

Rough Environments Require Appropriate Selection of Circuit Breakers for Equipment

Features that should be taken into account when selecting an appropriate circuit breaker.

Thermal circuit breakers for equipment (CBE) protect engines and equipment against electrical overload and short circuits. Machine tools and construction equipment, for example concrete tampers, high-pressure cleaners, mobile generators, welding equipment and circular saws, require that the circuit breaker is suitable for the demanding operating environment. Conventional circuit breakers, with push-button operation, have limitations when it comes to these applications; therefore the equipment manufacturers search for solutions of a circuit breaker with the following features:

- Operable with gloves
- Modular design with 1-, 2-, 3-pole options
- Integrated function of a manual On/Off
- Positive trip-free mechanism
- Compact design
- Fast and safe connectivity
- Wide temperature range
- Wide range of current ratings
- Customer-specific designs in color, form and labeling
- Complete approval from VDE, cURus and CCC

What type of circuit breaker actuator is best suited for rough environments?

Very often industrial gloves are worn for operating machine tools and construction equipment. This means that the appropriate circuit breaker must be able to operate safely and quickly with gloves (fig. 1). In contrast to rocker or pushbutton actuators, which do not guarantee safe and quick operation with gloves, a rotary knob is optimal. As a matter of direct personal safety, it is therefore critical that a circuit breaker can be operated fast and reliably.



Fig. 1: Fast and reliable operation even with industrial gloves

Modular design

Increasingly, manufacturers offer modular circuit breaker designs to cover a broad spectrum of applications. This means that the same type of circuit breakers are available in single, double and triple pole versions, with the capability of being mounted in different panel thicknesses (fig. 2).



Fig. 2: Same type of circuit breaker design with different functionality

A well-developed circuit breaker offers variations in circuit protection, such as 1-, 2- or 3-poles to provide flexibility in design. These features accommodate a variety of application specifications. (figure 3).

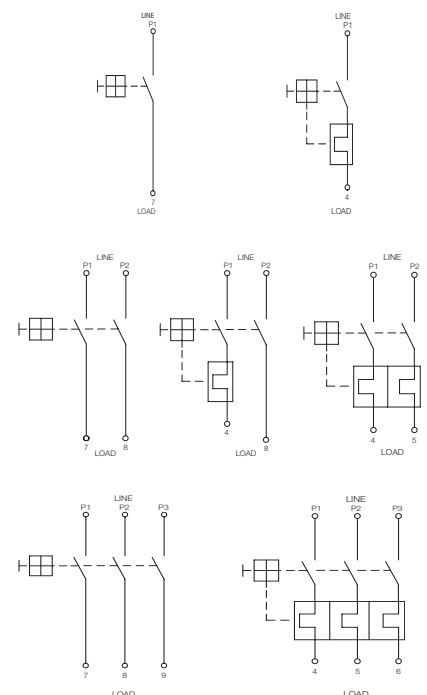


Fig. 3: Variants of protected and unprotected poles

Can be used as a manual On/Off switch

To keep manufacturing costs of the equipment as low as possible, and to reduce the number of components, the "On/Off" switching must be integrated into the overload and short circuit protection.

What is a positive trip-free mechanism?

If the circuit breaker trips due to overload or short circuit, then it must be switched manually to reset. With a positive trip-free mechanism the circuit breaker is designed mechanically in such a way that it cannot be manipulated to prevent the tripping of the circuit breaker, even with the use of adhesive tape or makeshift devices. Consequently, the positive trip-free mechanism cannot automatically re-switch, and guarantees the best possible protection of the operating personnel and the machine.

Compact design

Following the current megatrend of the electronics industry, namely "miniaturization", circuit breakers too must offer increasingly compact designs. Both of the requirements, including a unit that has the ability to operate with industrial gloves, and one that sports a compact design, appear to be opposite at first glance. However, the differentiation should be made between the actuating feature and the actual circuit breaker package. So, the rotary knob can be resized to enable a safe operation, while the circuit breaker itself remains compact, occupying minimum space in the equipment (figure 4).

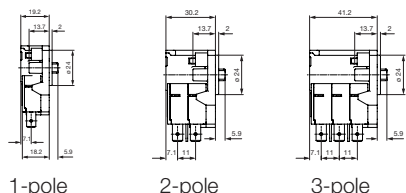


Fig. 4: Minimal space requirement thanks to compact design

Fast connectivity

The circuit breaker must provide a method of connection that is quick and safe. Faston terminals avoid tedious soldering when mounting and dismantling the circuit breaker. Making the connections with standard quick-connect terminals is not only fast, but safe. Additionally, quick connections allow for easy replacement of the unit in the "field".

Temperature range

There are potentially extreme temperatures, plus or minus in environments where machine tools and construction equipment operate. Construction machines are used at very low temperatures during winter and at very high temperatures during summer. Here the equipment manufacturer requires high reliability over a broad temperature range such as -30°C to +60°C.

Customer specific

The equipment manufacturer wants to have flexibility in design, and looks for circuit breaker manufacturers who provide various options such as form, color and labeling of the circuit breaker unit. Only a few manufacturers offer circuit breakers that can be customized according to specific requirements (figure 5).

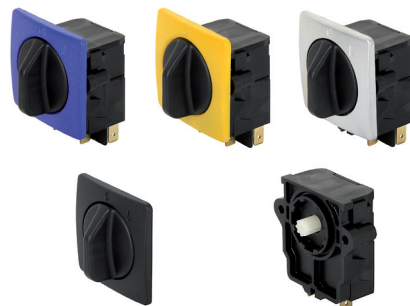


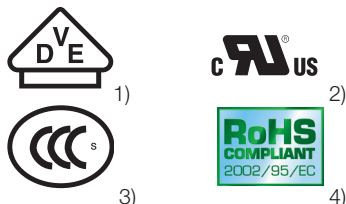
Fig. 5: Circuit breaker, customized according to specific equipment requirements

Wide range of rated currents

A wide range of rated currents ensures a broad spectrum of applications. Rated currents ranging from 0.05 A to 20 A offer significant advantage in that different equipment, with very low current requirements, can be fitted with the same type of circuit breaker. However, technically it means that the manufacturer must completely master the manufacturing process of direct and indirect heating of the bimetal, and be able to provide the current variations in the same housing.

Approvals

In a global environment, equipment is manufactured and potentially sold in all five continents. Consequently, this means that you and your equipment must have the appropriate approvals, which can be time consuming and cost intensive. Equipment manufacturers must look to circuit breaker manufacturers who carry all relevant component level approvals to shorten time-to-market and costs. For example, the TA35 marketed by Schurter is approved in accordance with IEC 60934, UL 1077, CSA C22.2 235 and GB 17701 and conforms to RoHS (figure 6).



- 1) IEC standard for Europe and Asia
- 2) UL standard for USA, Canada and Mexico
- 3) China standard
- 4) EU directive RoHS 2002/95/EC: "Restriction of the use of certain hazardous substances in electronic equipment"

Fig. 6: TA35 fulfills the appropriate international approvals

Conclusion

A circuit breaker, which is supposed to work safe and reliably even in the roughest environments, must possess the features necessary to meet these demands. The physical requirement of a "high temperature range" for example requires a large and finely tuned range of rated currents. On the other, hand a wide range rated currents is contradictory to compact design. A circuit breaker manufacturer who can fulfill all these requirements, and fulfills the required standards at the same time, must have immense know-how and decades of experience.

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