

Fused Disconnect Switch vs. Circuit Breakers

Understanding the Differences

Introduction

Adding extra strain to any person or object can be a recipe for disaster. This is especially the case for electrical circuits.

When they're tasked with carrying more current than they were designed to handle, the added burden can lead to detrimental and dangerous circumstances.

Not only could overloading your circuits damage or destroy your sensitive electronic equipment, but it could also generate extra heat in wires that weren't meant to carry the load. If this happens, it can cause a fire in a matter of seconds. This is where an overcurrent protection device, such as a fused disconnect switch or a circuit breaker, comes in.

Though they serve a similar purpose, these two components each have a unique design. Today, we're sharing how they work and how to choose the right one for your project.

Ready to learn more? Let's dive in.

How Circuit Protection Devices Work?

The field of circuit protection technology is vast, designed to prevent circuits from risks associated with overvoltage, overcurrent, reverse-bias, electrostatic-discharge (ESD) and overtemperature events. Such risks include:

- High-voltage transients
- Capacitive coupling
- Inductive kickback
- Ground faults
- High inrush currents

From your smartphone battery to your steering wheel, these components are necessary to ensure safe and reliable electronics.

While they all serve a valuable purpose, we're delving deeper today into the specific field of overcurrent protection.

Overcurrent protection devices are designed to disconnect or open a circuit quickly in the event that an overload or short-circuit occurs. This helps to mitigate any damage to the connected equipment and can also reduce the risk of electrical fires.

The two most common products in this category are fused disconnect switches and circuit breakers. While there are some applications in which these two parts can work interchangeably, most applications will require one over another.

What is a Disconnect Switch?

Also known as a load-break switch or a safety switch, a disconnect switch protects against electrical emergencies or equipment inconsistencies at your facility. As such, [the National Electric Code](#) (NEC) mandates that some applications require them.

In the event that there's an issue with your location's power supply, the switch will shut down and cut off power in under one second, preventing such dangers as short circuits, surges, and overloads. You can also use a disconnect switch to repair, maintain or inspect equipment during a lockout.

Fused vs. Non-Fused Disconnect Switches

You'll find disconnect switches in both fused and un-fused (non-fusible) varieties. While both are reliable ways to open and close circuits, [non-fusible switches](#) are often reserved for simpler, lower-load equipment.

On the other hand, if you're handling equipment with a heavier load, a fused disconnect switch often works best. This is because it includes multiple fuses that can provide an extra layer of protection against overcurrents and any other electrical mishaps that could occur.

In the event of an overcurrent, a fused disconnect switch works by incorporating two main components:

- A switch that disconnects the circuit
- A fuse that shuts the circuit off

How do the two work together?

The switch allows the user to manually shut off the power during times of installation or maintenance on the circuit or its equipment. Then, in the event of an electrical problem, the fuse comes into play.

It features a small filament matched to the circuit's current rating. If the amperage on the circuit grows higher than the fuse's rating for a set amount of time, the filament melts. When this happens, it disconnects the circuit in an automatic and permanent manner.

When the risk passes and you're ready to restore power to your operation, you'll replace the fuse to do so.

Standard vs. Slow-Burning Fuses

Note that the fuses for fused disconnect switches vary in size and rating. If your application requires a quick reaction to overcurrent situations, a standard fuse will work, as it breaks the circuit almost immediately.

However, you may need a fuse that can tolerate a high current for a short interval, such as the in-rush current that motors generate upon startup. Here, a slow-burning fuse works best, as it takes longer for the current to trigger a circuit breakage.



c3controls Non-Fused
Disconnect Switch



Fused Disconnect Switch

How Does a Circuit Breaker Work?

Like a fused disconnect switch, a circuit breaker also helps in the event of an electrical overcurrent. Yet, the way it does so is different.

Inside of each breaker, you'll find a spring that's hooked over a meltable, fusible alloy known as solder. Each individual breaker connects to an electrical wire running throughout your facility.

As electricity flows, it travels through the solder. If any connected wire becomes at risk of overheating, the solder will melt. As it does, the spring beneath it extends through the solder and pulls the switch off, shutting down that specific circuit.

Unlike a fuse, which you'll need to replace with every activation, you don't have to replace the alloy. Instead, you'll give it time to cool down, and then you can reset it by switching it back to the "on" position.

When you're installing or maintaining the circuit breaker, you can manually turn it off to do so, similar to using the switch component of the fused disconnect switch.



c3controls Miniature Circuit Breaker
3 Pole + Neutral

Pros and Cons of Each Option

Both fused disconnect switches and circuit breakers work to protect your circuit from an overcurrent situation. As such, you'll need to weigh the pros and cons of each to determine which one is the best fit for your specific application.

To that end, let's review a few of the benefits and drawbacks of each.

Pros of a Fused Disconnect Switch

One of the main reasons that electrical professionals choose a fused disconnect switch is for cost alone. Compared to an enclosed circuit protector, these are often more affordable while still getting the job done.

Though you'll have to replace them every time they blow, the idea is that if your circuit is designed in the correct way, you won't have to do so often. Thus, the one-time cost can be less expensive than its circuit breaker counterpart.

In addition, most fused disconnects are easy to install, featuring simple mechanics. Their wires usually connect with integral terminal blocks resembling screws. From there, you can attach most models to a utility panel using only a few bolts.

These components also offer improved electrical flexibility over circuit breakers. This makes them especially advantageous when you're working with unique circuits. While you can closely estimate the current requirements for most modern circuit designs, there are myriad scenarios that could cause the original fuse to blow.

If this happens, users can change out the selected fuse for a unit that's more appropriate to the application. For instance, consider a motor that has a high surge (power-up) current. While the original fuse specified might work well during the "run" current, it could blow every time a user energizes the circuit.

In this case, a technician can use a fuse set to fix the issue with a couple of new fuses at little cost. In place of the original fuses, he'll install time-delay or slow-burning fuses that carry the same current rating, correcting the issue in an instant.

Cons of a Disconnect Switch

What happens if you're working with an older, outdated system or one that's in need of repair?

You might find that you're blowing fuses on a regular basis, making their initial low cost not so economical anymore. In addition, you'll pay for the labor required to install the new one, and your business could suffer pricey downtime in the interim.

Similar to a circuit breaker, a disconnect switch is normally enclosed in a steel enclosure. The NEC requires that installers mount [UL-listed cam-type outlets](#) on an aluminum panel at the bottom of each enclosure. This serves to eliminate the [risk of hysteresis](#).

Still, another risk is present in that every time an electrician opens the enclosure, he's exposed to a live circuit. This means that when it's time to change out a blown fuse for a new one, the electrician must practice caution and use a set of insulated fuse pullers to do so. Most integral fuse sets include power disconnects that are designed to eliminate this hazard.

Pros of a Circuit Breaker

If your utility panel is short on space, most circuit breakers are smaller than their fused alternatives. Still, the main advantage of a circuit breaker is that it's easier to reset after a power failure occurs. Rather than waiting to purchase and install a new fuse, you only have to wait for the system to cool down before switching it back on.

A circuit breaker can also double as a power disconnect in many applications. Especially if you're working with equipment that requires regular service, this can be a convenient feature. In these cases, you can even find breakers that include [lockout/tagout facilities](#).

Another appeal of circuit breakers is that they are inherently safe, as their electrical connections are usually stored behind a protective panel. This eliminates the possibility of user electrocution, which is especially valuable in situations where non-electrical teams are tasked with servicing the equipment.

Finally, most circuit breakers come equipped with a visual indicator that alerts users when they've tripped. This tool can reduce diagnostic time and help you get straight to the source of the electrical issue. If you find it difficult to remember to check fuses, this can be an important benefit.

Cons of a Circuit Breaker

A well-designed and frequently-used circuit shouldn't trip on a regular basis. If yours is doing so, that's a clear indicator that there's an issue with the circuit itself.

Thus, though it may be more convenient to reset your breaker every time an overcurrent occurs, this could be postponing and offsetting the true issue. In most cases, the circuit will require an extensive (and expensive) correction or redesign.

In addition, circuit breakers don't include as high a level of electrical flexibility as fused disconnect switches. This makes adaptation a more time-consuming, laborious and costly step.

Using the high-surge motor example above, an electrician would have to remove and replace the breaker with a new unit that featured a condition-appropriate rating, rather than replace a few fuses.

Which One to Use for Your Application

Fused disconnect switches often work best in circuits that have extreme, high currents, as the fuse guarantees that the circuit will disconnect in the event of a problem.

With the exception of high-current situations, most modern breakers can serve the same purpose and be used for the same application. They provide a convenient alternative to fused disconnect switches, as they don't include fuses to replace.

One of the most common scenarios in which a circuit breaker is preferable is when you're working with [three-phase circuits](#). In this case, the breaker can provide a simpler solution than a fused disconnect switch could.

Either way, it's best to speak to an electrical professional if there are any questions about which component will work best for your facility or application.

The Disconnect Switch vs. Circuit Breaker Dilemma

In electrical design, circuit protection is a critical consideration that you cannot overlook.

Both a fused disconnect switch and a circuit breaker can be valuable resources in this regard, safeguarding your equipment against the dangers associated with short-circuit or overcurrent.

When deciding between the two, keep the pros and cons in mind, and also consider the unique requirements of your specific application. In addition, you'll need to factor in manufacturing costs, purchase price, space constraints and service requirements.

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