



Westinghouse Canada Limited  
Industrial Products Division

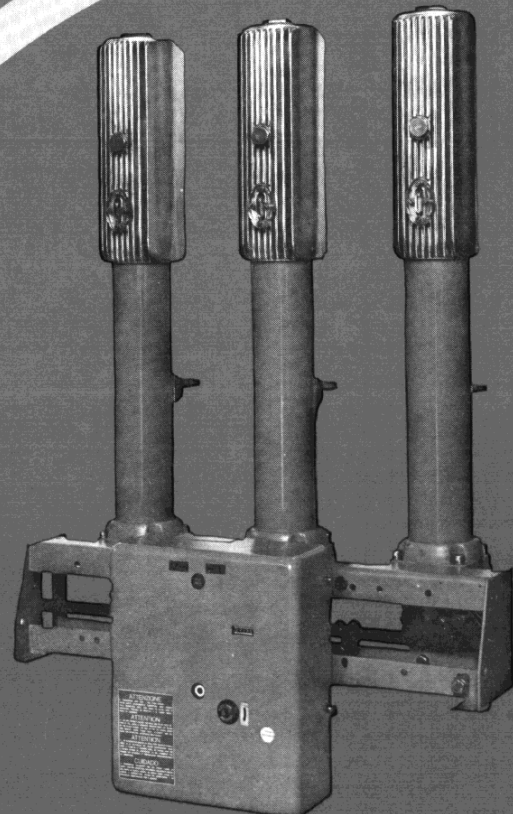
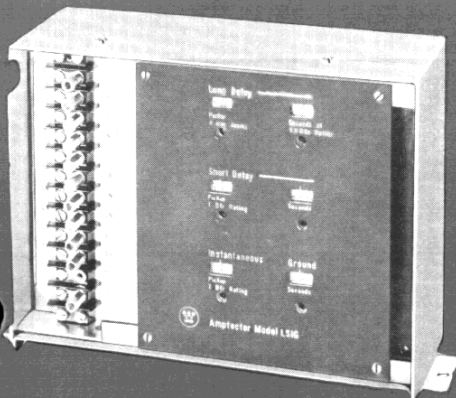
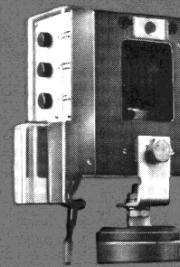
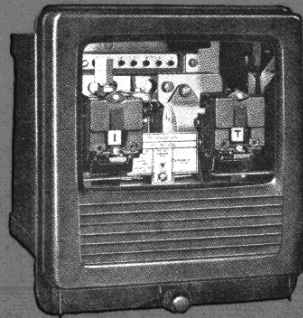
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Page 1

January, 1975  
New Information  
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2.4 to 38.5 Kv  
630 to 1750 Amperes  
60 to 1500 MVA

## Low-Oil Content Circuit Breakers Indoor, Type MG



**Introduction**

Indoor low-oil content circuit breakers are increasingly used in power distribution systems. These breakers are compact, light weight and are easy to maintain. They do not require a fireproof vault for installation in a building, provided the installation complies with rule 26-008 of CSA Standard C22.1-1972. The design of the MG breaker is time proven; in the past decade over 30000 breakers have been installed throughout the world and are still in service.

Type MG low-oil content circuit breakers have a maximum operating voltage ranging up to 38 Kv. They are available with continuous current ratings from 630 to 1750A with symmetrical interrupting capacities ranging from 60 to 1500 MVA.

**Application**

Type MG low-oil content circuit breakers provide a high degree of protection. They permit overcurrent and ground fault protection which may be fully coordinated with secondary breakers, differential transformer protection and automatic transfer schemes. Type MG circuit breaker can be provided with Amptector trip. This modern reliable solid state trip device has excellent repeatability and requires no external power source. A portable test set, identical to the one used for the type DS low-voltage switchgear, is available for test and field calibration of the Amptector.

Modular construction allows installation into any metal-enclosed switchgear assembly; either fixed mounted or drawout. They may also be installed in outdoor weather-proof assemblies.

Electrical and mechanical characteristics are given on tables I to IV, pages 4 and 5. Physical dimensions are shown on page 8.

Typical installations include:

- Electric utility systems
- Industrial plants.
- Commercial buildings
- Pumping stations
- Transportation systems
- Primary service entrance units.

**Standards**

The type MG low-oil content circuit breakers comply with International Standards CEI — IEC and most national standards, including CSA.

**Advantages**

- **Type MG low-oil content design** reduces weight and saves on oil handling facilities. Up to 1000 operations at rated current without oil change.
- **Rugged mechanism** designed to exceed 10000 mechanical operations.

- **De-ion arc chamber** reduces fault clearing time, contact burning and oil deterioration.
- **Extended arcing contact** provides effective control of the interrupting time, preserves the main contacts under short circuit conditions, thus maximizing operational life.
- **Breaker closed-open indicator** — operating mechanism gives visual indication of breaker status.
- **Quick-make, quick-break operation** — a heavy duty spring drives the moving contacts at high speed into either the open or closed position.
- **Standard accessories** apply to the total line of type MG low-oil content circuit breakers. Refer to table IV, page 5.

**Construction**

The type MG low-oil content circuit breaker consists of a rigid steel frame supporting 3 individual poles and one operating mechanism.

Each pole (Fig. 1) has an insulating tube fastened to the lower case by means of a flange. A special joint provides the necessary sealing between the insulating tube and the case.

The moving contact consists of a copper rod with its lower end linked to the operating mechanism through insulating connecting rods. Its upper end is provided with a copper tungsten tip.

Electric continuity (Fig. 2) between the moving contact and the lower terminal stud is effected through spring loaded current carrying rollers.

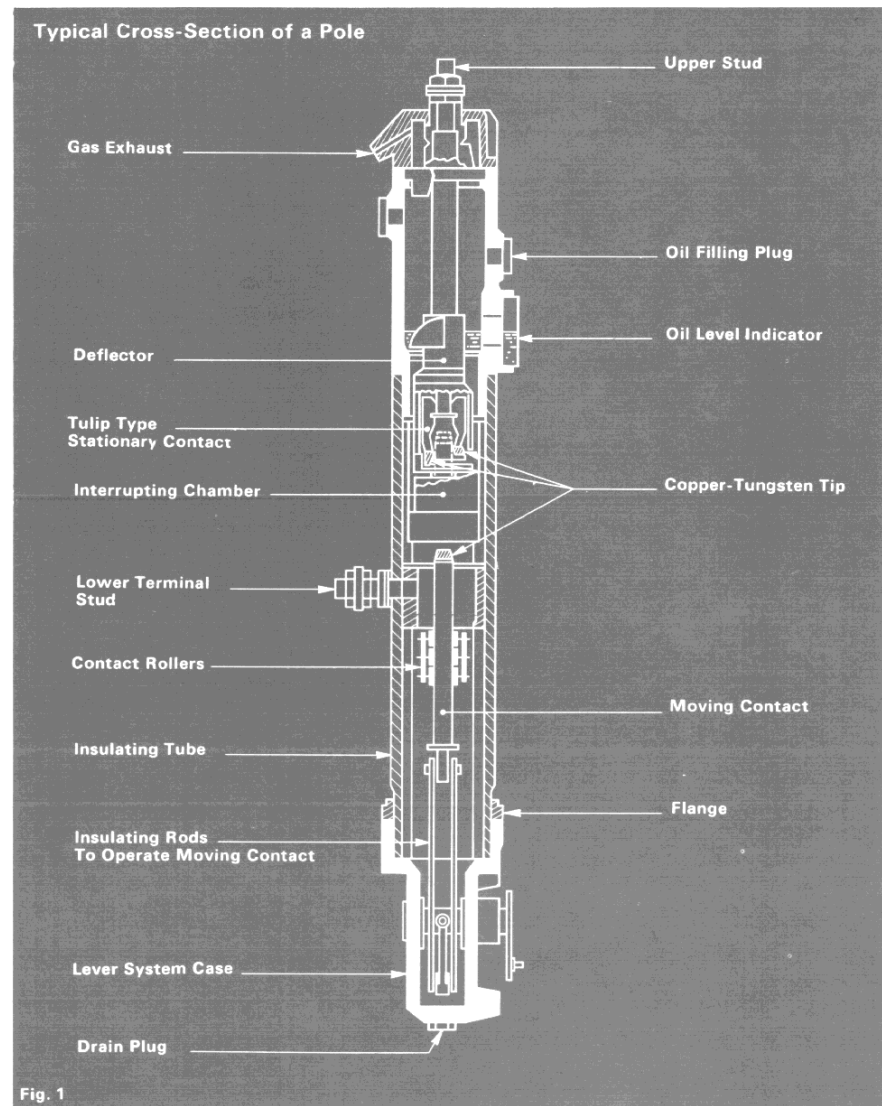


Fig. 1

This unique design eliminates sliding friction at this critical point of the circuit and provides automatic wear adjustment. Reliability of the breaker is assured even after long periods of inactivity and in different climatic conditions.

The interrupting chamber is made of arc resistant fiber plates and is located in the mid section of the pole. Immediately above it, there is a tulip type stationary contact with copper tungsten finger tips. One of the fingers is longer and is specially designed to act as an arcing contact. This feature prevents erosion on the face of the stationary current carrying contacts. The upper stud has a double function. It carries the current and holds the assembly of the stationary contact and the interrupting chamber in position.

The gas expansion chamber and the oil level indicator are located in the upper part of the pole.

Screw-on type plugs are provided for filling or draining the pole.

### Operation

In the type MG low-oil content circuit breaker, arc interruption is achieved in oil and is controlled such that chopping and restriking are virtually eliminated.

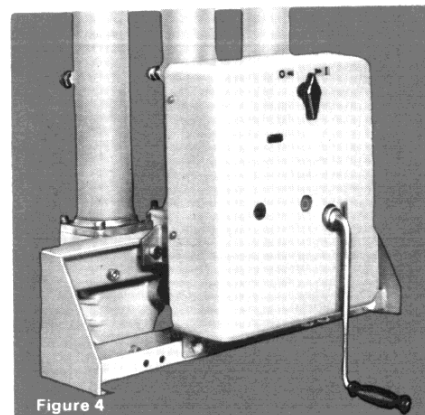
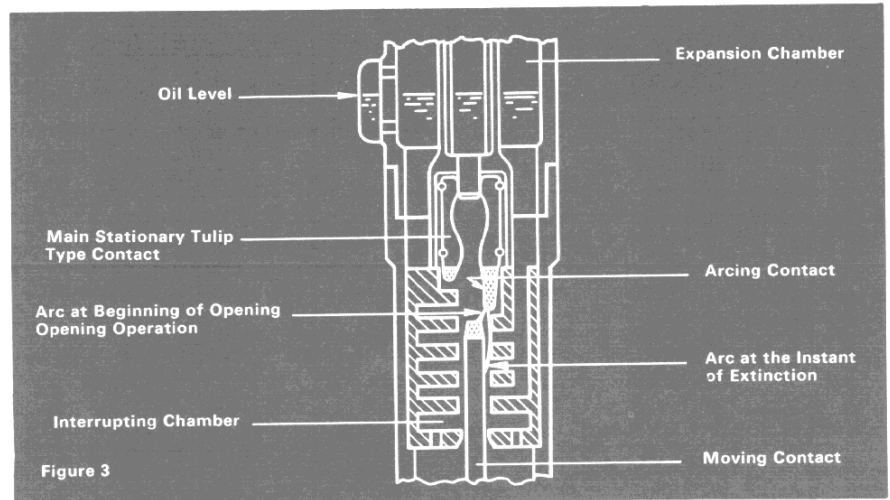
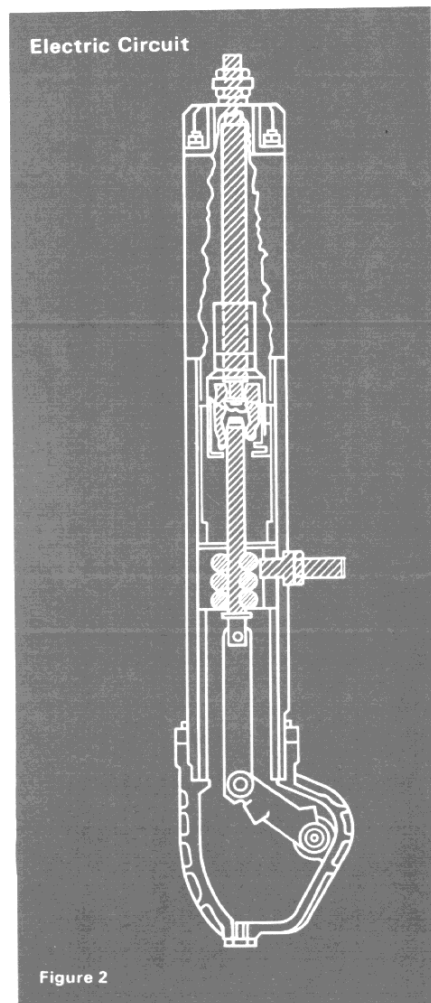
As soon as the moving contact is separated from the long tulip finger, an arc stretches between them and assumes a predetermined position in the interrupting chamber.

The arc vapourizes the oil between the contacts, thus producing a pressure in the chamber. Due to the unique shape of the interrupting chamber, this pressure forces non-vapourized oil to move in cross-wise and length-wise directions with respect to the moving contact. This causes the arc to be elongated and de-ionized. The elongation of the arc is a function of vapour pressure and thus of the current being interrupted. Virtually constant interrupting characteristics are therefore maintained from full short circuit down to low currents.

The action of the de-ionizing oil quenches the arc when the value of the instantaneous current tends to zero. This limits to a minimum the energy developed by the arc in the interrupting chamber.

At the start of the opening stroke, the moving contact is extracted from the stationary contact at a high speed. At a pre-determined distance between contacts, the moving contact is slowed down by means of a damper in the mechanism, which will only operate in the course of the opening stroke. This damper permits adequate control of the moving contact speed even when the high pressure in the interrupting chamber tries to accelerate the mechanism. The rate of contact opening and, therefore, the arc length is controlled so that electrical and mechanical stresses on the circuit breaker are maintained at a minimum.

At this point, the arc is extinguished. For the balance of the opening stroke, the damping action is removed and the moving contact travels until it reaches its final open position.



### Spring Stored-energy Mechanism

A spring stored-energy mechanism is used on the complete line of type MG low-oil content circuit breakers. The mechanism is fully enclosed in a separate housing. Targets are used to indicate the "OPEN" or "CLOSED" status of the breaker and the "CHARGED" or "DISCHARGED" condition of the springs.

Charging of the springs and closing release are effected through separate devices to provide two-step stored-energy closing.

Opening springs are charged automatically during the closing operation. Opening can be effected by means of a manual trip handle or through a number of standard electrical trip devices.

**Spring Stored-Energy Mechanism (Cont)  
Type B Manual Closing (Fig. 4)**

Closing springs can be charged and latched in with a removable handle crank in either the open or closed position. The latch can be released either manually by means of a closing handle or electrically by means of a closing spring release coil. An interlock prevents release before the springs are fully charged and a target indicates the spring charge status.

**Type BM Electrical Closing**

The B type mechanism is converted to electrical operation by the addition of a motor to charge the closing springs. This is designated by changing the identification code from B to BM. Interlocks provide for automatic recharging of the closing springs at the end of the closing stroke.

Manual back-up is provided for emergency manual operation.

Refer to table IV for burden and available operating voltages of the motor operator and other accessories.

**Notes:**

1. Three basic configurations B14/1, B20 and B40 exist for the operating mechanism described above, depending on the continuous current and MVA ratings of the breaker on which it is applied.
2. A manual only type CR mechanism is available for limited applications. Refer to Westinghouse for more information.

Breaker Type	Continuous Current Amps.	Symmetrical Interrupting Ratings at Standard System Voltages						Short Time Current KA		Dielectric Withstand KV		Operating Time <sup>③</sup> Millisec.				Breaker Weight With Oil		Oil per Breaker <sup>③</sup>	
		MVA			KA rms			1 Sec	3 Sec	60 Hz	BIL	Open-ing Time	Max. Arc-ing Time	Total Clear-ing Time	Make Time	Kg	Lbs.	Litre	Imp. Gal.

**Table I: 5 and 7.2 Kv Class — Circuit Breaker**

		2.4 Kv	4.16 Kv	7.2 Kv	2.4 Kv	4.16 Kv	7.2 Kv												
12 MG 250-6	630	60	105	150	14.5	14.5	12	14.5	8.5	35	75	50	20	70	80	80	175	5.9	1.3
12 MG 350-6	630	70	120	205	16.5	16.5	16.5	16.5	10	35	75	50	20	70	80	90	200	7.3	1.6
12 MG 350-8	800	100	170	300	24	24	24	24	14	35	75	50	20	70	80	90	200	7.3	1.6
12 MG 350-12	1250	100	170	300	24	24	24	24	14	35	75	50	20	70	80	105	230	7.3	1.6
12 MG 500-8	800	140	245	360	34	34	29	34	20	35	75	50	20	80	120	90	200	7.3	1.6
12 MG 500-12	1250	140	245	360	34	34	29	34	20	35	75	50	20	80	120	105	230	7.3	1.6
12 MG 500-17	1750	140	245	360	34	34	29	34	20	35	75	50	20	80	120	135	300	12.3	2.7
12 MG 750-12	1250	200	345	550	48	48	44	48	28	35	75	60	20	80	120	135	300	12.3	2.7
12 MG 750-17	1750	200	345	550	48	48	44	48	28	35	75	60	20	80	120	135	300	12.3	2.7

**Table II: 15 Kv Class Circuit Breaker**

		12.4 Kv	13.8 Kv	14.4 Kv	12.4 Kv	13.8 Kv	14.4 Kv												
17 MG 250-6	630	255	285	300	12	12	12	14.5	8.5	45	95	50	20	70	70	83	185	5.9	1.3
17 MG 350-6	630	310	320	335	14.5	13.5	13.5	14.5	8.5	45	95	50	20	70	70	83	185	5.9	1.3
17 MG 350-8	800	310	320	335	14.5	13.5	13.5	14.5	8.5	45	95	50	20	70	70	91	200	7.3	1.6
17 MG 350-12	1250	310	320	335	14.5	13.5	13.5	14.5	8.5	45	95	50	20	70	70	105	230	7.3	1.6
17 MG 500-8	800	470	480	500	22	20	20	24	14	45	95	50	20	70	70	91	200	7.3	1.6
17 MG 500-12	1250	470	480	500	22	20	20	24	14	45	95	50	20	70	70	105	230	7.3	1.6
17 MG 500-17	1750	470	480	500	22	20	20	24	14	45	95	50	20	70	120	135	300	12.3	2.7
17 MG 750-8	800	620	690	720	29	29	29	29	18	45	95	60	20	80	80	91	200	7.3	1.6
17 MG 750-12	1250	620	690	720	29	29	29	29	18	45	95	60	20	80	80	105	230	7.3	1.6
17 MG 750-17	1750	620	690	720	29	29	29	29	18	45	95	60	20	80	120	135	300	12.3	2.7
17 MG 1000-12	1250	825	920	960	38.5	38.5	38.5	38.5	24	45	95	60	20	80	120	135	300	12.3	2.7
17 MG 1000-17	1750	825	920	960	38.5	38.5	38.5	38.5	24	45	95	60	20	80	120	135	300	12.3	2.7

② At rated interrupting capacity.

③ Oil must be changed as follows:

- after 6 openings at maximum breaking capacity of the circuit breaker.
- after 10 openings at 50% of the breaking capacity.
- after 1000 openings at rated continuous current.
- In any case, however, the oil must be changed at least once every two years.

**Table III: 34.5 Kv Class Circuit Breaker**

Breaker Type	Cont. Current Amps.	Symmetrical Interrupting Rating at Standard System Voltages												Short Time Current		Dielectric withstand		Operating Time <sup>②</sup>				Breaker Weight with Oil		Oil per Breaker <sup>③</sup>	
		MVA						KA rms						Current		KV		Millisec.				Kg	lbs.	Litre	Imp. Gal.
		12.4 Kv	13.8 Kv	14.4 Kv	24.9 Kv	27.6 Kv	34.5 Kv	12.4 Kv	13.8 Kv	14.4 Kv	24.9 Kv	27.6 Kv	34.5 Kv	1 sec	3 sec	60 Hz	BIL								
38 MG 500-6	630	260	290	300	415	460	500	12	12	12	9.6	9.6	8.4	12	6	80	170	50	20	70	120	123	270	12.3	2.7
38 MG 500-8	800	260	290	300	415	460	500	12	12	12	9.6	9.6	8.4	12	6	80	170	50	20	70	120	123	270	12.3	2.7
38 MG 500-12	1250	310	345	360	515	570	575	14.5	14.5	14.5	12	12	9.6	18	10	80	170	60	20	80	120	180	395	21.4	4.7
38 MG 750-8	800	470	525	545	750	750	750	22	22	22	17.4	15.7	12.5	22	12	80	170	60	20	80	120	180	395	21.4	4.7
38 MG 750-12	1250	470	525	545	750	750	750	22	22	22	17.4	15.7	12.5	22	12	80	170	60	20	80	120	180	395	21.4	4.7
38 MG 1000-8	800	535	600	620	1000	1000	1000	25	25	25	23	21	17	25	16	80	170	60	20	80	120	180	395	21.4	4.7
38 MG 1000-15	1500	535	600	620	1000	1000	1000	25	25	25	23	21	17	25	16	80	170	60	20	80	120	180	395	21.4	4.7
38 MG 1500-8	800	620	690	720	1075	1200	1500	29	29	29	25	25	25	29	18	80	170	60	20	80	120	210	465	21.4	4.7
38 MG 1500-15	1500	620	690	720	1075	1200	1500	29	29	29	25	25	25	29	18	80	170	60	20	80	120	210	465	21.4	4.7

② at rated interrupting capacity.  
③ see note ③ page 4.

**Table IV: Breaker Accessories and Relative Burden**

Description	Operating Mechanism				Voltage		Burden		
	B		BM		Volts		Current Amps	Power	
	Std.	Optional	Std.	Optional	Ac 50/60 Hz	Dc		VA 50/60 Hz	W Dc
Shunt Trip <sup>①</sup>		1	1		120, 208-240	24, 48, 125, 250	1	300	200
Closing Spring Release Coil <sup>②</sup>		1	1		120, 208-240	24, 48, 125, 250		300	200
Series Trip <sup>③</sup>		1						25	
Primary Static Overcurrent Trip <sup>④</sup>		1		1				80	
Amprector TM Static Trip		1		1					
Undervoltage Release		1		1	120, 208-240	24, 48, 125, 250		60	15
Key Interlock		1		1					
Anti-pumping Relay				1	120, 208-240	24, 48, 125, 250		3	1.7
Operation Counter		1		1					
Motor Operator <sup>⑤</sup>			1		120, 208-240	24, 48, 125, 250		450 <sup>⑥</sup>	450 <sup>⑥</sup>
Auxiliary Contact to Indicate Spring Charged				1-NO	120, 208-240	125, 250	10		
Auxiliary Contact to Indicate Close or Open Position of Breaker		1-NO+1-NC (Form C) 1-NO 1-NC		1-NO+1-NC (Form C) 1-NO 1-NC	120, 208-240	125, 250	10		
Auxiliary Contacts <sup>⑦</sup> Mounted in Cubicle to Indicate Close or Open Position of Breaker		2-NO 2-NC		2-NO 2-NC	120, 208-240	125, 250	10		
Auxiliary Contacts <sup>⑧</sup> on Stationary Part to Indicate Service and Test Position of Breaker		2-NO 2-NC		2-NO 2-NC	120, 208-240	125, 250	10		

① Control power supply not provided.  
② Must be used with circuit opening relays. Control power supply not required.  
③ Available up to 600A as a standard. Refer to page 7.  
④ Available only on drawout execution. These contacts are only functional with breaker in service position.  
⑤ 900 for circuit breakers type 38 MG 1500-8 or -15.

Opening Time	Max. Arcing Time	Total Clearing Time	Make Time
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**Westinghouse Amptector™ Trip**

The Westinghouse Amptector is a solid state device that provides adjustable over-current tripping for the type MG low oil content circuit breakers. Only one Amptector is required per breaker, and it receives all its energy from a set of sensors — one mounted on each pole of the breaker. It develops an output for an associated trip actuator when preselected conditions of current magnitude and duration are exceeded.

The device can be supplied with any combination of four continuously adjustable over-current tripping functions: these are: 1. long delay, 2. short delay, 3. instantaneous, and 4. ground protection.

The breaker current rating for any frame size can be changed by simply changing the sensors. The wide range of long-delay pickup on the Amptector makes one set of sensors suitable for a number of current ratings. The Amptector itself need not be changed when the associated sensors are changed.

Each Amptector includes terminal receptacles to permit easy field checking of operation and calibration with an external power supply. A specially designed portable test device with a plug to match the Amptector receptacle is available to provide the utmost in simplicity for checking Amptector operation.

**Ranges**

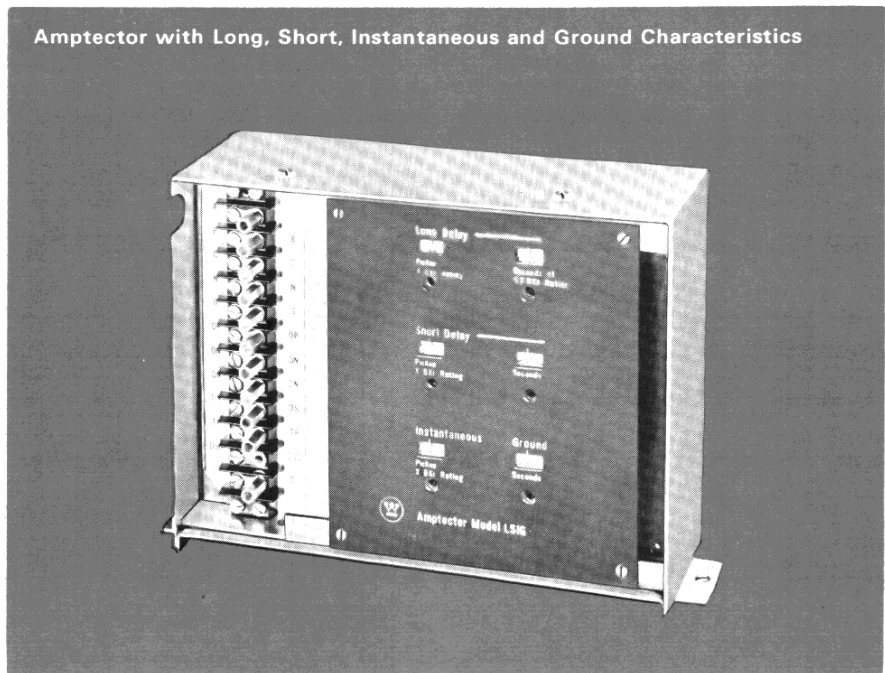
The ranges of pick-up current settings (in multiples of sensor rating) and time delay are as follows:

1. Long delay pick-up  
.5 to 1.25 x sensor rating
2. Long delay  
4 to 36 seconds at 6 x rating.
3. Short delay pick-up  
4 to 10 x sensor rating
4. Short delay  
.18 seconds to .5 seconds times pick-up setting.
5. Instantaneous pick-up  
4 to 12 times sensor rating
6. Ground Current  
Pick-up Not adjustable  
Delay 13 to 30 Cycles at 60 Hz

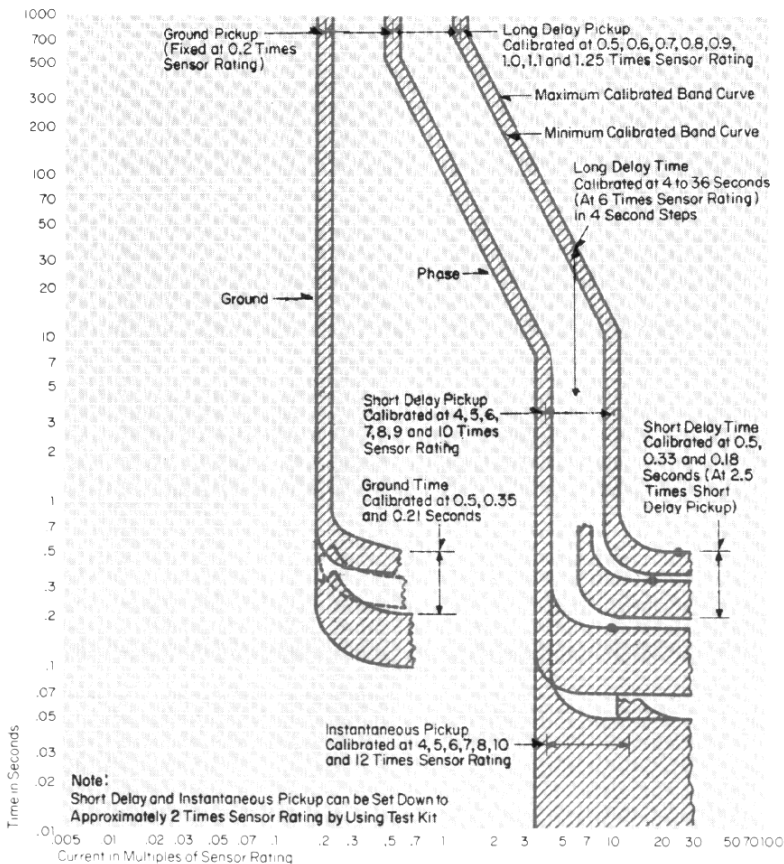
**Available Sensor Ratings**

The following sensor ratings are available: 100, 150, 200, 300, 400, 600, 800, 1200, 1600 Amps.

1 - Short Delay and Instantaneous Pickup can be Set Down to Approximately 2 Times Sensor Rating by Using Test Kit  
2 - Ground Pickup also available at 40-60-80% of Sensor Rating



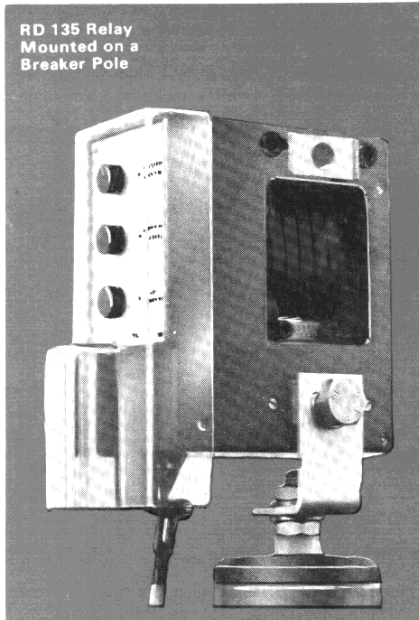
**Amptector Characteristics**



**Primary Static Overcurrent Trips Type RD-135**

Primary overcurrent trips are also available for the direct tripping of the type MG low oil content circuit breaker. This relay RD 135 is made of the following principle components:

1. A current transformer provided with primary winding, series connected with the protected pole of the circuit breaker and two secondary windings.
2. An electronic circuit, operated by the secondary windings of the above mentioned current transformer, sensitive to current fluctuations and provided with a silicon controlled rectifier (SCR).
3. An electro-magnet for the operation of circuit-breaker tripping lever.



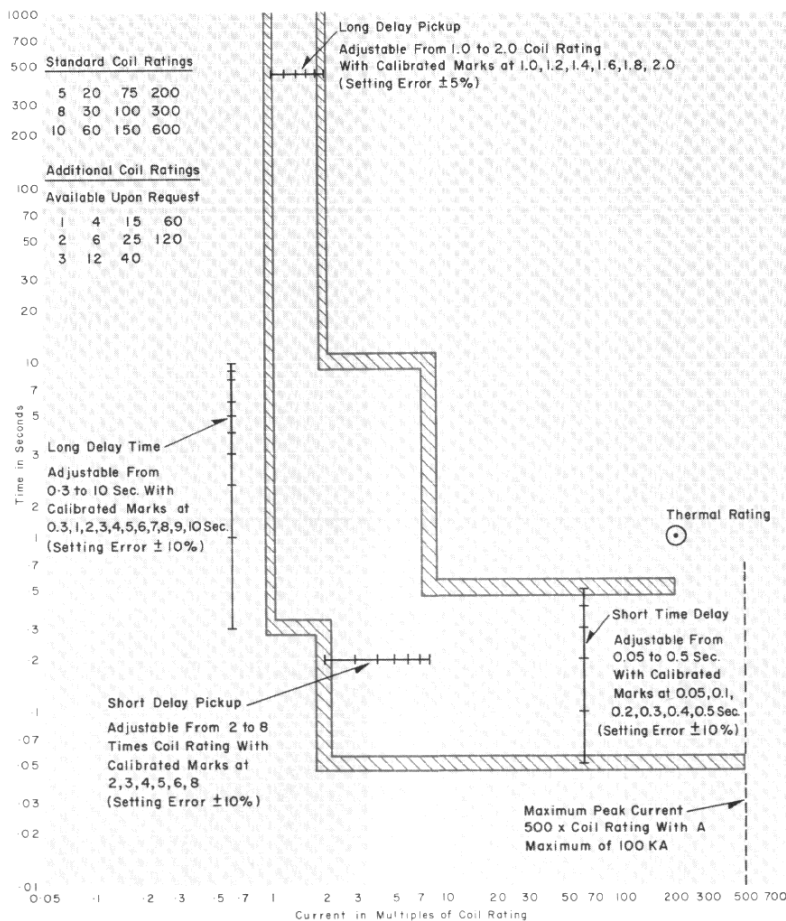
4. Three potentiometers for the setting of operating time, time delay current pickup and instantaneous pickup current.

The relay RD 135 has the following advantages:

- Case made of insulating material.
- Minimum overall dimensions.
- Low power consumption.
- No noise.
- High drop-out/pick up ratio.
- Continuous setting of operating currents and time.
- Easy replacement of current transformer in case of rated current changing.
- By request, instantaneous or delayed operation only is available.

When line current exceeds the preset value, the transformer secondary currents operate the electronic circuit, gating the final SCR which permits the current flow necessary to operate the tripping electromagnet. The relay operation can occur instantaneously or with a preset delayed time according to the overcurrent value through the circuit-breaker pole.

**RD 135 Relay Characteristics.**



**Electrical Characteristics**

- Rated current (I<sub>r</sub>) : 1 - 600 A\*
- Frequency : 40-60 Hz
- Continuous current setting range for delayed operation : 1 to 2 I<sub>r</sub>.
- Error on the current preset value for delayed operation : ± 5%.
- Continuous current setting range for instantaneous operation : 2 to 8 I<sub>r</sub> (by request 3 to 6 I<sub>r</sub>).
- Error on the current preset value for instantaneous operation : ± 10%.
- Drop out/pick up ratio : 95%.
- Maximum continuous current : 2 I<sub>r</sub>.
- Thermal rating : 200 I<sub>r</sub>, 1 second.
- Peak current : 500 I<sub>r</sub> with a maximum of 100,000 A.
- Continuous adjustable time setting range : 0,3 to 10 sec. (by request other ranges are available).
- Instantaneous tripping time : 0,09 to 0,04 secs.
- Power consumption at rated current I<sub>r</sub> : 60 to 80 VA.

\*Standard rated current values and other possible values ( )  
 (1) - (2) - (3) - (4) - 5 - (6) - 8 - 10 - (12) - (15) - 20 - (25) - 30 - (40) - 50 - (60) - 75 - 100 - (120) - 150 - 200 - 300 - 600.

By request the relays can be supplied for other rated current values, even higher than 600 A.

N.B. : I<sub>r</sub> = rated current

Indoor Low-Oil Content Circuit Breaker, Type MG

Dimensions — Approximate only, do not use for construction

Table V: Dimensions for Breaker up to 1250A and 750 MVA<sup>①</sup>

	Voltage Class					
	5 and 7.2 Kv		15 Kv		34.5 Kv	
	mm	in.	mm	in.	mm	in.
A	417	16.4	417	16.4	507	20.0
B	578	22.8	692	27.2	1130	44.5
C	965	38.0	965	38.0	1195	47.0
D	307	12.1	307	12.1	397	15.6
E	230	9.1	230	9.1	230	9.1
F	448	17.6	448	17.6	572	22.5
G	178	7.0	235	9.3	400	15.7
H	82	3.2	82	3.2	165	6.5
I	140	5.5	140	5.5	165	6.5

① For breakers type 12MG750-12, 38 MG 500-12, 38 MG 750-8 and -12: Refer to Table VI.

Table VI: Dimensions for Breaker above 1250A and/or 750 MVA

	Voltage Class					
	5 and 7.2 Kv		15 Kv		34.5 Kv	
	mm	in.	mm	in.	mm	in.
A	463	18.2	463	18.2	463	18.2
B	578	22.8	692	27.2	1130	44.5
C	1090	42.9	1090	42.9	1385	54.5
D	303	11.9	303	11.9	303	11.9
E	230	9.1	230	9.1	230	9.1
F	456	18.0	456	18.0	636	25.0
G	178	7.0	235	9.3	400	15.7
H	82	3.2	82	3.2	165	6.5
I	140	5.5	140	5.5	165	6.5
J	165	6.5	165	6.5	165	6.5

