

Understanding Industrial Fuses

Types, Protections, and UL Standards

Industrial power fuses play a critical role in electrical systems, providing reliable overcurrent protection that prevents equipment damage, fire hazards, and system failures. Choosing the right fuse depends on the specific application, performance requirements, and relevant safety standards like UL certifications.

In this article, we explore key aspects of **industrial fuses**, including the differences between supplementary and branch protection, current limiting characteristics, fuse response types, UL classifications, and more.



Supplementary, Branch, and Main Feeder Protection

When selecting the right industrial fuse, it's essential to understand the three core levels of circuit protection: **Supplementary, Branch, and Main Feeder**. Each plays a distinct role in safeguarding electrical systems and components.

■ **Supplementary Circuit Protection:**

Supplementary protection fuses are designed to protect individual components within a device or panel. These are not intended to protect the branch circuit wiring but instead serve as a second layer of defense for specific loads such as motors, transformers, or sensitive electronics.

Supplementary fuses are ideal for applications where component-level isolation is critical, especially in control panels or electronic equipment.

■ **Branch Circuit Protection:**

Branch circuit protection fuses are intended to protect the wiring and connected equipment in a branch circuit from overcurrent conditions. They serve as primary protection and are required to meet stricter interrupting ratings and safety standards.

This type of protection is often used for protecting individual loads fed from a main panel. This fuse should be coordinated with the main feeder fuse to provide selective coordination protection.

Common fuse classes for branch protection include Class CC, Class J, Class RK5, and Class T.

■ **Main Feeder Circuit Protection:**

Main feeder protection is used to safeguard the entire electrical system or panel, typically at the main service entrance or distribution board. These fuses must also meet rigorous safety and interrupting standards but differ from branch protection by their higher current ratings and broader system coverage.

Due to their high amperage ratings, Class CC fuses (which max out at 30A) are not suitable for feeder protection. Instead, larger fuse classes such as Class J, Class T, or Class RK5 are typically used.

The Role of Current Limiting in Overcurrent Protection

Current limiting fuses are specially designed industrial fuses that open the circuit before the fault current reaches its peak during overcurrent or short-circuit conditions. By minimizing the let-through energy (I^2t), these fuses significantly reduce thermal and mechanical stress on electrical equipment, enhancing system safety and preventing costly damage. Current limiting fuses are essential components in protecting motors, transformers, and sensitive devices in **industrial and commercial electrical systems**.

Response Time: Fast-Acting vs. Time-Delay

The right fuse response time depends on your application. Choosing between fast-acting and time-delay fuses ensures optimal performance and reduces unnecessary downtime.

Fast-Acting Fuses

Fast-acting fuses are designed to respond quickly to overloads and short-circuit faults. These industrial fuses are commonly used to protect sensitive equipment that cannot tolerate dangerous inrush current or sudden power surges.

Time-Delay Fuses

Time-delay fuses react quickly to short-circuit faults but feature a built-in delay mechanism to allow temporary inrush currents—common in motors, transformers, and inductive loads—to pass without blowing. This delay prevents nuisance trips while still providing reliable overcurrent protection.

5 Key Industrial Fuse Types by OptiFuse

OptiFuse offers five main classes of UL-listed industrial fuses, each designed to provide reliable protection tailored to specific applications and electrical requirements.

■ Midget Fuses:

Midget fuses are industrial fuses tested to the **UL 248-14** standards, ensuring safety and performance in a variety of applications. They are available in both fast-acting and time-delay styles.

- Fast-acting midget fuses are commonly used in control panels and lighting circuits where quick interruption of faults is critical to protect sensitive electronics.
- Time-delay midget fuses are designed to handle temporary inrush currents and are often used in motor control transformers and circuits with designed power surges.

Midget fuses primarily provide supplementary circuit protection for individual components within electrical devices.



■ **Class CC Fuses:**

Class CC fuses are tested to the **UL 248-4** standards. These fuses are rated for branch circuit and are offered with both fast-acting and time-delay styles.

- The fast-acting versions are often used in control panels, lighting circuits, and control transformer circuits where a fast-acting trip speed is required.
- The time-delay versions are often used for protection of motor branch circuits and power control transformers.



■ **Class T Fuses:**

Class T fuses are tested to **UL 248-15** and designed for branch circuit protection, with higher amperage models often used in main feeder circuit protection. They feature a fast-acting response and are known for their high current-limiting capabilities and compact, low-profile design. Class T fuses are popular for battery and inverter protection in the marine and RV industries. In the industrial industry, these fuses are often seen in load centers, panelboards, switch boards, metering centers, and variable load drives.



■ **Class J Fuses:**

Class J fuses are tested to **UL 248-8**. These fuses are rated for branch circuit protection and higher amperage models are often used as main feeder circuit protection. They are offered in both fast-acting and time-delay styles.

- Common applications for the time-delay versions include motor circuits, feeders, lighting, heating, transformers, control panels, and load centers.
- The fast-acting versions are often used in load centers, lighting, heating, feeder circuits, capacitors, and panelboards.



T6J

■ **Class RK5 Fuses:**

Class RK5 fuses are tested to **UL 248-12** standards. These fuses are rated for branch circuit protection and higher amperage models are often used as main feeder circuit protection. These fuses are offered in a time-delay style and are often used for motor overload protection in industrial equipment, air conditioning units, pumps, and other motor driven machinery.

Note: OptiFuse Class RK5 fuses do not reach the higher amperage ratings and typically are not recommended for main feeder protection. For assistance with sizing fuses to protect your system, please consult a qualified electrical engineer.



TRK5-NR

Outside of the standard offerings listed above, other common industrial fuse types include class RK1, Class K, Class L, Class G and additional versions of the Class RK5 fuses.

A complete breakdown of all OptiFuse industrial fuse offerings is shown below in the table below:

Operation Class	Part Number	Trip Speed	Current Limiting	Voltage Rating	Amperage Rating	Interrupting Rating	Protection Type
Midget	FPK	Fast-Acting	No	600VAC; 600VDC	1A~30A	100kA @ 600VAC; 10kA @ 600VDC	Supplementary Protection
Midget	TPK	Time-Delay	No	500VAC	500mA~30A	10kA @ 500VAC	Supplementary Protection
Class CC	FPK-R	Fast-Acting	Yes	600VAC; 300VDC	1A~30A	200kA @ 600VAC; 20kA @ 300VDC	Branch Protection
Class CC	TPK-R	Time-Delay	Yes	600VAC; 600VDC; 300VDC	100mA~30A	200kA @ 600VAC; 50kA @ 600VDC; 10kA @ 300VDC	Branch Protection
Class T	F3T	Fast-Acting	Yes	300VAC; 160VDC	1A~1200A	200kA @ 300VAC; 50kA @ 160VAC	Branch Protection; Main Feeder Protection
Class T	F6T	Fast-Acting	Yes	600VAC; 300VDC	1A~800A	200kA @ 600VAC; 50kA @ 300VDC	Branch Protection; Main Feeder Protection
Class J	F6J	Fast-Acting	Yes	600VAC; 500VDC	1A~600A	200kA @ 600VAC; 100kA @ 500VDC	Branch Protection; Main Feeder Protection
Class J	T6J	Time-Delay	Yes	600VAC; 500VDC	1A~600A	200kA @ 600VAC; 100kA @ 500VDC	Branch Protection; Main Feeder Protection
Class RK5	TRK5-NR	Time-Delay	Yes	250VAC; 150VDC	10A~60A	200kA @ 250VAC; 50kA @ 150VDC	Branch Protection; Main Feeder Protection