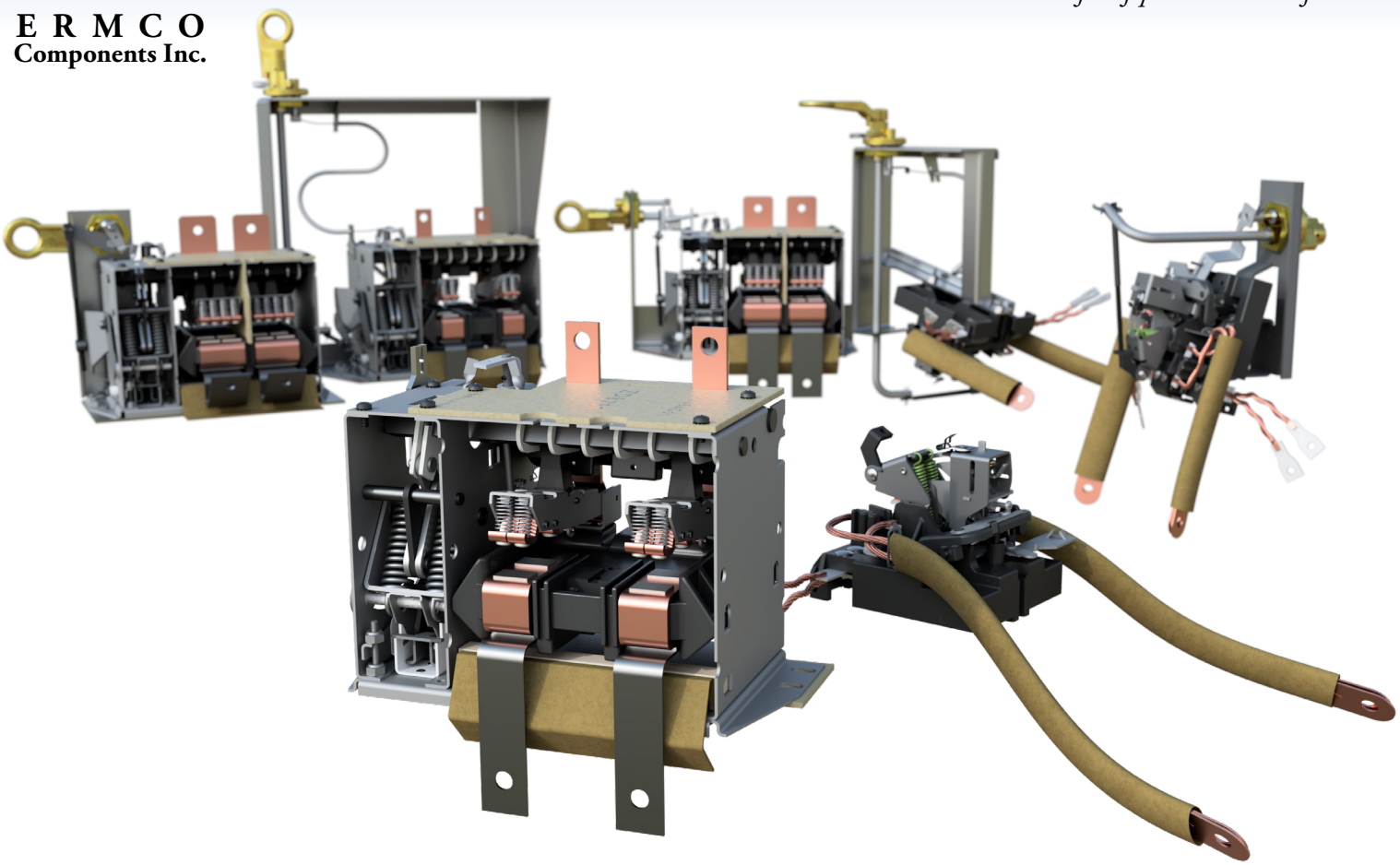
ERMCO
Components Inc.

Fact Sheet

Internal, Oil-Immersed Secondary Circuit Breakers

The Heart of Self-protected Transformers



BEYOND THE STANDARD

General Information

ECI internal oil-immersed secondary circuit breakers are designed for use as part of a protection package for either single or three-phase distribution transformers. The breaker is electrically located between the transformer's low voltage coil and the low voltage bushing to provide protection against overloads and secondary faults.

The normal load cycle of a distribution transformer is characterized by a relatively light load during the greater part of the day, with one or more peaks lasting from a few minutes to a few hours. This permits operation of the transformer at loads exceeding its continuous self-cooled rating during short peaks, since the heat storage capacity of the transformer results in a relatively slow increase of internal temperatures. Since the deteriorating effects of temperature are cumulative, it is possible to obtain satisfactory life from transformer insulation with peak temperatures exceeding those permitted for continuous loading if the duration of these temperatures is sufficiently restricted.

Transformers subjected to overloading or applied on lines without overload protection should be self-protected. Self-protected distribution transformers offer a complete, unified system of overload protection. The primary means of protecting the transformer is the circuit breaker, which is designed to give adequate protection from short circuits and severe overloads. Other protective equipment available from ECI includes internally mounted primary expulsion fuses.

For more information about Internal, Oil-Immersed Secondary Circuit Breakers, contact your Ermco Components representative or call (877) 267-1855

ECI internal oil-immersed, low-voltage secondary circuit breakers are available for distribution transformers rated 10-167 kVA with secondary voltages of 120/240 or 240/480 single-phase. Some transformers rated 25 kVA and all rated 37.5 kVA and above, single-phase, feature magnetic trip circuit breakers. Three-phase circuit breakers are available from 15-150 kVA at 480 volts and below, and from 45-300 kVA at 480 volts.

The circuit breaker is typically mounted inside the transformer tank, directly above the coil-and-core assembly. Operating linkage for the circuit breaker is brought out through the tank and connected to an external operating handle. On pad-mounted transformers, the circuit breaker operating handle is typically mounted in the low-voltage compartment. The circuit breaker operating handle (Figure 11) is equipped with a metal loop for operation with standard hook stick.

The secondary circuit breaker is tripped by the deflection of bimetallic elements in series with the low-voltage leads (Figure 16) heated by the combination of current in the bimetals and the temperature of the oil. As maximum safe operating load is approached, the bimetals deflect and trip the operating mechanism. That opens the contacts and disconnects the secondary load from the transformer, protecting the transformer from burnout. Positive mechanical interlock between the circuit-breaker poles assures simultaneous opening of all poles. If the operator tries to close the breaker while a fault exists on the line, the breaker will open even though the circuit-breaker operating handle is held in the closed position.

Magnetic trip circuit breakers offer improved performance in fuse coordination, fault-interrupting capability and, with the ECI T-12 circuit breaker, lower short-circuit forces in transformer windings. The magnetic trip circuit breaker follows the normal thermal time current characteristics (Figure 14) except when the secondary current exceeds 10-15 times rated load current. Under those circumstances, the magnetic trip takes over and bypasses the bimetal, causing immediate circuit-breaker trip by the activation of the magnetic trip plate. Figure 15 illustrates typical long-time operating characteristics of 15 and 25 kVA, 7,200-volt transformers, showing trip time for 75% initial load and 35°C ambient. Short-time, total-clearing, time-current characteristic curves are shown in (Figure 14).

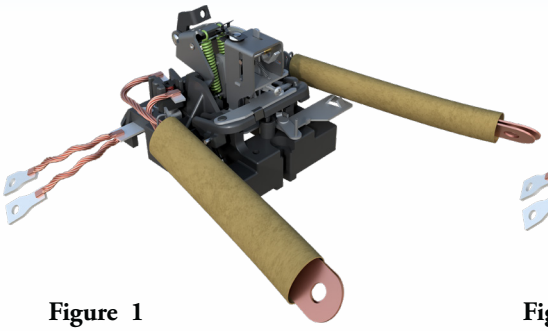


Figure 1

Type T-1 circuit breaker, thermal trip, single-phase, 10-25 kVA, 120/240 volts; 10-50 kVA, 240/480 volts.

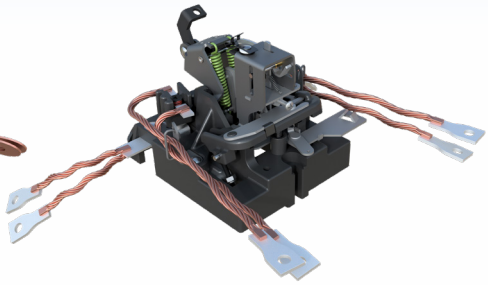


Figure 2

Type T-12 circuit breaker, thermal and magnetic trip, single-phase, 37.5-50 kVA, 120/240 volts; 75-100 kVA, 240/480 volts.

Features

- **Special contact material** to reduce arcing and eliminate the possibility of contacts welding in service.
- **High interrupting capability** to successfully clear bolted secondary faults without contacts welding.
- **Rigidly interlocking contacts** to give simultaneous interruption of both breaker circuit contacts

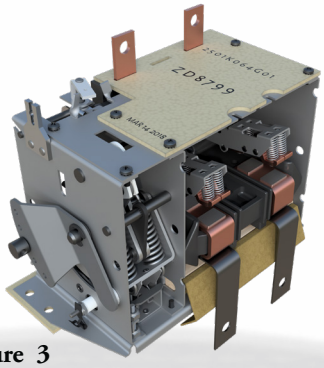


Figure 3

Type T-13 circuit breaker, thermal and magnetic trip, single-phase, 75-100 kVA, 120/240 volts; 167 kVA, 248/480 volts. Maximum short-circuit capability: 25,000 amps for five operations.

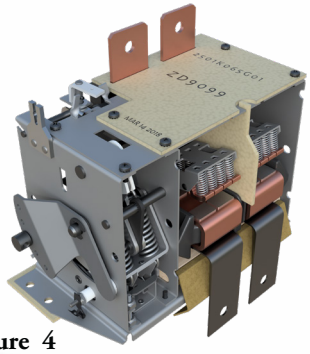


Figure 4

Type T-14 circuit breaker, thermal and magnetic trip, single-phase, 167 kVA, 120/240 volts. Maximum short-circuit capability: 30,000 amps for five operations.

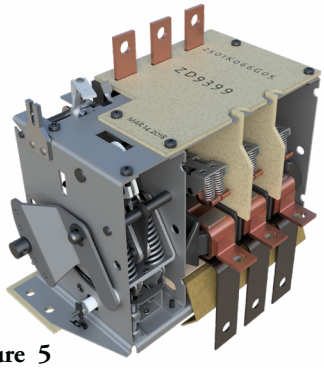


Figure 5

Type T-15 circuit breaker, thermal trip without magnetic trip, three-phase, 15-150 kVA, 480 volts and below: 45-300 kVA, 480 volts delta, 460Y/225 volts, 480Y/227 volts.

Breaker on Bracket

The breaker on bracket is a completely assembled breaker operating kit designed to provide the transformer manufacturer with simpler design and assembly as well as providing the utility customer a solution to the most common complaint associated with secondary breakers.

The breaker on bracket consists of a breaker mounted to a rigid steel bracket together with the operating handle and linkage. The package comes completely assembled and adjusted from the factory. One catalog number covers everything, no other components required. When a signal light is used with any given breaker, it will need to be ordered separately. In addition, the light will require a separate hole in the transformer tank wall. Refer to the signal light bulletin A4-9 for further details.

Installation in the transformer is simple and quick. The breaker and bracket is secured to the tank interior by means of the operating handle that passes through the tank wall. The bracket is designed to rigidly mount the breaker in a fixed position relative to the operating handle. This assembly eliminates the engineering effort to layout the transformer interior to insure the breaker is properly positioned. It also eliminates the time spent adjusting the breaker linkage on the transformer assembly line because these adjustments are set at the breaker factory.

An improperly adjusted link may result in an inoperable breaker when the utility customer receives the transformer. This problem can be accentuated if the breaker is mounted to a surface such as a flat tank wall of a pad-mounted transformer that can flex and change the distance between the operating handle. The breaker on bracket provides a solution to these assembly issues because the linkage connecting the breaker with the operating arm is factory adjusted by trained breaker technicians and locked in place before the breaker assembly is shipped to the transformer manufacture.

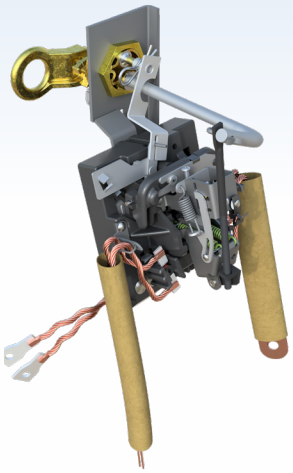


Figure 6

Type T-1 & T-12 circuit breaker on bracket for rigidly mounting on flat or curved surface.

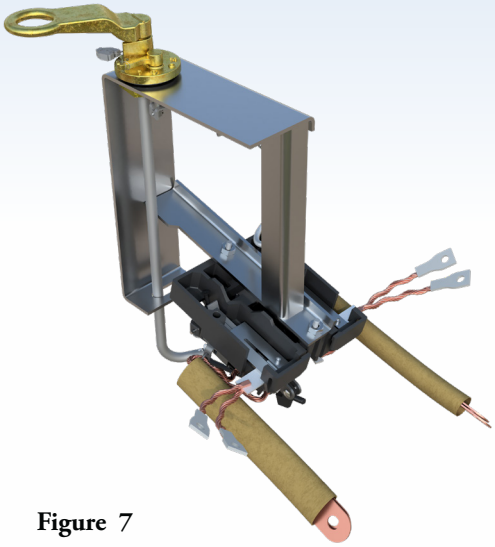


Figure 7

Type T-1 & T-12 circuit breaker on submersible bracket for rigidly mounting on transformer lid.

Features

- **Preadjusted** - No linkage adjustments are required by the transformer manufacturer.
- **Order as a complete kit** - One catalog number supplies the breaker, bracket, linkage and operating handle.
- **Rigid mounting brackets** - eleminates misalignment.

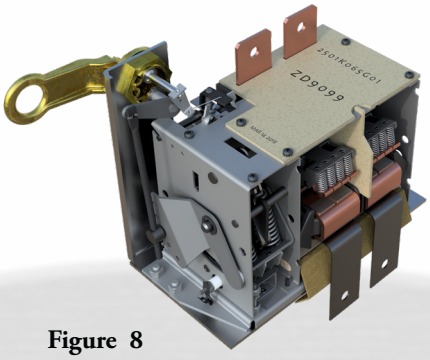


Figure 8

Type T-13 / T-14 / T-15 circuit breaker on bracket for rigidly mounting on flat surface.

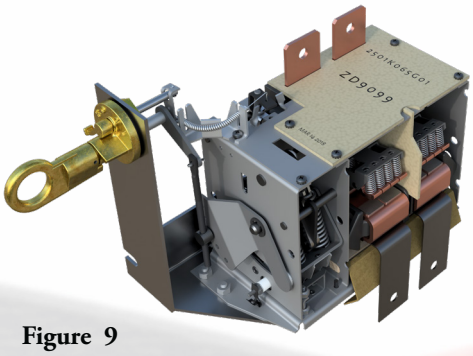


Figure 9

Type T-13 / T-14 / T-15 circuit breaker on bracket for rigidly mounting on curved surface.

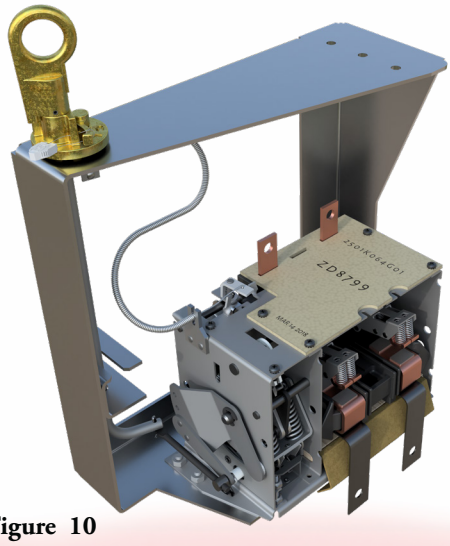


Figure 10

Type T-13 / T-14 / T-15 circuit breaker on submersible bracket for rigidly mounting on transformer lid.

THE FINEST AVAILABLE

ERMCO Components secondary circuit breakers are the finest manufactured for the protection of overhead and underground distribution transformers. They ensure fast, precise tripping in the event of an overload and provide proven reliable operation with high interrupting capability.

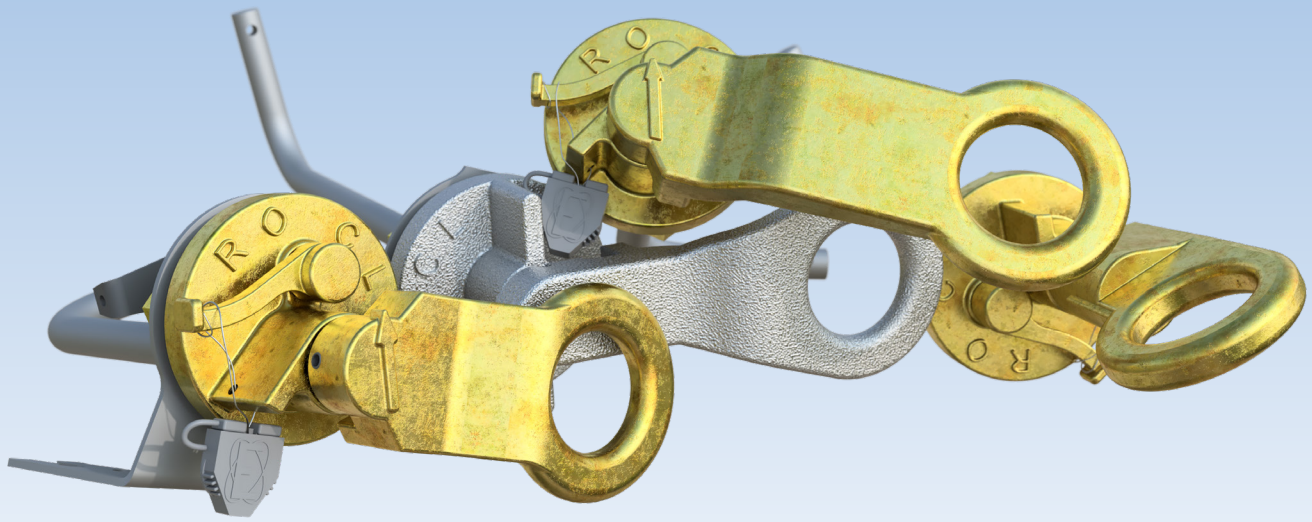


Figure 11
Circuit-Breaker Operating Handles

Figure 11 shows the operating handles and emergency overload lever. The standard operation to open the low-voltage circuit manually, move the handle so the pointer moves from "C" (Closed) to "O" (Open). When the pointer coincides with the "O" position, the low-voltage circuit is open. To close the breaker, move the handle to the position "C" (Closed). If the breaker has tripped thermally or magnetically, move the handle to position "R" (Reset) to engage the latch mechanism, then to "C" (Closed). The "L" (Light) position is not used on a pad-mounted transformer. If desired, the breaker operating handle can be operated with a switch hook.

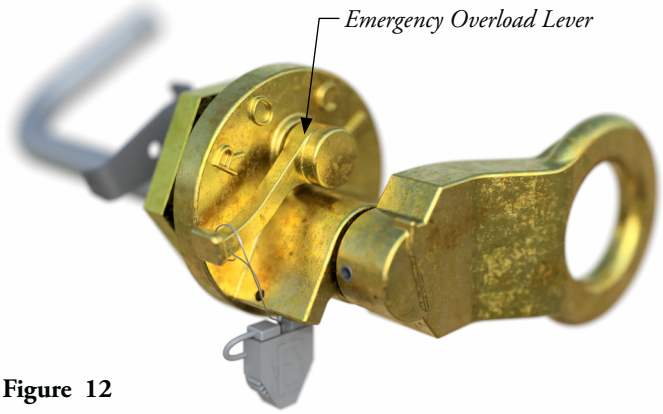


Figure 12
Emergency Overload Lever

Through the use of the emergency overload lever, self-protected transformers are able to carry overloads in excess of those normally permitted by the circuit breakers (Figure 15). The lever, mounted on the circuit-breaker operating handle, can be moved to permit change from normal to emergency overload setting. If a transformer circuit-breaker has tripped and the bimetals are still at trip temperature, the use of the emergency overload lever may allow the operator to close the circuit-breaker to restore service.

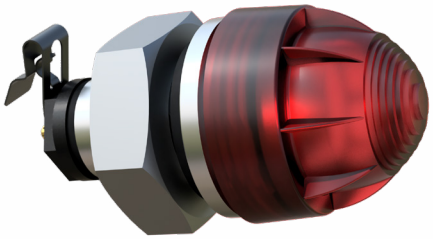


Figure 13
Signal Light

One of the features of the self-protected pole-type transformers is the signal light (Figure 13). The switch in the signal-light circuit is an integral part of the circuit breaker. The switch reacts to the degree of loading in precisely the same manner as the circuit-breaker. When the transformer is thermally overloaded, the signal light will light, serving as visual evidence that an unusual overload has occurred on the transformer. In this way, the signal light serves as a continuous load-survey device on each individual transformer. Light characteristics for 15 and 25 kVA units are shown in (Figure 15). This light will remain on until reset by the circuit-breaker operating handle. Provision is also made to check the signal light bulb when the transformer is in service. Rotating the circuit-breaker operating handle to beyond the closed position should cause the signal light to come on. If it does not, the bulb should be replaced.

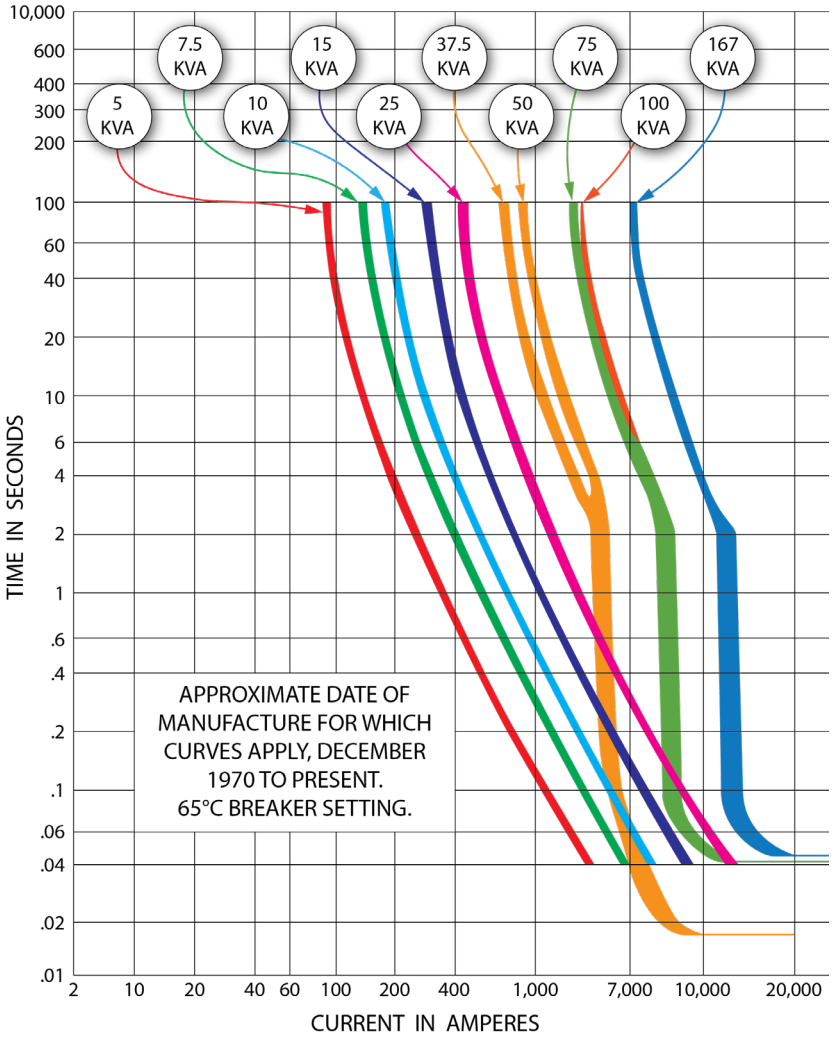


Figure 14

Typical short-time, total clearing, time-current characteristics (25°C, no initial load) for circuit breakers in single-phase transformers at 240 volts.

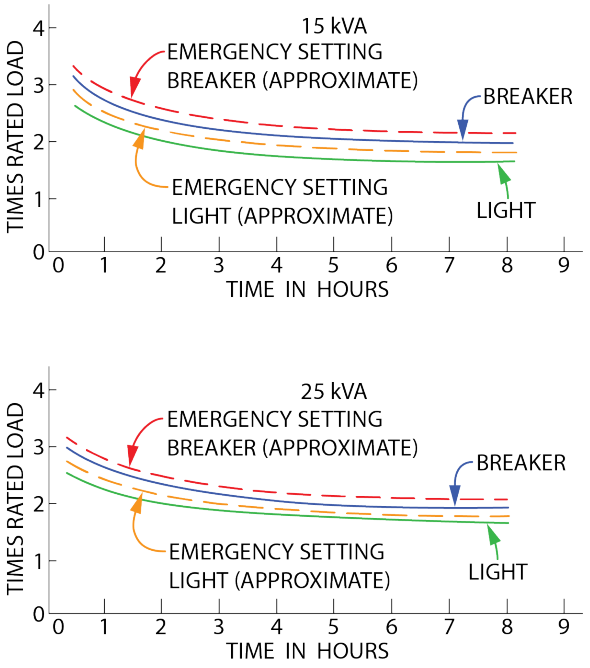


Figure 15

Typical performance curves for 12470 GRDY/7200 transformer. Circuit-breaker trip timeis for 75% initial load and 35° ambient.

For circuit breaker curves ask for:

GES-6301 (single-phase)

GES-6300 (three-phase)

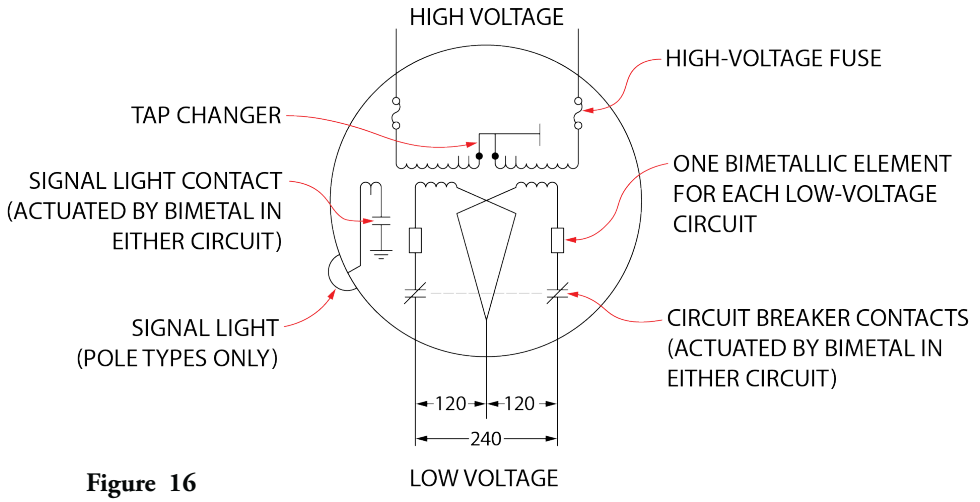


Figure 16

10-100 kVA connection diagram.

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