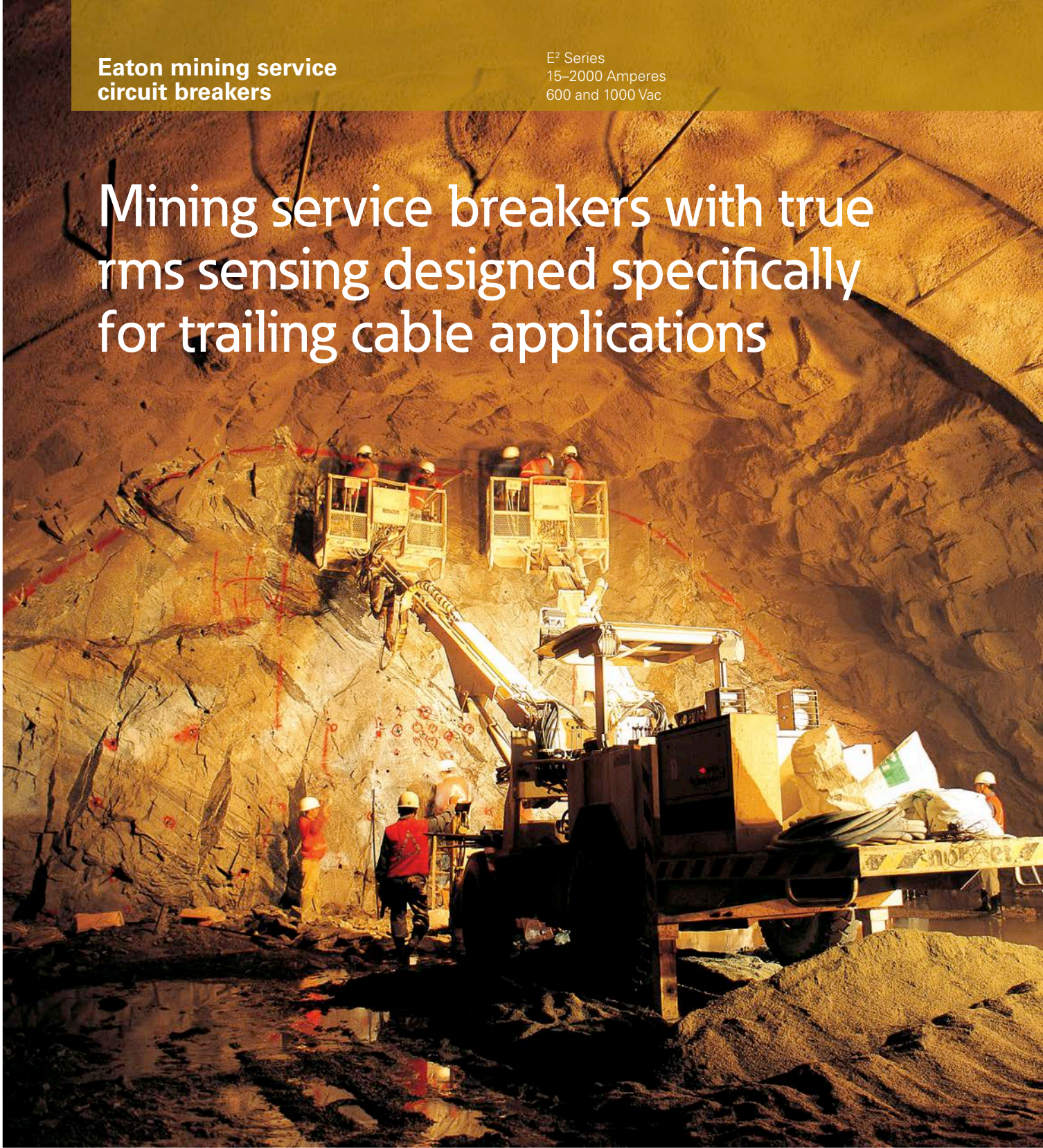


Eaton mining service
circuit breakers


E² Series
15–2000 Amperes
600 and 1000 Vac

Mining service breakers with true rms sensing designed specifically for trailing cable applications



EATON

Powering Business Worldwide



E² mining service breakers and plug-in field mountable accessories

The tradition continues

With Eaton's mining service circuit breakers, we're continuing a 40-year tradition of being the undisputed leader in electric power distribution to the mining industry. E² mining service breakers exemplify Eaton's commitment to the mining industry: to provide the mining service breakers that customers said they needed.

State-of-the-art E² mining service breakers incorporate the rigid specifications and testing procedures developed by a focus group led by engineers from several large coal companies and Eaton design engineers. Additionally, the performance of these breakers was proven and verified during hundreds of hours of field testing in harsh mine environments.

E² mining service breakers

Proven performance

E² mining service breakers are designed for a broad range of mining applications up to 1200 Vac, especially for trailing cable protection per MSHA 30 CFR 75.

E² mining service breakers are available in seven frames—trip units are interchangeable between 600 Vac and 1000 Vac E² frames; 1200 Vac units are sold as complete breakers only.

E² breakers also cover all trailing cable sizes with just two frames and three trip units.

Electromechanical trip units are also available with a wide range of magnetic pickup settings.

Improving safety with Eaton's 310+ electronic trip unit technology

With integrated Eaton electronic 310+ trip units, E² mining service breakers are designed to clear faults faster than microprocessor-initiated instantaneous trips, delivering "faster than instantaneous" clearing times for enhanced safety during maintenance operations. Faster clearing time reduces arc energy as much as 75 percent to enhance safety for operators who are working in close proximity to downstream equipment or are performing maintenance on downstream equipment.

Mining service electronic trip units with rms sensing provide the highest accuracy possible

E² K- through R-Frame breakers provide the mining industry with true rms sensing. The trip units—available in Instantaneous Only, Long/Short/Instantaneous and Arcflash/Long/Short/Instantaneous with Maintenance Mode—are field interchangeable and provide eight adjustable instantaneous pickup settings. A high load alarm option is also available on the LSI and ALSI units.

Current sensing circuits provide inverse time delay tripping adjustments for overload conditions, and instantaneous tripping for protection against short-circuit conditions that exceed preset conditions. In open air at 40 °C, the breaker will carry continuously a current equal to its maximum ampere rating without exceeding a 50 °C rise at the terminals.

The instantaneous pickup settings conform to the Code of Federal Regulations 30 75.601-2 for trailing cable applications and cover conductor sizes from #14 to 500 kcmil with three trip units and two frames. Refer to the trailing cable protection setting chart on **page 4**.

Thorough in-plant testing ensures quality, dependability and reliability

The E² mining breaker, with its undervoltage release, has been tested for 10,000 tripping operations, plus maximum short-circuit and overload tests at 1000 Vac.

Additionally, factory tests are conducted on every pole of every breaker to verify the trip unit calibration, continuity and accuracy.

Easy and uncomplicated field testing

Each E² mining breaker with electronic trip unit includes a built-in test port for convenient field testing with the handheld, 120 Vac test kit. The kit checks the trip unit electrically, and an operator can quickly verify the integrity of the trip unit and check all functions except the CTs.

For mechanical testing, the push-to-trip button checks the tripping function and should be used to exercise the operating mechanism during scheduled maintenance.

Field replacements

All trip units and accessories are field replaceable. See the mining breaker replacement cross-reference chart on **page 3** for more information.

Contact your Eaton distributor or sales engineer for further details.



Factory service for molded-case circuit breakers

The Breaker Service Centers are extensions of our manufacturing plants. They are the only facilities authorized to service Eaton and classic Westinghouse® circuit breakers.

When and where to use

- Minor physical damage to a handle, a lug or the like, which otherwise would be fully functional
- Circuit breaker that has experienced some normal wear, but is in generally good condition, as an economically driven alternative to new
- Breaker exchange—Eaton offers credit toward the purchase of our new breaker technologies (E² Mining and Series C® Industrial) in exchange for the old breaker

Why use Eaton factory service?

- Reduces overall breaker cost of ownership
- Greater reliability when compared to unknown third-party refurbishing
- Circuit breakers are tested to ensure that the manufacturer's specifications are met
- Simple and convenient solution with quick turnaround on many frame styles
- One-year manufacturer's warranty

Factory trained

The Service Center staff is dedicated to providing genuine factory-supported services and solutions to our customers.

- Factory-trained technicians
- Modern state-of-the-art cleaning and test equipment
- Dedicated facility supported by design and manufacturing technology center engineers

Capabilities

- Basic tune-up—clean, test, re-certify
- Basic service—replace accessories and attachments, including terminals, trip units, UVRs, shunt trips and auxiliary switches
- Service plus—replace components, including covers, handles and stationary contacts
- Basic modifications—accessory installation for new or existing operational breakers
- Custom service—trip unit upgrades, frame or trip unit replacement
- UL® modifications to factory-sealed breakers

Service Center locations

There are two Breaker Service Centers ready to serve you:

- Evansville, IN
- Beaver, WV

Please call 1-877-BRK-SRVC (factory service for molded-case circuit breakers) or contact your local Eaton authorized distributor or sales office for more information.

Mine Safety and Health Administration (MSHA)

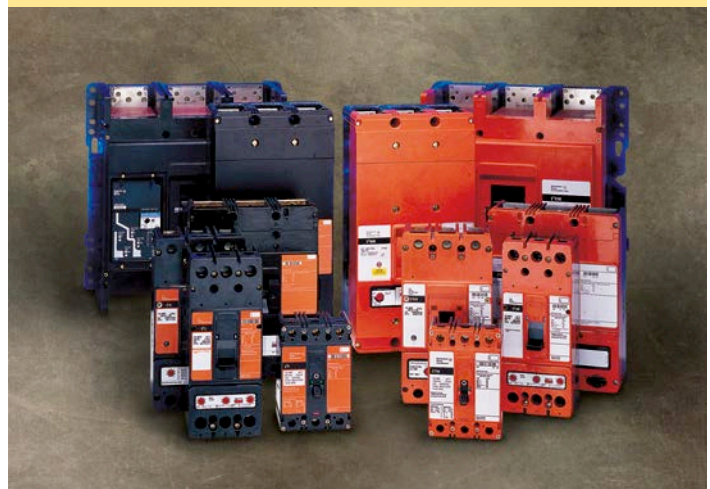
Program information bulletin: P06-02

MSHA recommends repairing circuit breakers to the original manufacturer's specifications using components exactly like those furnished by the manufacturer. Independent repair shops, the original equipment manufacturer (OEM) or an authorized OEM repair shop can repair circuit breakers when replacement components exactly like those furnished by the manufacturer are available.

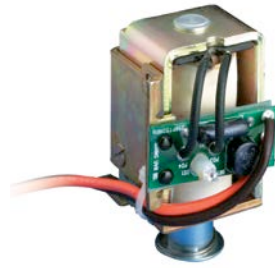
Before modifying any molded-case circuit breaker or repairing any circuit breaker with components other than those from the manufacturer, consult the manufacturer to determine if the modification will have any adverse effect on the circuit breaker. Because circuit breaker designs and specifications are proprietary information, independent repair shops may not be able to obtain the required specifications from the manufacturer. If the independent repair shop cannot obtain the specifications, the circuit breaker should be modified by the OEM or an authorized OEM repair shop.

Mine operators are ultimately responsible for all repairs and modifications made to the circuit breakers whether made by the OEM, an authorized OEM repair shop, independent contractor or by a repair/rebuild shop facility. The mine operator must make sure that all repairs are made in a workmanlike manner and that any modifications will not adversely impact the performance of the circuit breaker.

Learn more at <http://www.msha.gov>



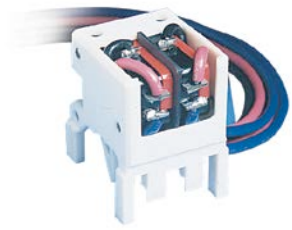
Plug-in field mountable accessories



120 Vac Electrical Reset Undervoltage Release with LED Indicator
Helps extend the breaker's mechanical life.



Shunt Trip
Provides remote-controlled tripping.



Auxiliary Switch
Remotely indicates open or closed contacts.

120 Vac electric reset undervoltage release (UVR) with LED indicator

Monitors a voltage (typically a line voltage) and trips the breaker when the voltage falls to between 70 and 35 percent of the solenoid coil rating. The electric reset will not permit the breaker to be reset without power to the UVR. The LED, when lit, indicates that the UVR is energized. The breaker should not be reset when the LED is not lit. Through visible indication of the UVR status, the operator can know when the breaker can be closed or reset.

The electric reset and LED features help extend the breaker's mechanical life.

Note: UVR mechanism accessories are not designed for, and should not be used as, circuit interlocks.

Shunt trip

Provides remote-controlled tripping and includes an intermittent rated solenoid with a tripping plunger and a cutoff switch mounted on a plug-in module. On AC rated shunt trips required for use with ground fault protection devices, most solenoids are suitable for operation at 55 percent of rated voltage.

Auxiliary switch

Remotely indicates if the breaker contacts are open or closed. It consists of one or two SPDT switches housed in a plug-in module. Each SPDT switch has one "a" and one "b" contact. When breaker contacts are open, the "a" contact is open and the "b" contact is closed.

Other accessories

A bell alarm that indicates if the breaker tripped, a rotary and Flex Shaft™ handle mechanism, and an electric operator for remote operation are also available. All accessories are provided with standard 18-inch leads. An optional terminal block is available.

For more information

Contact your Eaton distributor or sales engineer for additional information on mining service circuit breakers.

- Selection Data: CA08100005E, Volume 4: Circuit Protection
- Dimensions: TD01217001E

This information can be found on the Eaton website at www.eaton.com.

For the location of your local Eaton distributor, call toll free **1-800-525-2000**.

Interrupting capacity

Circuit Breaker Type	Interrupting Capacity (Symmetrical kA)					
	Vac (50/60 Hz)					Vdc ①
	240	480	600	1000Y/577	1200	250
E ² F	65	25	18	—	—	10
E ² J	65	35	18	—	—	10
E ² K	65	35	25	—	—	10
E ² LME	100	65	35	—	—	42
E ² L	65	35	25	—	—	22
E ² M	65	35	25	—	—	22
E ² N	65	50	25	—	—	—
E ² R	125	65	50	—	—	—
E ² FM	—	25	18	10	—	10
E ² JM	—	35	18	10	—	10
E ² KM	—	35	25	14	—	10
E ² LMZ	100	65	35	10	—	42
E ² LM	—	35	25	14	—	22
E ² MM	—	35	25	18	—	22
E ² NM	—	50	25	25	—	—
E ² RM	—	65	50	25	—	—
E ² KW	—	—	—	—	10	—
E ² LW	—	—	—	—	10	—
E ² MW	—	—	—	—	12	—

① Two poles in series. Breakers with electronic trip units are not DC rated.

Mining breaker replacement cross-reference chart

600 Vac			1000 Vac		
E ² Mining	Classic	Series C®	E ² Mining	Classic	Series C
E ² F	FBM	FDBM	E ² FM	HFM	
	HFBM	FDM			
	HFDM (Mag. only)				
E ² J		JDM	E ² JM		JDCM
E ² K	KAM	KDM	E ² KM	HKAM	KDCM
	KAMH				
E ² L	LAM	LDM	E ² LM	HLAM	LDCM
	LAMH				
	LCM				
	LCMH				
E ² M	MAM		E ² MM	HMAM	
	MAMH				
	MCM				
	MCMH				
E ² N	NBM		E ² NM	HNBM	
	NBMH				
	NCM				
	NCMH				
E ² R			E ² RM ①	HPMB	

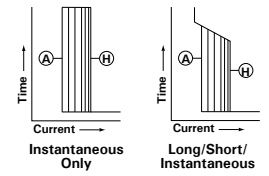
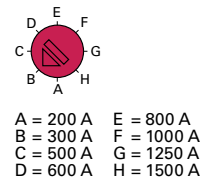
① E²R/E²RM is a new frame physically different from the HPBM. See TD01217001E.



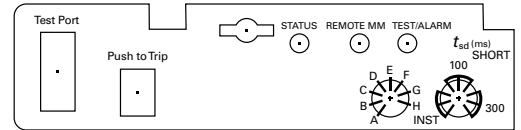
E²MM Breaker 1000 V



Instantaneous pickup settings



Sample 310+ trip unit nameplate



Three types of electronic trip units

- Instantaneous Only
- Long/Short/Instantaneous ❶
- Arcflash/Long/Short/Instantaneous with Maintenance Mode ❶

❶ High load alarm available.

Trailing cable protection setting per MSHA 30 CFR 75

Conductor Size	Maximum Breaker Instantaneous Setting	Maximum Ampere 75 °C Insulated Conductor	E ² Instantaneous Only Mining Breaker	Trip Setting
14	50	15	E ² KM 150 A	A
12	75	20	E ² KM 150 A	B
10	150	30	E ² KM 150 A	C
8	200	50	E ² KM 225 A	A
6	300	65	E ² KM 225 A	B
4	500	85	E ² KM 225 A / E ² LM 400 A	C/A
3	600	100	E ² KM 225 A / E ² LM 400 A	D/B
2	800	115	E ² KM 225 A / E ² LM 400 A	E/C
1	1000	130	E ² KM 225 A / E ² LM 400 A	F/D
1/0	1250	150	E ² KM 225 A / E ² LM 400 A	G/E
2/0	1500	175	E ² KM 225 A / E ² LM 400 A	H/F
3/0	2000	200	E ² LM 400 A	G
4/0	2500	230	E ² LM 400 A	H
250	2500	255	E ² LM 400 A	H
300	2500	285	E ² LM 400 A	H
350	2500	310	E ² LM 400 A	H
400	2500	335	E ² LM 400 A	H
500	2500	380	E ² LM 400 A	H

Eaton is dedicated to ensuring that reliable, efficient and safe power is available when it's needed most. With unparalleled knowledge of electrical power management across industries, experts at Eaton deliver customized, integrated solutions to solve our customers' most critical challenges.

Our focus is on delivering the right solution for the application. But, decision makers demand more than just innovative products. They turn to Eaton for an unwavering commitment to personal support that makes customer success a top priority. For more information, **visit www.eaton.com/electrical**.

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