and each contact has a continuous current rating of 30 amperes. In applications where a control supply voltage in excess of 250 V is to be used, the higher voltage contacts are double spaced (i.e. the adjoining contact is unused).

Contacts are formed copper, cadmium plated and mounted in a polycarbonate moulding. The moulding is designed with high barriers between contacts to provide large creepage distances. The movable secondary contact block fitted to the breaker assembly is spring mounted to ensure alignment with the stationary contacts.



Shunt Trip

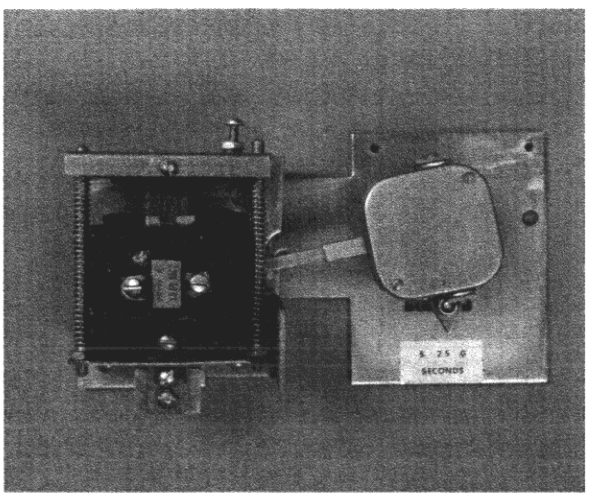
Shunt Trip
The shunt trip is a solenoid device separate from the dedicated solenoid used with the USD relay. When energized it acts directly on the breaker trip shaft to trip the breaker. Coils are interchangeable with all standard control ratings available. (See rating data). A shunt trip is supplied as standard on electrically operated breakers and is available as an option on manually operated breakers.



Shunt Close

Shunt Close

The shunt close device is used to release the energy stored in the closing spring to close the breaker from a remote position. It is standard on electrically operated breakers and is available as an option on manually operated breakers.



Undervoltage Trip with Time Delay Attachment

Undervoltage Trip

The undervoltage trip provides protection on loss of system voltage or low system voltage. It is an a.c. solenoid holding two compressed springs which will trip the breaker mechanically when the supply voltage falls too far below normal. (See rating data). Tripping action may be instantaneous or delayed up to 5 seconds when the adjustable time-delay attachment is specified.

The device is energized directly, or from a control transformer, and is connected across two phases.

If voltage is available on the line side terminals, the coil is energized and will compress the springs. The breaker may then be closed in the normal manner. In operation, the coil drops-out at 35% of rated voltage for 120V a.c. and 46% of rated voltage for 240V a.c. Both pull in at 80% rated voltage.

Overload Lockout Device

The overload lockout device prevents reclosing of the breaker either manually or electrically after the breaker has been tripped by the overload relay, until this device is manually reset.

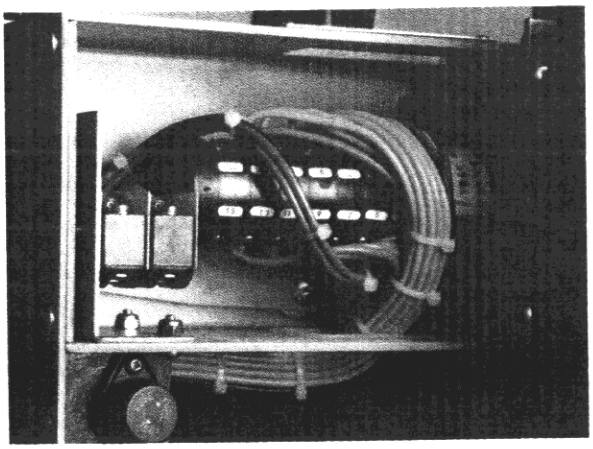
The direct acting shunt trip solenoid plunger mechanically holds the closing mechanism in the trip-free position, preventing closing of the main contacts. The latch check switch wired in series with the closing coil is open in this position, to block electrical operation of the closing coil.

The device is reset by pushing the manual overload lockout reset button on the breaker faceplate. This reset button is spring returned to its normal position.

Alarm Contacts

A Single Pole Double Throw contact is supplied and operated in conjunction with the overload lockout device. Contact is reset with the overload lockout device. Where overload lockout is not required a momentary overload alarm contact can be supplied to operate a remote flag relay.

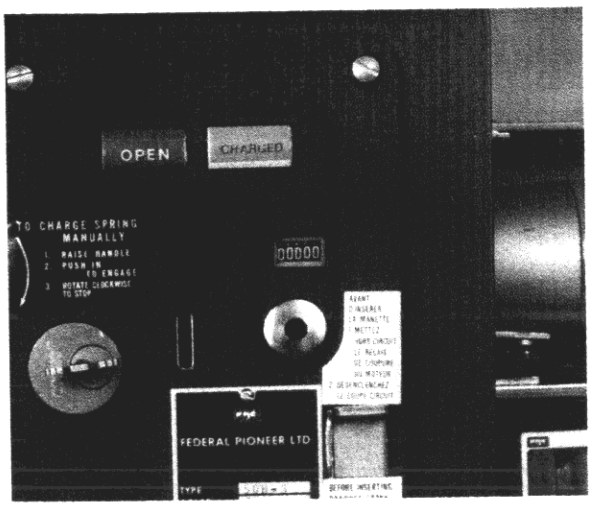
ACCESSORIES FOR H-3 AND HL-3 CIRCUIT BREAKERS



Auxiliary Switch

Auxiliary Switch

All H-3 and HL-3 units use a multi-section rotary switch coupled directly to the closing shaft, operated on a snap action principle which provides quick break switching. Switches with up to 20 poles are available.



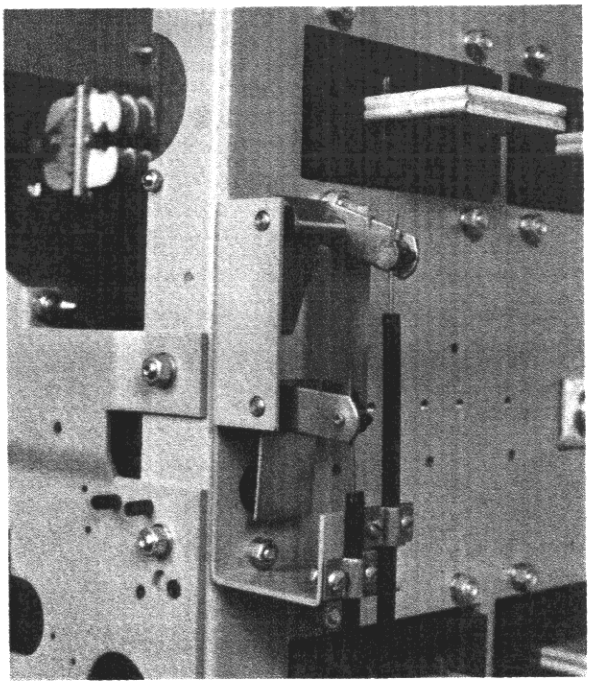
Operations Counter

Operations Counter

A five digit mechanical counter can be supplied, mounted in the faceplate of the breaker.

This device is mechanically driven by the "CHARGED-DISCHARGED" indicator, and operates once for each charging of the breaker closing spring.

Operations counters are recommended where breakers will be subjected to frequent operations as an indicator of the recommended maintenance intervals.

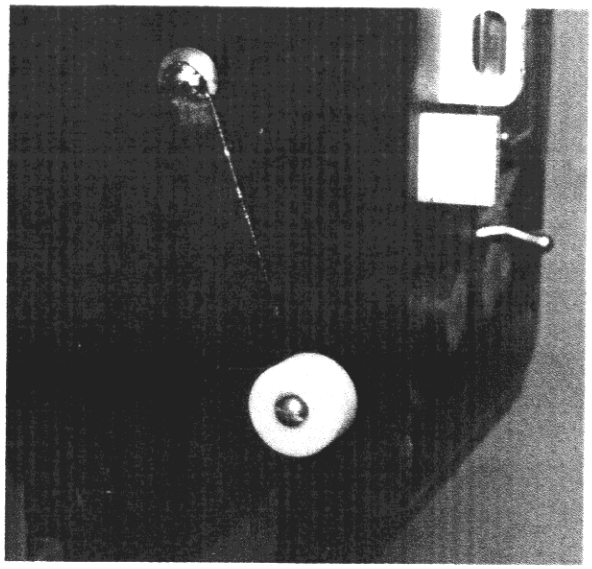


Mechanical Interlock

Mechanical Interlock

Mechanical interlocks are available on all H-3 and HL-3 breakers. They are used to mechanically interlock breakers in a two or three breaker transfer scheme. In the case of a two breaker transfer scheme, mechanical interlocks ensure only one breaker is closed while the other is held in a trip-free position. Mechanical interlocks connect the closing shaft of one breaker to the trip shaft of a second breaker by means of a flexible cable and vice versa. In a three breaker transfer scheme mechanical interlocks ensure only two breakers are closed while the third is held in a trip-free position.

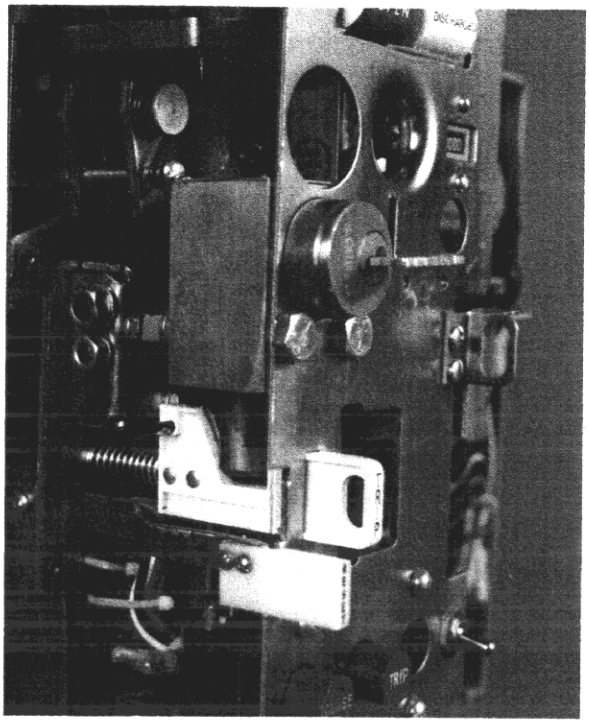
Drawout breakers are interlocked by cable connections between the cradles. There are no permanent connections between the breaker and matching cradle when interlocking is supplied, so the breaker can be freely withdrawn from the cell. Mechanical interlocks are operable only when the breaker is in the connected position. When withdrawn to the "test" position, breakers can be test operated in the normal manner.



Door Interlock

Door Interlock

All H-3 and HL-3 circuit breakers may be fitted with a device which acts to trip the unit when the cell door is opened. In operation, the door lever acts internally on the mechanical trip button causing it to move in towards the faceplate.

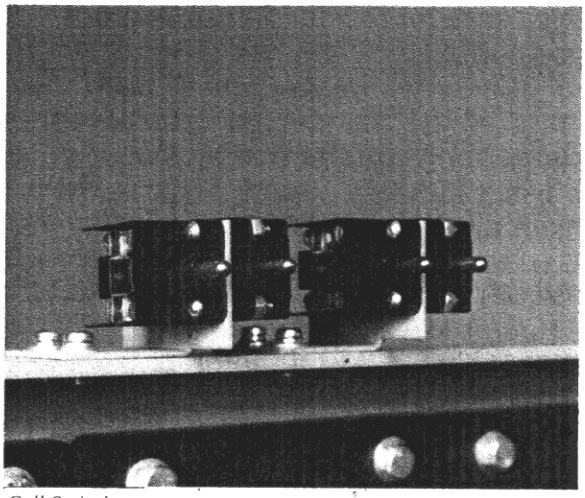


Key Interlock

Key Interlocks

Type VF key interlocks, single or double lock, with 3/8 inch (9.5mm) projection can be provided. Provision is made for key interlocks on all frame sizes.

With the key removed the closing mechanism is completely trip-free, preventing closing of the main contacts. On electrically operated units an auxiliary switch contact is provided to operate in conjunction with the interlock isolating the closing circuit.



Cell Switches

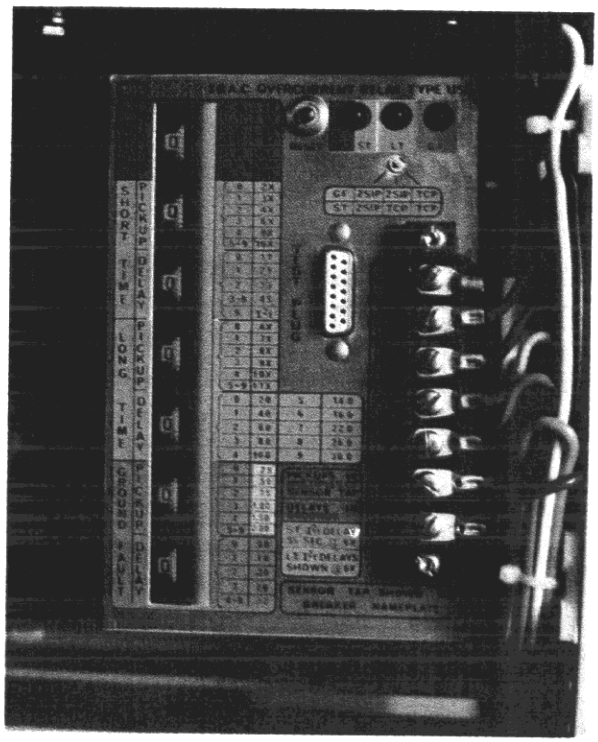
Cell Switches

Cell switches mounted in the cradle can be provided to serve as position indicators or as an electrical interlock bypass. The switches are operated when the breaker is removed from the "connected" position in the enclosure.

Each switch contains one normally closed and one normally open contact. A total of six switches can be supplied. These contacts are rated 10 amperes up to 300V a.c.

USD SOLID STATE OVERCURRENT RELAY

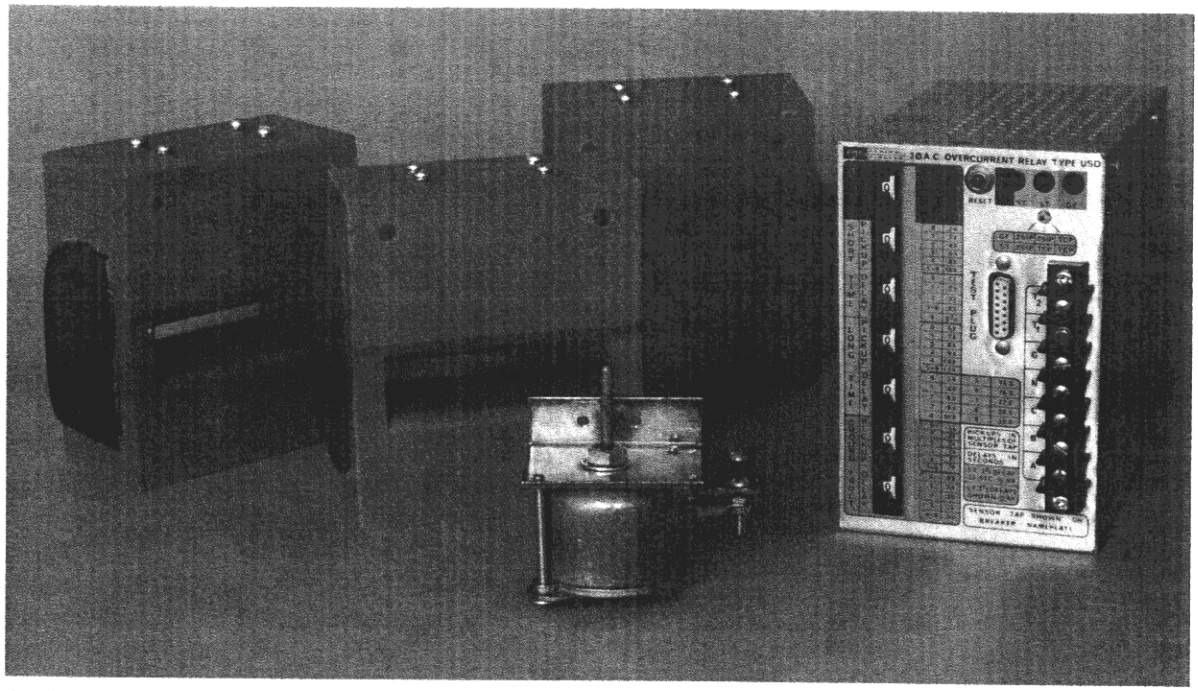
AVAILABLE FEATURES	BENEFIT
Long time, short time instantaneous and ground fault protective functions	Selective co-ordination for maximum service continuity
Pick up elements work independently	Relay reliability
ZSIP® on short time and ground fault	Selectivity with minimum system damage
Thumbwheel programming switches with positive detents and gold plated contacts. Factory calibrated discrete values for pick up and time delay.	Precision setting of protection function, without in service "drift".
Colour keyed faceplate	Ease of setting relay
Local and remote indication	Rapid fault location



USD Relay - A standard feature of H-3, HL-3 breakers

Type H-3 and HL-3 breakers are supplied with the Federal Pioneer Type USD Solid State Overcurrent Relay, as a standard feature. The USD relay protects low voltage power systems against damage caused by short circuits, overloads and ground faults. The relay may have up to four pick up elements: instantaneous, short-time, long time and ground fault, each working independently of the others for increased reliability. Local and remote indication are available. In addition ZSIP® (ZONE SELECTIVE INSTANTANEOUS PROTECTION) is available for the short-time and ground fault elements.

USD SOLID STATE OVERCURRENT RELAY



Carefully matched components of the USD trip system

The Type USD Relay is mounted low on the front of the breaker frame, away from the arc-chutes.

Tripping energy for the operation of the circuit breaker is obtained solely from the circuit being protected. Other power sources are only required for fault indication (if specified).

The USD relay complies with ANSI Standard C37.17 "Trip Devices for AC and General-Purpose DC Low-Voltage Power Circuit Breakers".

Three multiple-tap current sensors, mounted on the breaker provide power input to the USD relay from the protected circuit and current signals to the fault detection logic circuit. A fourth sensor, can also be ordered where four-wire ground fault protection is required. Sensors utilize high quality grain-oriented silicon steel alloy cores, and are encapsulated in POLESTIGLASS to provide moisture protection and mechanical strength. Sensor tap setting is shown on the breaker faceplate by an adjustable rotatable disc.

Solenoid Trip Device — A dedicated direct acting solenoid provides positive activation of the trip latch on the breaker, and positive resetting after operation, completes the trip system.

Pick up levels and time delay settings are factory programmed and calibrated in discrete settings for repetitive accuracy and precision. Gold plated contacts on the thumbwheel switches used for selecting settings, assure long lasting, positive electrical performance.

ZSIP®

Selectivity between main and feeder breakers is conventionally obtained by using time co-ordinated trip devices, with the device furthest downstream set for minimum time delay. The disadvantages of this method is that fault levels increase in zones closer to the main breaker and the time to clear these faults increases. The power system must withstand these high fault current levels until the time delay on the first device upstream of the fault expires.

With ZSIP® the trip device that senses a fault in its zone of protection trips instantaneously, minimizing system damage.

The USD relay also sends a restraint signal to all upstream devices and causes them to operate according to their time co-ordinated protection mode, increasing service continuity.

ZSIP® is available on the short time and ground fault elements of the USD relay.

LOCAL AND REMOTE INDICATION

Local indication is by long-life LED's on the relay faceplate while remote indication is facilitated through a set of dry contacts which can be connected to remote annunciating or alarm devices. 120 volt a.c. 2.5VA control power is required.

USD RELAY MODELS

CHARACTERISTICS		USD-3	USD-3IR	USD-6-*	USD6-IR-*
ELEMENTS*	LONG TIME	•	•	•	•
	SHORT TIME WITHOUT ZSIP®	•	•		
	SHORT TIME WITH ZSIP®			•	•
	INSTANTANEOUS	•	•	•	•
	GROUND FAULT WITH ZSIP®			•	•
LOCAL AND REMOTE INDICATION			•		•

*Add the following suffixes:

6 for use with CUD 1.5 and CSD-6 sensors

8 for use with CSD-8 sensors

16 for use with CSD-16 sensors

20 for use with CSD-20 sensor

32 for use with CUD-30 and CUD-32 sensor

40 for use with CUD-40 and CUD-60 sensors

TYPE H-3 BREAKER DATA

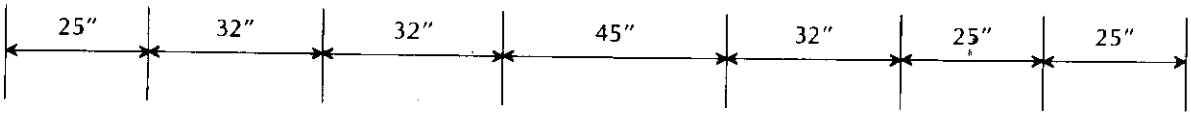
BREAKER TYPE		30H-3	42H-3	50H-3	65H-3	50H-3	75H-3	100H-3	100H-2
MINIMUM ENCLOSURE WIDTH (INCH)		25	25	25	32	32	32	32	45
VOLTAGE (VOLTS)	Voltage Ratings	600	600	600	600	600	600	600	600
	Rated Maximum Voltage	635	635	635	635	635	635	635	635
	1 minute withstand	2200	2200	2200	2200	2200	2200	2200	2200
CURRENT (AMPERES)	CONTINUOUS CURRENT	600/800	600/800	1600/2000	1600/2000	3000/3200	3000/3200	4000	6000
	INTERRUPTING CURRENT (RMS SYMMETRICAL) (1)								
	WITH INSTANTANEOUS TRIP								
	254 V	42,000	50,000	65,000	65,000	65,000	85,000	130,000	130,000
	508 V	30,000	42,000	50,000	65,000	50,000	85,000	85,000	85,000
	635 V	30,000	42,000	50,000	65,000	50,000	65,000	85,000	85,000
	WITH SHORT TIME DELAY (2)								
	254 V	30,000	42,000	50,000	65,000	50,000	65,000	85,000	85,000
	508 V	30,000	42,000	50,000	65,000	50,000	65,000	85,000	85,000
	635 V	30,000	42,000	50,000	65,000	50,000	65,000	85,000	85,000
	MAKING CURRENT (Peak amperes)	69,000	96,600	115,000	149,500	115,000	149,500	195,500	195,500
OPERATING TIMES (SECONDS)	-Closing (Contact Touch)	.025	.025	.025	.030	.030	.030	.030	.030
	-Closing (Breaker Latched)	.030	.030	.030	.035	.035	.035	.035	.035
	-Contact Parting	.004	.004	.004	.005	.005	.005	.005	.005
	-Arcing (Max.) (3)	.0085	.0085	.0085	.0085	.0085	.0085	.0085	.0085
	-Total Clearing incl. USD relay operation time	.034	.034	.034	.034	.034	.034	.034	.034
	-Reclosing Time (No Intentional Time Delay) (4)	.176	.176	.176	.176	.176	.176	.176	.176
	-Motor charging time	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
TEMPERATURE RISE ON TERMINALS (40°C AMBIENT)		— less than 55°C —							

(1) INTERRUPTING DUTY CYCLE consists of an opening operation, a 15 second interval, followed by a close-open operation, per ANSI Std. C37.50.
(2) SHORT-TIME DUTY CYCLE consists of 2 — 30 cycle intervals with a 15 second period of zero current between the two periods, per ANSI Std. C37.50.
(3) Maximum Arcing Time in critical current range (Range 175-400A) is .035 seconds.
(4) Operating factor for reclosing duty is 100%.

Suggested cell arrangements:

Based on nominal 90" high metal enclosed draw-out switchgear showing minimum cell size requirements.

30H3 800 42H3 800 50H3 1600 50H3 2000	65H3 1600 65H3 2000	50H3 3200 75H3 3200 100H3 4000				30HL-3 800
30H3 800 42H3 800 50H3 1600 50H3 2000	65H3 1600 65H3 2000	50H3 3200 75H3 3200 100H3 4000		75HL3 3000 100HL3 4000	50HL3-1600 50HL3 2000	30HL3-800
30H3 800 42H3 800 50H3 1600 50H3 2000	65H3 1600 65H3 2000	50H3 3200 75H3 3200 100H3 4000	100H2 6000	75HL3 3000 100HL3 4000	50HL3 1600 50HL3 2000	30HL3 800
30H3 800 42H3 800 50H3 1600 50H3 2000	65H3 1600 65H3 2000	50H3 3200 75H3 3200 100H3 4000		75HL3 3000 100HL3 4000	50HL3 1600 50HL3 2000	30HL3-800



Note actual member of units per vertical section will depend on total continuous current of breakers and other application variables. Consult manufacturer of switchgear.

TYPE HL-3 BREAKER DATA*

BREAKER TYPE	FRAME SIZE AMPS	INTERRUPTING RATING BREAKER C/W FUSE KA SYM.	INTERRUPTING RATING BREAKER ONLY KA SYM.			MAXIMUM FUSE SIZE AMPS
			240V	480V	600V	
30HL-3	600	200	42	30	30	1600 NEMA L
30HL-3	800	200	42	30	30	1600 NEMA L
50HL-3	1600	200	65	50	50	3000 NEMA L
50HL-3	2000	200	65	50	50	3000 NEMA L
75HL-3	3000	200	85	85	65	4000 NEMA L
100HL-3	4000	200	130	85	85	5000 NEMA L

*All data for HL-3 is same as corresponding size H-3 air circuit breaker, except for increased interrupting capacity.

SPRING CHARGING MOTOR DATA

NOMINAL VOLTAGE	48 VOLTS DC	125 VOLTS DC	250 VOLTS DC	120 VOLTS AC	240 VOLTS AC
CURRENT REQUIRED (INTERMITTENT)	7 amperes	4 amperes	2.5 amperes	4 amperes	2.5 amperes
MOTOR CHARGING TIME	4.0 sec.	4.0 sec.	4.0 sec.	4.0 sec.	4.0 sec.

AUXILIARY SWITCH CONTACT RATINGS

10 amperes up to 254V a.c.
1 ampere at 250V d.c.
2 amperes at 125V d.c.

SECONDARY CONTROL CONTACT RATING

30 amperes

CELL SWITCH CONTACT RATING

10 amperes up to 300V a.c.

TECHNICAL DATA SUMMARY

COIL RATING DATA

	RATED CONTROL VOLTAGE	MINIMUM OPERATING VOLTAGE	D.C. OHMS	AMPERES INRUSH	AMPERES SEALED
SHUNT	120 AC	75	30.0	2.45	0.34
TRIP	240 AC	150	312.0	1.5	0.15
TYPE A	48 DC	40	6.0	8.0	0.2
	125 DC	40	50.0	2.2	0.2
	250 DC	70	312.0	0.8	0.1
SHUNT	120 AC	60	13.0	1.4	
TRIP	240 AC	120	50.0	1.0	MOMENTARY
TYPE B	48 DC	40	13.0	2.0	RATED
	125 DC	40	86.0	2.5	ONLY
	250 DC	70	215.0	1.25	
SHUNT	120 AC	90	30.0	2.45	0.34
CLOSE	240 AC	180	312.0	1.5	0.15
	48 DC	40	6.0	8.0	0.2
	125 DC	60	50.0	2.2	0.2
	250 DC	150	312.0	0.8	0.1
UNDERVOLTAGE	120 AC	96	23.0	2.45	0.34
TRIP	240 AC	190	312.0	0.8	0.1
BLOWN-FUSE	240 AC	90	13.0	2.8	MOMENTARY
TRIP	480 AC	90	13.0	5.6	RATED
DEVICE	600 AC	90	13.0	7.0	ONLY

NOTES:

Type A shunt trip is continuously rated and is used only when a continuous rated coil for a separate trip source is required.

Type B shunt trip is momentary rated. It is used as the dedicated solenoid for the USD relay or earlier SD relay and/or when only a separate trip coil is required.

USD RELAY SETTINGS

ELEMENT	PICK UP LEVELS IN MULTIPLES OF SENSOR TAP	DELAY IN SECONDS
INSTANTANEOUS	4X, 5X, 6X, 8X, 10X, 12X, OFF (1)	NO INTENTIONAL TIME DELAY
SHORT TIME	2X, 3X, 4X, 6X, 8X, 10X	.11, .25, .33, .45, I^2t (2), .05 in ZSIP® mode regardless of short time delay setting.
LONG TIME	.6X, .7X, .8X, .9X, 1.0X, 1.1X	2.0, 4.0, 6.0, 8.0, 10.0, 14,0, 16.0, 22.0, 26.0, 30.0 (3)
GROUND FAULT		
Catalogue Numbers:		
USD-6 (IR) -6	.25, .50, .75, 1.0, 1.5, 2.0	.08, .14, .20, .26, .32, .02 in ZSIP® mode regardless of ground fault time delay setting.
USD-6 (IR) -8	.25, .50, .75, 1.0, 1.25, 1.5	
USD-6 (IR) -16	.20, .30, .40, .50, .60, .70	
USD-6 (IR) -20	.20, .25, .30, .40, .50, .60	
USD-6 (IR) -32	.20, .22, .24, .28, .32, .36	
USD-6 (IR) -40	.20, .22, .24, .26, .28, .30	

TEMPERATURE RANGE: The USD relay is ambient temperature compensated over the range -20°C to +55°C. Tolerances apply over this range. Operation outside this range is possible. Consult Federal Pioneer.

(1) DISCRIMINATOR: When the instantaneous pick-up switch is in the "OFF" position, the instantaneous element will not pick up unless the breaker closes on a fault that exceeds 13X the sensor tap setting, in which case a discriminator will initiate tripping. In addition a trip will be initiated if a fault of 13X the sensor tap setting, or greater occurs while the breaker is supplying a load of less than 0.04X the sensor tap setting. If the breaker closes and the current is greater than 0.04X, but less than 13X the sensor tap setting, the discriminator monitors the current for 40ms. and if the fault level of 13X is not exceeded during this time, the discriminator switches itself off.

(2) SHORT TIME Time Delay .55 sec. @ 6X

(3) LONG TIME Time Delays shown @ 6X

TOLERANCES: ± 8% on pick up values

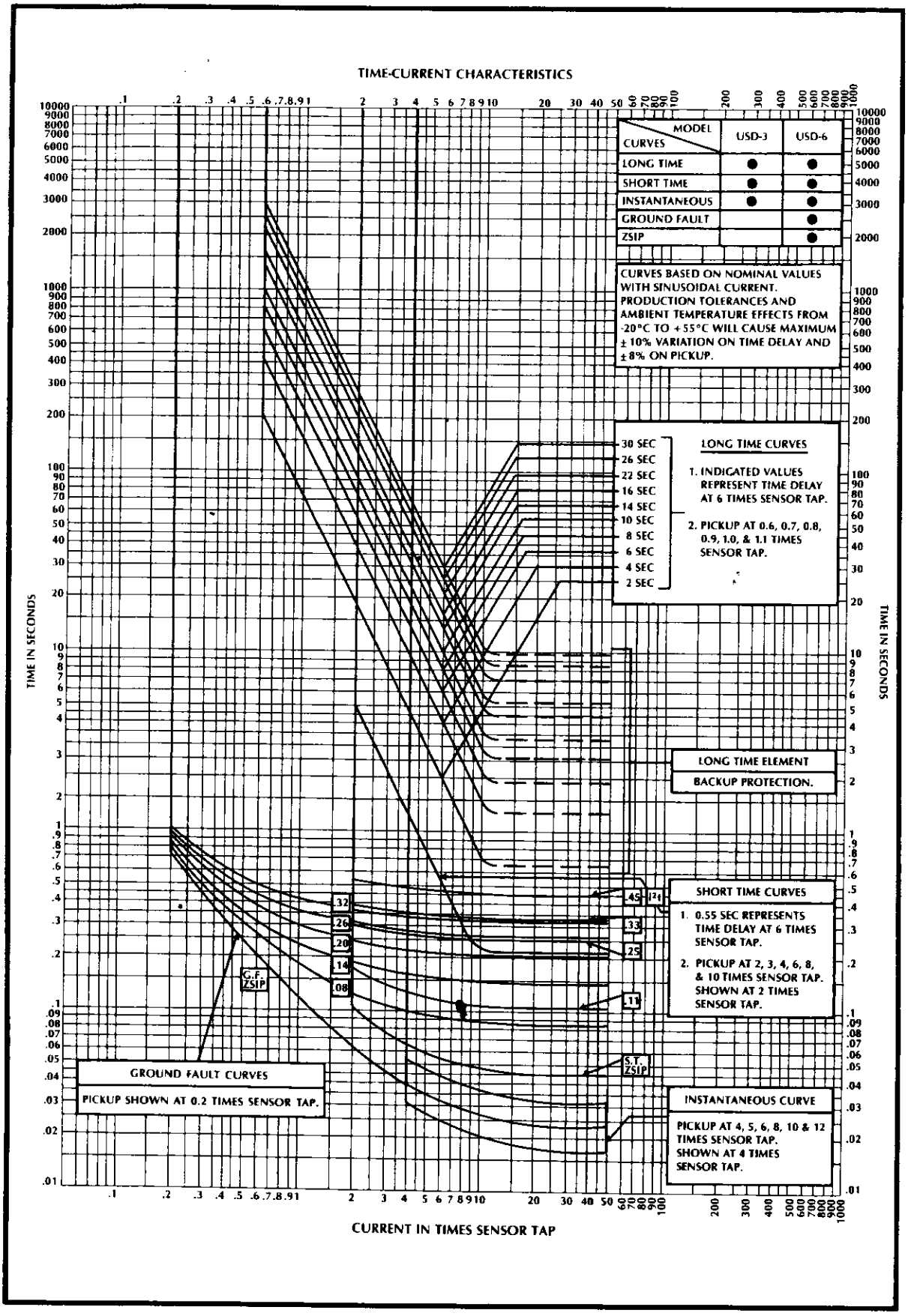
± 10% on time delay values

RELAY RESET TIME: 30ms

CURRENT SENSOR SIZES AND AMPERE TAPS

SENSOR TYPE	TAPS AVAILABLE IN PRIMARY TAPS	BREAKER FRAME	
CUD-1.5	100, 150	600A	30H-3, 42H-3
		800A	30H-3, 42H-3
		1600A	50H-3, 65H-3
		2000A	50H-3, 65H-3
CSD-6	250, 400, 600	600A	30H-3, 42H-3
		800A	30H-3, 42H-3
		1600A	50H-3, 65H-3
		2000A	50H-3, 65H-3
CSD-8	400, 600, 800	800A	30H-3, 42H-3
		1600A	50H-3, 65H-3
		2000A	50H-3, 65H-3
CSD-16	1000, 1200, 1600	1600A	50H-3, 65H-3
		2000A	50H-3, 65H-3
CSD-20	800, 1200, 2000	2000A	50H-3, 65H-3
CUD-30	1200, 2000, 3000	3000A	50H-3
		3000A	75H-3
		3200A	50H-3
		3200A	75H-3
		4000A	100H-3
		6000A	100H-2
CUD-32	1600, 2000, 3200	3200A	50H-3
		3200A	75H-3
		4000A	100H-3
		6000A	100H-2
CUD-40	1600, 3000, 4000	4000A	100H-3
		6000A	100H-2
CUD-60	5000, 6000	6000A	100H-2

TYPE USD SOLID STATE OVERCURRENT RELAY



TYPICAL SPECIFICATION

Low voltage power air circuit breakers shall be 3 pole 600 volt class with continuous current ratings and trip ratings as detailed on the plans. Interrupting ratings will be in accordance with NEMA Standards for the frame and/or their application in a fully rated system. Breakers shall have double break main contacts, a 3 phase solid state overload relay and shall be trip free in operation. A compression spring stored energy closing mechanism (either manually or electrically charged) shall be used for all ratings, with breakers being closed by means of a push button and shall have the ability to close and latch at interrupting rating at 600 volts. An emergency manual spring charging handle shall be supplied for electrically operated breakers.

Breaker faceplate shall have "closed-open" indicator, spring "charged-discharged" indicator, provision to padlock manual charging handle, provision to lock breaker in "open" position, and provision to lock drawout mechanism. Drawout circuit breakers shall be suitable for 3 position (connected, test, disconnected) racking with enclosure door closed, and shall be equipped with an interlock to ensure breaker contacts are open and closing spring is discharged when racking tool is inserted. Faceplate mounted control buttons, indicators interlocks etc. shall be accessible without opening enclosure door. Electrically operated breakers must have provision for emergency manual closing by inserting a special tool through the faceplate. A control isolating switch shall be provided on the faceplate to isolate the supply to the spring charging motor.

Relay pickup and time delay settings shall be selected in discrete factory calibrated values by means of detent action thumbwheel actuated switches with gold-plated contacts. When a solidly-grounded system is used, the relay shall be equipped with Zone Selective Intantaneous Protection feature on short time and ground fault elements. A direct acting dedicated solenoid shall be used for initiating breaker triping.

Breakers shall be Federal Pioneer Limited Type H-3 or HL-3.

FPL FEDERAL PIONEER

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Subsidiary Companies:

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Rapifax — 011-44 902-728385

La Compagnie Électrique Pioneer du Québec, Inc.
Granby, Quebec

TYPE H-3, HL-3 LOW VOLTAGE POWER AIR CIRCUIT BREAKERS

APPLICATION
Type H-3 and HL-3 low voltage power air circuit breakers are used in metal-enclosed switchgear and unit substations for the protection and control of low voltage power circuits up to 250 volts dc and 600 volts ac. They are a means of safely switching loads and automatically clearing circuits when such abnormal conditions as sustained overloads, short circuits, ground faults, or under-voltage occur.

RATINGS
600, 800, 1600, 2000, 3000, 3200, 4000 and 6000 ampere continuous current rating are available. Interrupting capacities from 30,000 to 130,000 amperes for Type H-3, and up to 200,000 amperes for Type HL-3 fused air circuit breaker are available.

DRAWOUT OR FIXED MOUNTING
Type H-3 and HL-3 breakers are available mounted on a drawout cradle with disconnecting primary power and secondary control contacts. Type H-3 breakers can also be provided for fixed mounting.

ELECTRICAL OR MANUAL OPERATION
The breakers are provided with either a manually operated handle or an electric motor for charging the stored-energy closing mechanism.

USD SOLID STATE OVERCURRENT RELAY
Full overcurrent protection features include USD solid-state relays with Federal Pioneer's ZSIP® (ZONE SELECTIVE INSTANTANEOUS PROTECTION).

STANDARDS
Federal Pioneer Type H-3 and HL-3 circuit breakers and switchgear conform to the following standards:

— ANSI Standards – C37.13, .16, .17, .19, .28, .50

Type H-3 and HL-3 low voltage power circuit breakers meet or exceed American National Standards (ANSI) and have passed all tests required by ANSI C37.50 test procedures. These tests were witnessed by Underwriters Laboratories (UL) and the U.L. Label certifies compliance with ANSI standards. The circuit breakers are UL labelled. (UL label not applicable to 6000 ampere ratings).

British Standard 4752, "Part 1"

CSA C22.1 — "Canadian Electrical Code, Part 1".
CSA C22.2 — No. 31, "Switchgear Assemblies"

EEMAC G8-2 — "Switchgear Assemblies"

IEC 157-1, — 1A "Specification for Switchgear and Control Gear for voltages up to and including 1000V ac and 1200V dc. Part 1, Circuit Breakers."

NEMA SG-3 — "Low-Voltage Power Circuit Breakers"

NEMA SG-5 — "Switchgear Assemblies"

FEATURES	BENEFITS
Trip-free operation	SAFETY
Proven multi-segment design double break contacts	High contact pressure and low resistance
USD relay with instantaneous, short time, long time, ground fault and ZSIP®	Selective protection and adjustable time current characteristics
Stainless steel in critical areas of frame	Prevents magnetic heating
Precision assembly	Reliability and interchangeability
Compression spring, stored energy operating mechanism	Positive control of speed and force of closing, independent of the operator
Ratchet-wheel stored energy mechanism	Pause anywhere in charging cycle. No handle flyback
Easy interchangeability of type H-3 with Federal Pioneer Type H-2 breaker	No obsolescence
Fibre reinforced polyester arc chutes	No asbestos used
Silver plated main drawout contacts	Maximum efficiency and low temperature rise
Individually spring-loaded main draw-out contacts designed for "blow-on" effect.	Contact pressure increases with higher current flow.
DRAWOUT CONSTRUCTION	
Inherently dead front	SAFETY
Three position closed-door racking	SAFETY
Safety Interlock ensures breaker is open and spring discharged before breaker is connected or withdrawn	SAFETY
Rejection feature to prevent breaker being installed in vacant cell of different current rating.	SAFETY
MANUAL OR ELECTRICAL OPERATION	Choice of local or remote control.
TYPE HL-3 FUSED AIR CIRCUIT BREAKER	Up to 200,000 ampere rms symmetrical interrupting capacity.
Blown fuse, single phase protection	Protection of rotating machinery
Blown fuse indicator	Rapid identification of faulted phase
OPTIONAL FEATURES	
Padlockable shutters on drawout breakers	SAFETY
Overload lockout	SAFETY
Mechanical Interlocks	SAFETY
Door Interlocks	SAFETY
Key Interlocks	SAFETY
Cell Switches	SAFETY
Up to 48 auxiliary contacts	Flexibility in control schemes
Shunt trip and shunt close	Remote operation possible
Undervoltage trip	Protection from undervoltage damage to rotating machinery
Operations Counter	Monitoring of maintenance intervals
Breaker Lifting Devices	Easy handling