



Introduction to CBE Products



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1. Circuit Breakers for Equipment (CBE)

In the modern world, the need for safety is always an inarguable requirement. This is not only because of authorities insisting on equipment meeting national standards, or a particular industry requiring certain approvals, but also because customers needs have become more sophisticated. The risk to any company brought about by failure of their products is larger now than ever before. In this situation the need for protection of equipment that uses electric energy has increased. The risk of fire and injury to persons posed by overheating of conductors and components must be considered in any design of electrical equipment.

The acronym CBE stands for Circuit Breakers for Equipment. These products are usually used for the protection of equipment, sub-systems or components of equipment. The equipment may be connected to a fixed installation or may be mobile. It could generate, distribute, manage or use electric energy. The need for protection may arise from inadequate protection of the mains supply (fixed installation of electric supply) to the equipment, or from the fact that the equipment is part of a system where the electricity is generated and distributed, such as found in mobile applications.

Why differentiate equipment from the usual application of protecting the fixed electrical installation? The fixed electrical installation is covered by a country's electrical code which has at its core the protection of cable and cable insulation to avoid fire and electric shock to people. It cannot and does not cover the variety found in equipment, as this would simply not be practical. The environment that equipment is exposed to may also differ substantially from that encountered in the fixed installation. Thus, the protection that may be adequate to protect the fixed installation may not be adequate for equipment. An economical solution that provides an acceptable level of protection for specific applications is required.

Leading authorities have therefore generated specific circuit breaker specifications particularly for this type of equipment protection, i.e. IEC/EN 60934 and UL 1077.

The CBE Hydraulic-Magnetic Product Range

The product range is divided into three sections:

- **Rail mounted products**, also known as miniature circuit breakers (MCB's), consisting of the QL, QZ, QF, QY and QDC range. The QL, QZ and QF range is for AC applications, while the QY and QDC range is for DC applications
- **Front mounted products with rear termination**, consisting of the B, C and DD-Frames (AC and DC applications)
- **Surface mounted products** consisting of the E, F and L range (AC and DC applications)

The rail mounted CBE range is based on the standard MCB product range of CBI, and by its nature is less flexible than the products normally associated with equipment use such as the B, C and DD types. The availability of special curves, mounting and actuation features are not available in the rail mounted CBE range. The rail mounted products have a cost advantage over the more specialised breakers due to large volume production. This allows the use of the product in a variety of fixed applications, including cases where power distribution specifications are required for a particular application.

The DC Products in this range are mainly aimed at telecom DC distribution applications. Other typical DC applications include protection in alternative energy systems such as solar power applications and uninterrupted power supply systems.

The front mounted B, C and DD-Frame products are normally associated with use in equipment. These products have a wide variety of actuating, mounting and termination options to suit customer's specific needs. They have a wide range of tripping curves that may be tailor-made to suit the application and are available with current ratings from as low as 20mA. The products meet stringent environmental and other technical specifications.

CBE's are used for equipment, sub-systems or components of equipment

2. Introduction to CBI's Hydraulic Magnetic Circuit Breaker Technology

For the above products, CBI uses hydraulic magnetic (Hy-Mag) technology for current sensing. Hydraulic Magnetic Circuit Breakers operate on the magnetic force produced by a load current flowing through a series connected solenoid coil which is wound around a hermetically sealed tube containing an iron core, a spring and dampening fluid (Fig.1).

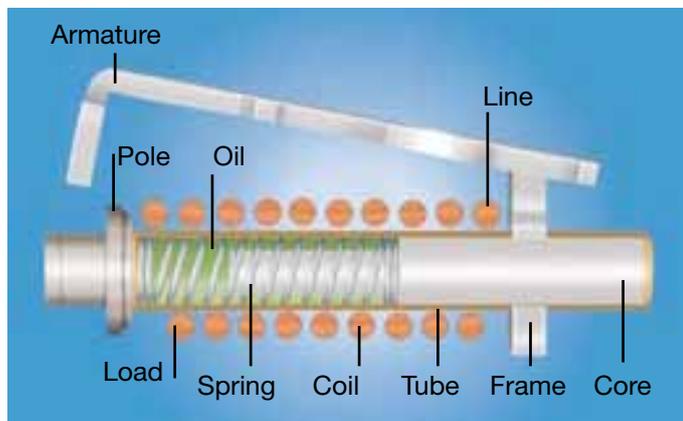


Figure 1: Series Connected Coil

At currents below the circuit breaker rating, the magnetic flux in the solenoid is insufficient to attract the core towards the pole piece, due to the spring pressure (Fig. 2).

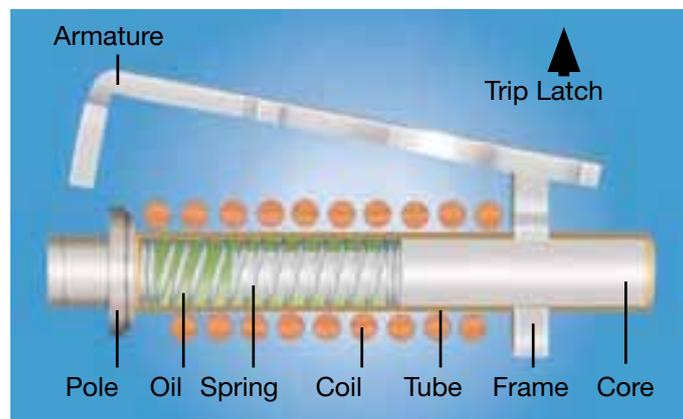


Figure 2: Rated current or Less

Where an overload occurs, i.e. currents above the circuit breaker rating, the magnetic flux in the solenoid produces sufficient pull on the core to commence its movement toward the pole piece. During this movement, the hydraulic fluid regulates the core's speed of travel, thereby creating a controlled time delay which is inversely proportional to the magnitude of the current. This time delay is useful in that if the overload is of short duration, i.e. start up of motors, etc., the core returns to its rest position once the overload disappears (Fig. 3).



Figure 3: Overload Current (Time Delay)

If the overload persists, the core reaches the pole piece after a time delay particular to that current and in so doing, the reluctance of the magnetic circuit drops considerably, so that the armature is attracted to the pole face with sufficient force to collapse the latch mechanism (toggle) and consequently trip the breaker. The contacts separate, the current ceases to flow, and the core returns to its rest position (Fig. 4).

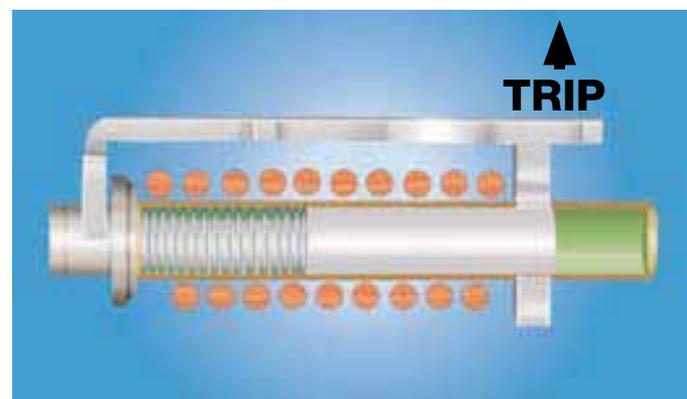


Figure 4: Overload Current (Trip)

With high values of overloads or short circuit, the magnetic flux produced by the coil is sufficient to attract the armature to the pole face and trip the breaker even though the core has not moved. This is called the instantaneous trip region of the circuit breaker characteristic (Fig. 5). Unlike thermal circuit breakers, the hydraulic magnetic circuit breaker's trip point is unaffected by ambient temperature. After tripping, the breaker may be re-closed immediately since there is no cooling down time necessary. By the nature of the principle of operation, it is possible to obtain any variation of time / current characteristic.

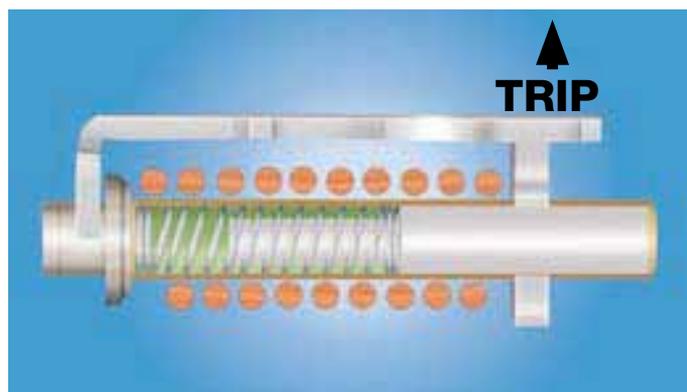


Figure 5: Instantaneous trip

*Hydraulic Magnetic products
are unaffected by
ambient temperature.*

Features of the Hydraulic Magnetic Principle

- Circuit breakers can carry 100% of rated current independent of ambient temperature
- Always trip at 125% of rated current independent of ambient temperature
- Immediate resetting after trip
- Any current rating possible, even fractions of amperes
- Large range of time delays available

Features of the construction common to all CBI circuit breakers

- **Trip free operation:** Even if the handle is locked in the **ON** position the breaker will trip if an overload occurs
- **Positive ON and positive OFF:** The handle always indicates the status of the breaker contacts
- **Silver alloy contacts:** The contact tips ensure a long, trouble-free life, even in harsh environments, ensuring a low impedance connection throughout the life of the breaker
- **Superior quality polymer materials:** Meet or exceed the requirements as laid down by international specifications for polymer materials to be used in circuit breaker application, such as IEC 60947-2 and UL 489
- **Environmental Safety:** Ensures better flammability, toxicity and isolation properties, thereby ensuring safety for the users and installation
- **Hermetically sealed sensing / time delay mechanism:** Ensures no aging or deterioration and thereby a longer service life with precise time delay and tripping characteristics throughout the life of the breaker
- **Multi-pole circuit breakers are fitted with common trips:** All CBI multi-pole circuit breakers are externally coupled with a handle tie bar and internally with a common trip linkage, ensuring that all poles switch and trip simultaneously

3. Selection of a CBE product

To choose the correct CBE product for an application is no different from choosing other types of protection or branch circuit protection. There are however a few more variables to consider. The ultimate goal is to supply energy to the equipment in a safe and economic manner. Fundamentally, one must understand the application and what needs to be protected. Thereafter comes the method of mounting, termination and actuation and the environment that the product will be used in. Regulations specific to an industry must also be considered.

Advantages of the use of hydraulic magnetic circuit breakers for equipment

- Low life-cycle cost, due to resetting of the circuit breaker after a fault
- Close overload protection combined with a wide range of tripping characteristics, mounting, termination and actuation options that makes cost-effective design possible
- The wide range of mountings and actuator styles enable more ergonomic designs, improving customer satisfaction
- The ability to isolate and switch, as well as quick reset times enable easier fault finding and maintenance
- Very low or no replacement inventory compared to the use of fuses
- Robust, good quality products that will function in harsh environments for long, trouble-free operation
- A wide range of international approvals makes it easy to compete in international markets

AUSTRALIA

CBI-electric: Australia
90 Fairbank Road Clayton South
Melbourne Victoria 3169 Australia
Tel: + 61 39590 3500
Fax: +61 3 9551 1051
Email: headoffice@cbi-electric.com.au
Website: www.cbi-electric.com.au

SOUTH AFRICA

CBI-electric low voltage
Tripswitch Drive Elandsfontein
Gauteng South Africa
Tel: +27 11 928 2000
Fax: + 27 11 392 2354
Email: cbi@cbi-electric.com
Website: www.cbi-electric.com

USA

CBI-electric: North America
35E Uwchlan Ave Suite 328
Exton PA 19341 USA
Tel: +91 610 524 9949
Fax: +91 610 524 9945
E-mail: info@cbibreakers.com
Website: www.cbi-electric.com