



MINIATURE CIRCUIT BREAKERS

UL489 VS UL1077 GUIDE

Introduction

When should you use UL489 vs UL1077 breakers be used in panels or equipment? For OEM machine builders and control panel builders, this is a common question that often arises. While the answer appears straightforward, simple questions like these can lead to confusion.

Ensuring compliance with required standards is crucial. The following information aims to provide clarity on the standards that must be met and how to achieve compliance.

The primary role of a circuit breaker is to protect circuits and their components from overload (thermal) and short-circuit (magnetic) conditions. Similar to an airbag in a car, a circuit breaker interrupts current flow upon detecting a fault, safeguarding both equipment and personnel.

Without circuit breakers, equipment like motors would be vulnerable to damage from short circuits, leading to costly repairs, component replacements, and operational downtime.

What is UL489 and UL1077?

UL489

UL489 circuit breakers are designed for installation within circuit breaker enclosures or as components of other devices like service entrance equipment and panelboards. They are typically mandated in panel designs according to the National Electrical Code.

UL1077

UL1077 defines supplementary protectors as devices intended for overcurrent, over-voltage, or under-voltage protection within appliances or electrical equipment where branch-circuit overvoltage protection is either provided separately or unnecessary.

Key Distinction:

While both UL489 and UL1077 devices are commonly referred to as circuit breakers, UL1077 devices are categorized as Supplementary Protectors by UL and not as Circuit Breakers.

UL Standards Comparison – UL489 vs UL1077

Under UL services, low-voltage air circuit breakers, molded-case circuit breakers, and miniature circuit breakers undergo evaluation and “Listing” to UL 489 as standalone products.

In contrast, devices “Recognized” under UL 1077 as Supplementary Protectors are evaluated solely for integration as components within “Listed” products.

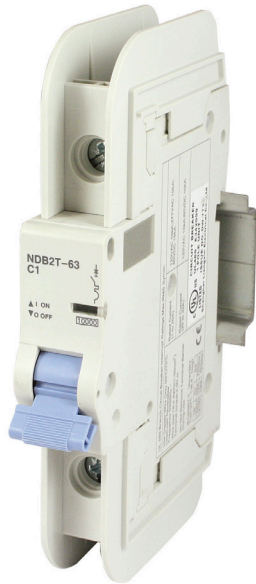
Both UL 489 and UL 1077 devices undergo rigorous testing including calibration, overload, endurance, and short-circuit tests. However, UL 489 testing requirements are more stringent compared to those for UL 1077 devices. Unlike UL 489, a UL 1077 protection device may not be required to survive certain types of testing.

For a visual comparison of these testing requirements, refer to Figure 1.

Figure 1 - Comparison of UL489 and UL1077 Test Standards

	UL489	UL1077
Minimum Terminal Spacing	1/2 inch up to 130V 3/4 inch up to 300V 1 inch up to 600V through air	For commercial appliances 3/32 inch up to 300V 1/4 inch at terminals
Calibration Test	Varies with current rating. 12 sec to 2 min @ 200% <1 hour @ 135% (<50A) <2 hours @ 135% (>50A)	@ 300% and @ trip current +5%
Maximum Temperature Rise at Terminal	50°C / 122°F	50°C / 122°F
Overload Test	50 cycles @ $6 \times I_N$ or 150A minimum	50 Cycles @ $1.5 \times I_N$ (general use) @ $6 \times I_N$ (motor starting)
Endurance Test	10,000 cycles (6000 @ I_N + 4000 mechanical (up to 100A))	6000 cycles @ (S-type)
Short-Circuit Test	1-3 times (O-C-O) @ 5000A or less. depends on current and voltage (may fail safe or recalibrate after short-circuit tests for “fit for futher use”)	Depends on ratings. 3-7 times @ 5000A minimum and must operate @ 200% final test

Physical Difference



UL489 Branch Circuit Breaker



UL1077 Supplementary Circuit Breaker

The key physical distinction between a UL 489 miniature circuit breaker and a UL 1077 supplementary protector is in their required pole spacings:

- UL 489: Requires 1 inch spacing through the air and 2 inches over the surface.
- UL 1077: Requires narrower spacings of 3/8 inch through the air, and 1/2 inch over the surface.

When to use UL489 vs UL1077

Choosing between UL 489 circuit breakers and UL 1077 supplementary protectors depends on their intended applications:

- **UL 489 Circuit Breakers:** These are suitable for protecting multiple devices simultaneously, such as entire control panels. They are essential for branch circuits that serve motors, transformers, or equipment exits requiring comprehensive protection as specified by UL 489 standards.
- **UL 1077 Supplementary Protectors:** Designed to safeguard individual devices within appliances or electrical equipment. They are suitable where branch-circuit protection is separately provided or not necessary. Supplementary protectors are commonly used to protect outlets or to supply utilization equipment.

Figure 2 - The Differences Between UL489 Branch Protection and UL1077 Supplementary Protection

Power Circuit

Control Circuit

UL489 Branch Circuit Breakers

UL 489 Branch Circuit Breakers are designed to act as the primary defense against overcurrent and short-circuits in electrical panels. They safeguard not only downstream equipment and systems but also the connected wires and cables by maintaining proper pole spacing. These breakers are versatile, as UL 489 miniature circuit breakers can be employed in both UL 489 and UL 1077 applications.

UL1077 Supplementary Protectors

UL 1077 Supplementary Protectors are not meant to serve as the primary circuit protection device but can be utilized within or directly upstream of single electrical equipment to open the circuit or provide additional protection. To verify correct usage, one can test the circuit integrity by removing the supplementary protector. If the circuit remains adequately protected due to upstream devices, then the UL 1077 protector is being used appropriately. Note that UL 1077 supplementary protectors are strictly for use in UL 1077 applications.

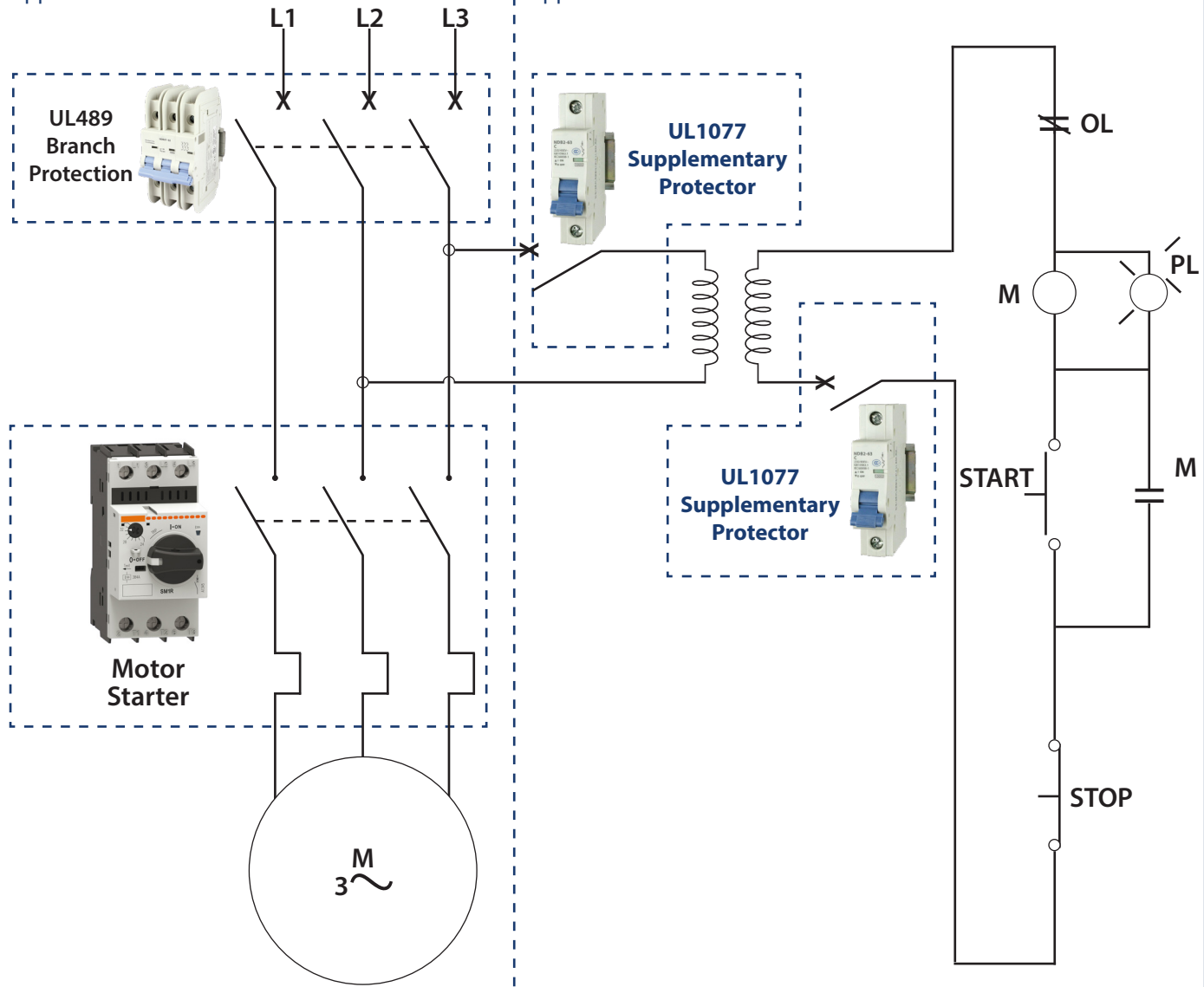
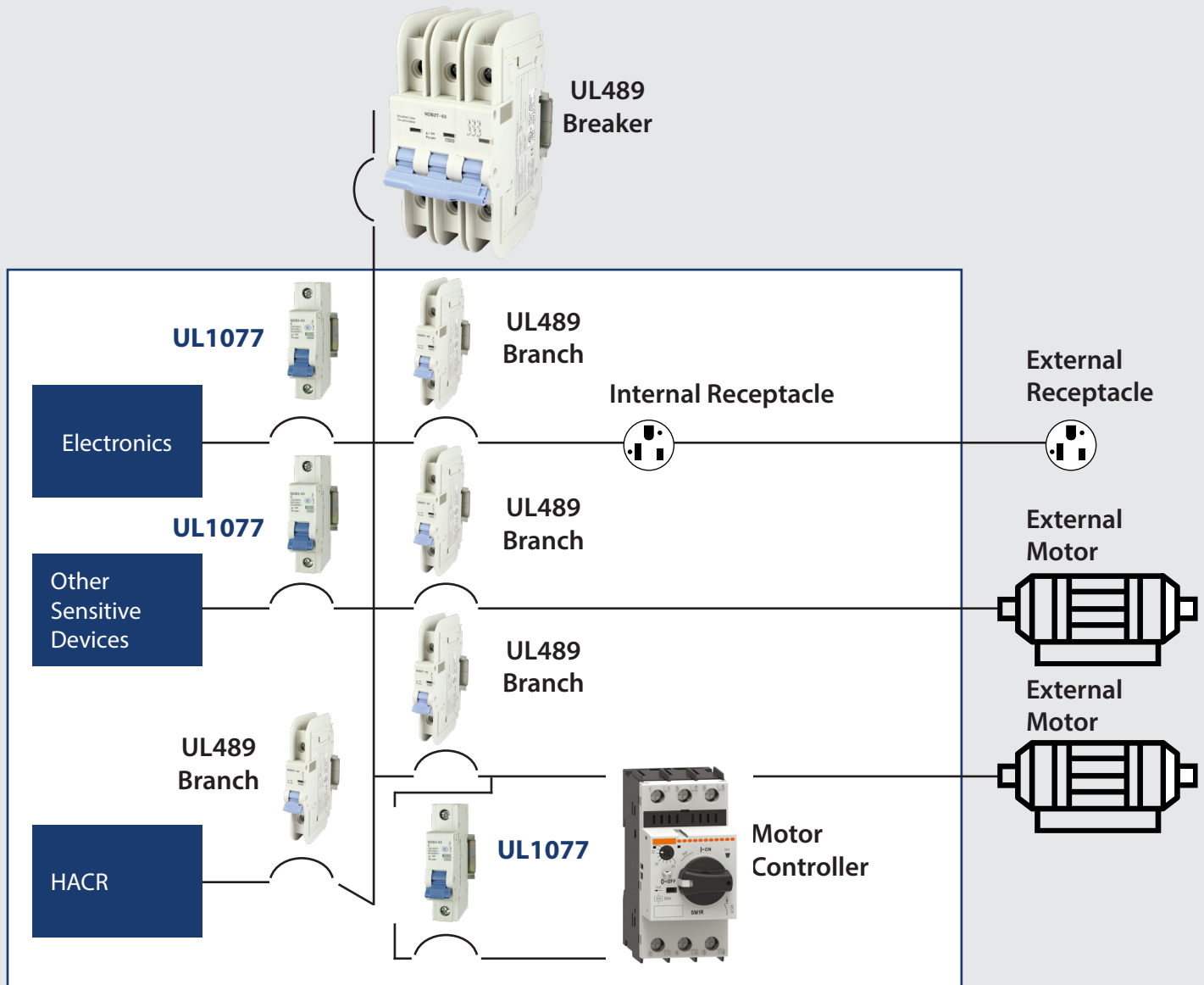


Figure 3 - UL489 Circuit Breaker and UL1077 Supplementary Circuit Protection as used in an application



Conclusion

As control equipment advances, the components within control panels become more susceptible to overcurrent damage caused by overloads or short circuits. Protecting operators and equipment from electrical failures is necessary to prevent injuries and equipment damage.

A thorough understanding of circuit protection and UL standards and requirements is crucial for OEMs to design and build safer, more reliable control panels and machinery. This knowledge ensures that both the systems and the people who operate them are adequately safeguarded.

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