

# A Quick Guide: UL 489 or UL 1077 in Control Panels and Equipment



## UL 489 or UL 1077 in control panels and equipment — a quick guide

A common question that comes up with OEM machine builders and control panel builders is “How do I know when to use UL 1077 or UL 489 breakers in panels or equipment?” The answer is seemingly simple, but like most simple questions, there is usually some confusion. No one wants to be the only person in the room who puts up their hand and asks a question to which they believe “everyone else” knows the answer.

How do you assure that you meet the required standards? The following information should give you a better understanding of the standards that must be met — and how to meet those standards.

The function of a circuit breaker is to provide overload (thermal) and short-circuit (magnetic) protection to a circuit and its downstream components. A circuit breaker functions like an airbag in a car, protecting circuit components and people by tripping the circuit to interrupt the current flow if it detects a fault condition in the control system.

Without circuit breakers, motors and other equipment would be susceptible to damage due to short circuits, resulting in costly repair or replacement of components, as well as frustrating downtime.

### What are UL 489 and UL 1077?

#### UL 489 Circuit Breakers

UL 489 circuit breakers are “intended for installation in a circuit breaker enclosure or as parts of other devices, such as service entrance equipment and panelboards.” They are regularly required on panel designs, per the National Electrical Code.

#### UL 1077 Supplementary Protectors

UL 1077 defines supplementary protectors as devices intended for use as overcurrent, over-voltage or under-voltage protection within an appliance or other electrical equipment where branch-circuit overvoltage protection is already provided or is not required.

**Important Note:** While the term circuit breaker is used to describe both UL 489 and UL 1077 devices, UL 1077 devices are not considered Circuit Breakers by UL. They are defined as Supplementary Protectors.

## UL Standards Comparison – UL 489 vs UL 1077

Under the UL services, low-voltage air circuit breakers, molded-case circuit breakers, and miniature circuit breakers are evaluated and “Listed” to UL 489 for use as a standalone product.

By contrast, “Recognized” devices under UL 1077, Supplementary Protectors for Use in Electrical Equipment, are evaluated only for use as components in “Listed” products.

In contrast to “Listed” circuit breakers, UL 1077 supplementary protectors are “Recognized” components. This means that they are investigated for factory installation in “Listed” products, such as a UL 508a panel.

Both UL 489 and UL 1077 devices must pass a series of calibration, overload, endurance and short-circuit tests.

The UL 489 and UL 1077 Standards testing are similar, but the UL 489 testing is more rigorous. Unlike UL 489, a UL 1077 circuit protection device does not necessarily need to survive the test. See Figure 1, below, for a comparison of the testing.

**Figure 1 - Comparison of UL 489 and UL 1077 Test Standards**

	UL 489	UL 1077
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 x I <sub>N</sub> or 150A minimum	50 Cycles @ 1.5 x I <sub>N</sub> (general use) @ 6 x I <sub>N</sub> (motor starting)
Endurance Test	10,000 cycles (6000 @ I <sub>N</sub> + 4000 mechanical (up to 100A))	6000 cycles @ I <sub>N</sub> (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 further use”)	Depends on ratings. 3 - 7 times @ 5000A minimum and must operate @ 200% final test

## Physical Difference

The major physical difference between a UL 489 miniature circuit breaker and a UL 1077 supplementary protector is the required pole spacings. cleaner starts up.

- UL 489 - 1 inch through the air, 2 inches over surface.
- UL 1077 - 3/8 inch through the air, 1/2 inch over surface.

Figure 1 - Physical Difference UL 489 vs UL 1077



UL 489 Miniature Circuit Breaker



UL 1077 Supplementary Protector

## When to use UL 489, when to use UL 1077

The general rule is that a UL 489 circuit breaker can protect multiple devices at one time, such as an entire control panel; whereas a UL 1077 supplementary protector protects one device, EXCEPT FOR those that feed motors or transformers and those that exit the equipment. These would be classified as branch-circuits, or could be used for outlets or for feeding utilization equipment. Supplementary protectors can be used where UL 489 (branch circuit) protection is not required, or is provided by another device. A UL 489 listed circuit protector can act as the final overcurrent device dedicated to protecting the branch-circuit and outlets. It does not require that an additional backup overcurrent device be wired. Finally, a UL 489 circuit breaker can be used in place of a UL 1077 supplemental protection device, but a UL 1077 supplemental protection device cannot be used as a UL 489 branch circuit breaker.

Figure 2 - The Differences Between UL 489 Branch Protection and UL 1077 Supplementary Protection

**Power Circuit**

**UL 489 Branch Circuit Breakers**

UL 489 Branch Circuit Breakers are designed to serve as the primary overcurrent and short-circuit upstream circuit protection of an electrical panel. In addition to downstream equipment and systems, branch protectors guard the connected wires and cables against improper pole spacings. UL 489 miniature circuit breakers can be used in both UL 489 and UL 1077 applications.

**Control Circuit**

**UL 1077 Supplementary Protectors**

UL 1077 Supplementary Protectors, while not the primary device of circuit protection, can be used within or directly upstream from single electrical equipment devices to open the circuit or provide supplementary protection. One common method to test whether or not a supplementary protector is being used properly is by evaluating the circuit integrity when it is removed from the circuit. If a UL 1077 type circuit breaker can be removed and maintain proper protection due to upstream protective devices, then the UL 1077 Miniature Circuit Breaker is used correctly. UL 1077 supplementary protectors can only be used in UL 1077 applications.

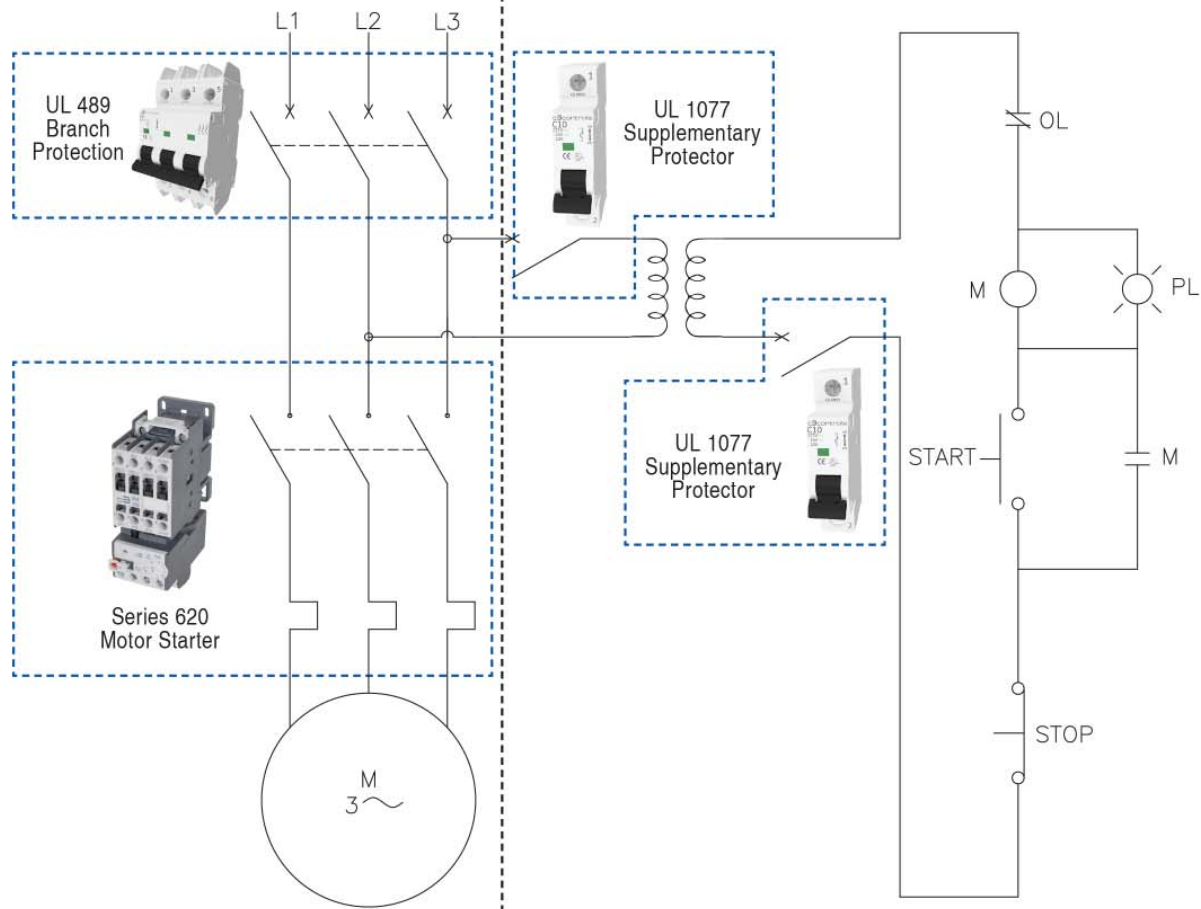
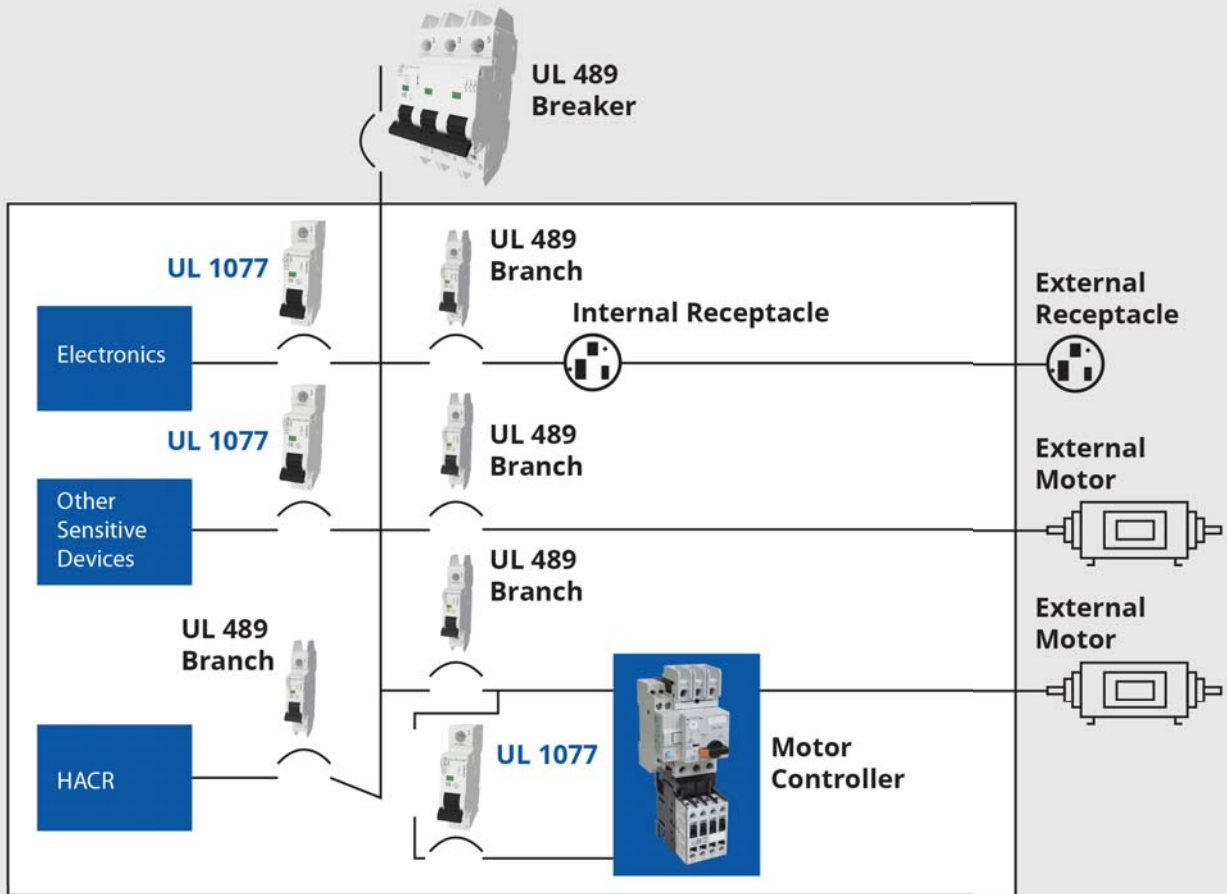


Figure 3 - UL 489 Circuit Breaker and UL 1077 Supplementary Circuit Protection as used in an application.



## Conclusion

Control equipment continues to grow in complexity. This is accompanied by proportional growth in the sensitivity of the components within a control panel to damage caused by overcurrent resulting from an overload or short circuit. It is necessary to protect both the operator and the equipment from electrical failure, and avoid damage to human life and equipment.

A good understanding of circuit protection and the UL standards and requirements is required for OEM's to design and build better, safer and more reliable control panels and machinery.

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