Understanding Type F RCCBs

As electrical installations evolve particularly with the rise of variable-speed drives, inverter-based appliances, and complex electronic loads the traditional Type AC and Type A RCCBs are no longer sufficient in all scenarios. This is where Type F RCCBs enter the picture.

Why Type F Exists: The Problem with Modern Loads

Today's single phase appliances incorporating energy efficiency rely on complex electronics to control motor speed. These systems produce complex (composite) residual currents containing multiple frequency components resulting from the mains, inverter and motor.

Type A RCDs are not designed to detect composite residual currents.

Type F are designed for use in single phase inverter applications that do not require the complexity of Type B RCDs

What Is a Type F RCCB?

Type F RCCBs are specifically designed to detect composite residual currents – see Regulation 531.3.3 (iii)(a) i.e. the behaviour of the RCD is defined, its tripping characteristic is not random, as may be the case with Type A RCDs subjected to different frequencies.

Detecting Composite Residual Currents

In addition to the requirements of EN 61008 or EN 61009 for Type A currents, Type F must also meet EN 62423: Composite residual current containing three frequency components, based on the rated residual operating current $I\Delta n$ of the RCD and its rated frequency.

Type F responds to: Pure AC residual currents, Pulsating DC residual currents, Mixed frequency residual current from 10Hz to 1kHz. Maximum Smooth DC components up to 10 mA

Where Type F RCCBs Should Be Used

Type F is recommended for circuits supplying: Washing machines with single phase inverter motors, small wall mounted Heat pumps and Air conditioning units. Tumble dryers, Dishwashers and LED lighting.

Other common applications using single phase inverters, pumps, tools, battery charging. Mode 3 Charging of certain vehicles may require Type F.

Operational leakage currents and residual currents associated with circuits containing non – linear loads i.e. current drawn is not proportional to the supply voltage, will

consist of mixed frequency components creating a composite residual current - see Figure 1.

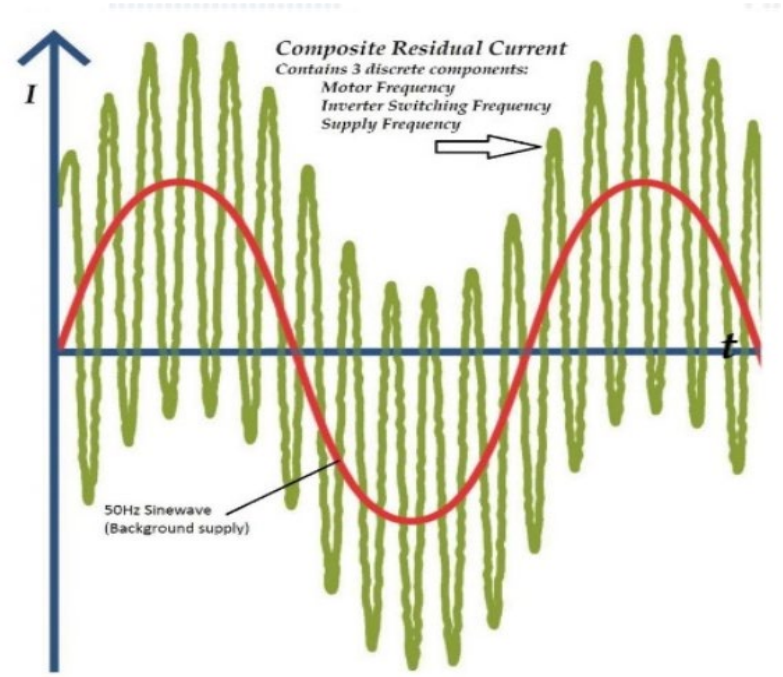


Fig 1. Current drawn is not proportional to the supply voltage

Type F Detection Technology

Manufactures use various detection systems. The Doepke Type F uses a sophisticated, patented electronics system, powered from the energy within the summation current transformer, generated by the residual current. Therefore, the residual current circuit-breaker works independent of supply voltage for the detection of Type A and Type F residual currents.

Conclusion

Modern day appliances under fault conditions produce complex composite residual currents. This requires more sophisticated protection in the form of a type F RCCB to EN 61008 and EN 62423.

You should always check the equipment manufactures instructions, as some single-phase inverters require the use of Type B RCDs. This is due to the individual inverter design frequency characteristics and the level of smooth DC residual current produced under certain fault conditions.

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