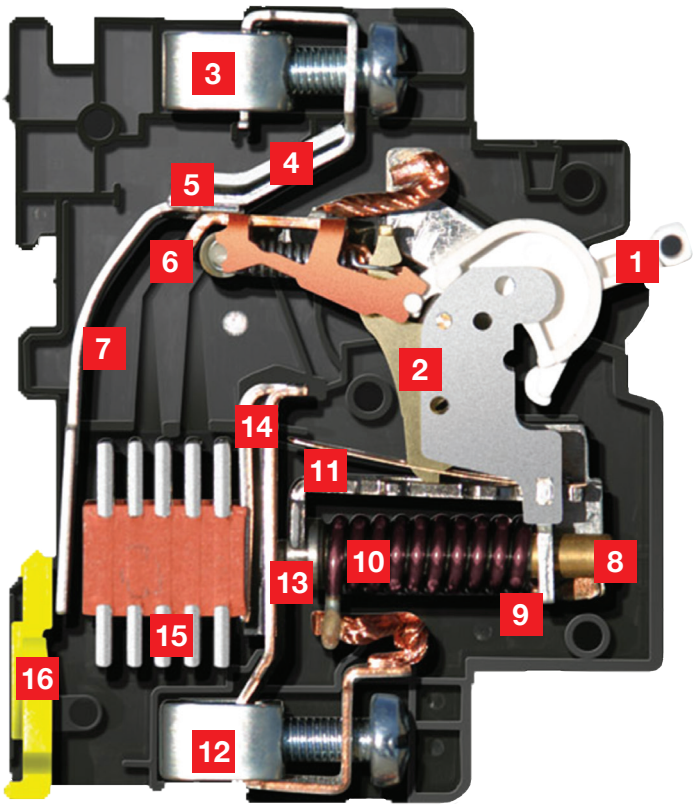
Features

Features of the Hydraulic-Magnetic Principle

- Circuit breakers can carry 100% of rated current independent of ambient temperature
- Do not require de-rating for 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
- Can mount a large number of circuit breakers side by side

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:** Materials meet or exceed the requirements laid down by international specifications for polymer materials to be used in circuit breaker applications, such as IEC 60947-2 and UL 489
- **Environmental Safety:** Ensures better safety properties for flammability, toxicity and isolation, ensure safety for users and the installation
- **Hermetically sealed sensing / time delay mechanism:** These ensure 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



Hydraulic-Magnetic Circuit Breaker

Circuit Breaker Components

1. Handle
2. Mechanism assembly
3. Line terminal
4. Fixed contact
5. Contact tips
6. Moving contact
7. Arc runner line side
8. Hermetically sealed tube
9. Magnetic frame
10. Solenoid coil
11. Armature
12. Load terminal
13. Pole piece
14. Arc runner load side
15. Arc grids
16. Clip-in springs

100% rated, unaffected by ambient temperature

Principle of Operation

Hydraulic-Magnetic Technology

Hydraulic-magnetic circuit breakers operate on the magnetic force produced by a load current flowing through a series-connected solenoid coil that is wound around a hermetically sealed tube containing an iron core, a spring and dampening fluid, as shown in Figure 1.

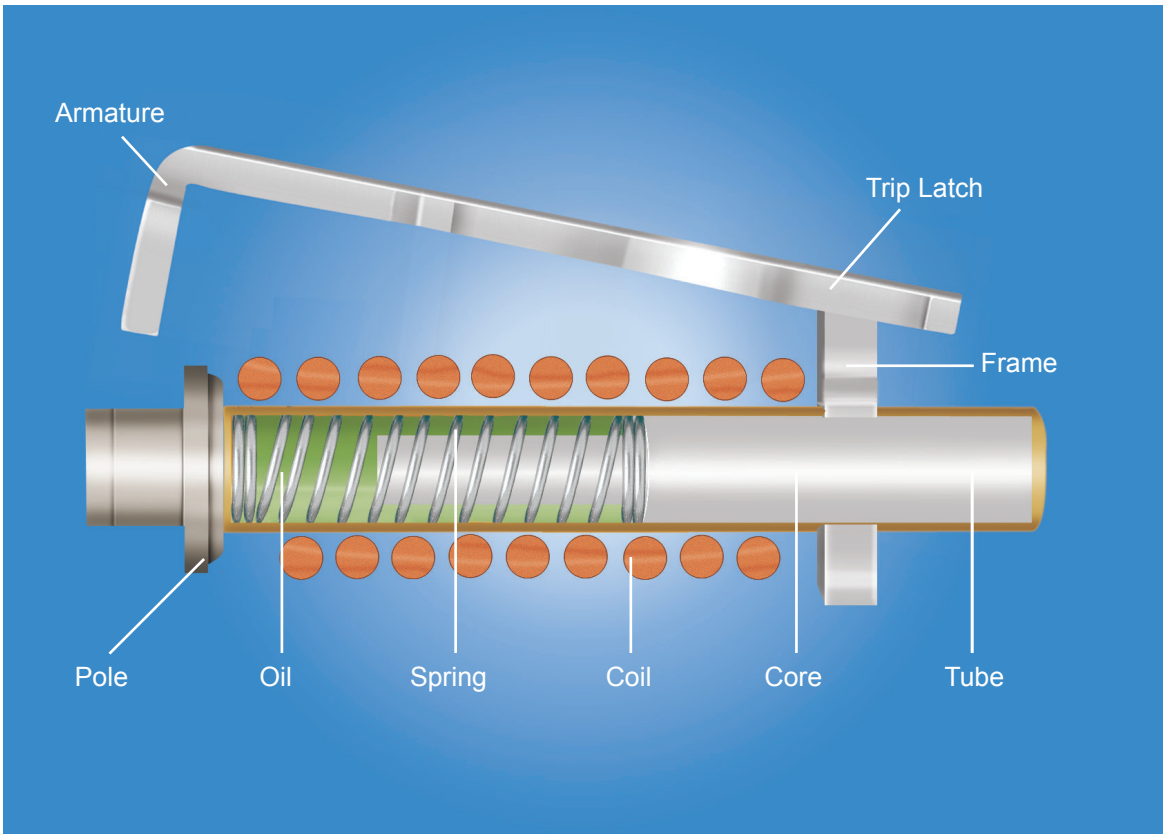


Figure 1: Series Connected Coil

Normal Operation

At the circuit breaker's rated current or below, the magnetic flux in the solenoid is insufficient to attract the core towards the pole piece, due to the spring force shown in Figure 2. Therefore the circuit breaker remains loaded and the circuit is energised.

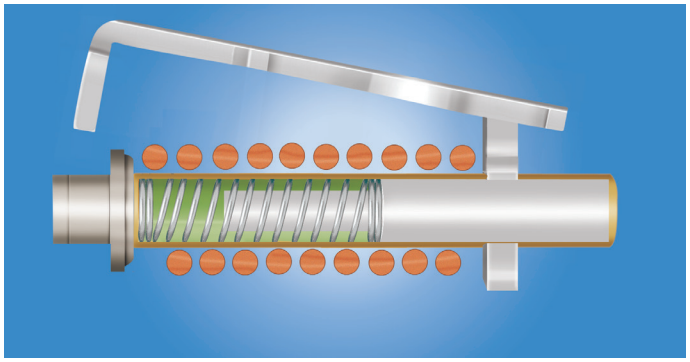


Figure 2: Rated Current or Less

Overload

When an overload occurs, i.e. current Is greater than the circuit breaker's rating, the magnetic flux in the solenoid produces sufficient pull on the core to start its movement towards the pole piece. During this movement, the hydraulic fluid regulates the core's speed of travel, creating a controlled time delay inversely proportional to the magnitude of the current. This time delay is useful in that if the overload is of short duration, e.g. start-up of motors etc., the core returns to its rest position when the overload disappears (Figure 3).

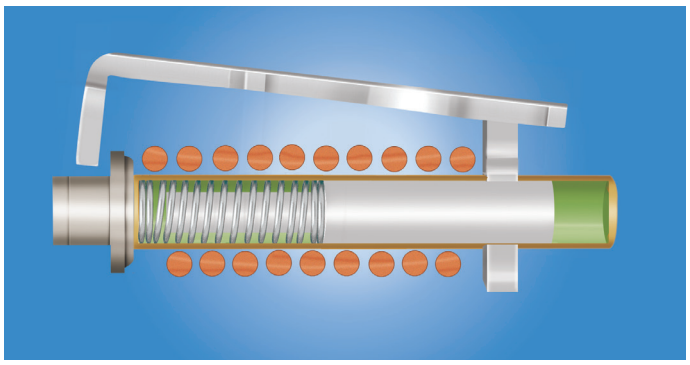


Figure 3: Overload Current (Time Delay)

If the overload persists, the core reaches the pole piece. As a result the reluctance of the magnetic circuit is reduced, so that the armature is attracted to the pole piece with sufficient force to collapse the latch mechanism (toggle), and trips the breaker (Figure 4). The contacts separate, the current ceases to flow and the core will then return to its rest position.

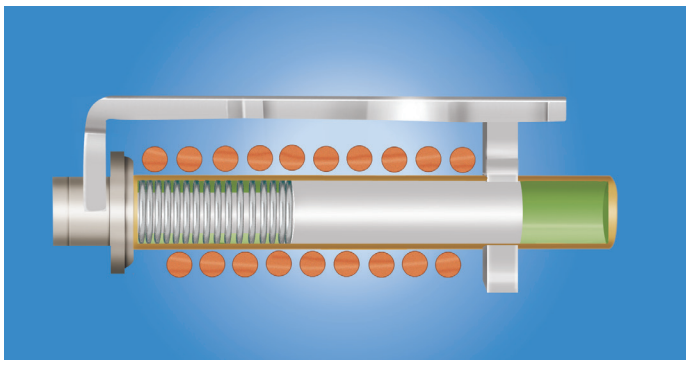


Figure 4: Overload Current (Trip)

Short Circuit

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 (Figure 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.

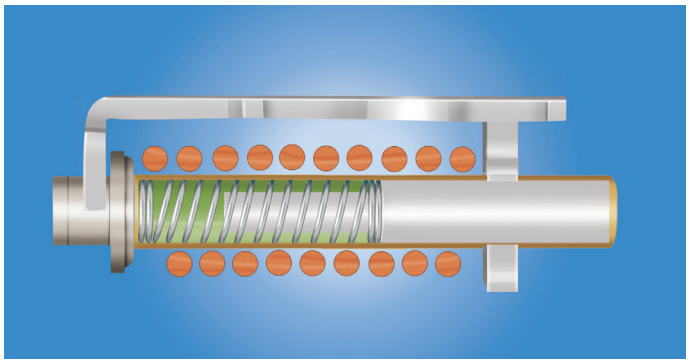


Figure 5: Instantaneous Trip

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