

What is Inrush Current?

Inrush Current is the additional energy drawn to start up a luminaire with an electronic fluorescent ballast or LED driver. Due to the electrolytic capacitors inside of the electronic device, the inrush current can be 30-40% higher than older forms of lighting, like magnetic ballasts that had inrush between 4%-6% of the continuous current range. The initial extra draw at start up is quick but can still affect the electrical system. This can be more of an issue at 277V than 120V because the current draw of the device is less at 277V, but inrush is higher.

Calculating the number of drivers that can be on a single circuit breaker

There are two things to consider when looking at how many drivers can be wired to a single circuit. The first is the Nominal Input Current and the second is the Inrush Current.

Nominal Input Current is the input current of a luminaire and should be listed on the label. If it is not, the maximum input current of driver will be found on its label.

Example:

A 55 watt driver operating at 120V has a nominal input current of 0.56 amps. Most circuit breakers used in lighting circuits are rated for continuous operation at 80% of the nominal ampere rating, so we would have $20 \times 80\% = 16$ amps, $16 / 0.56 = 28$ drivers.

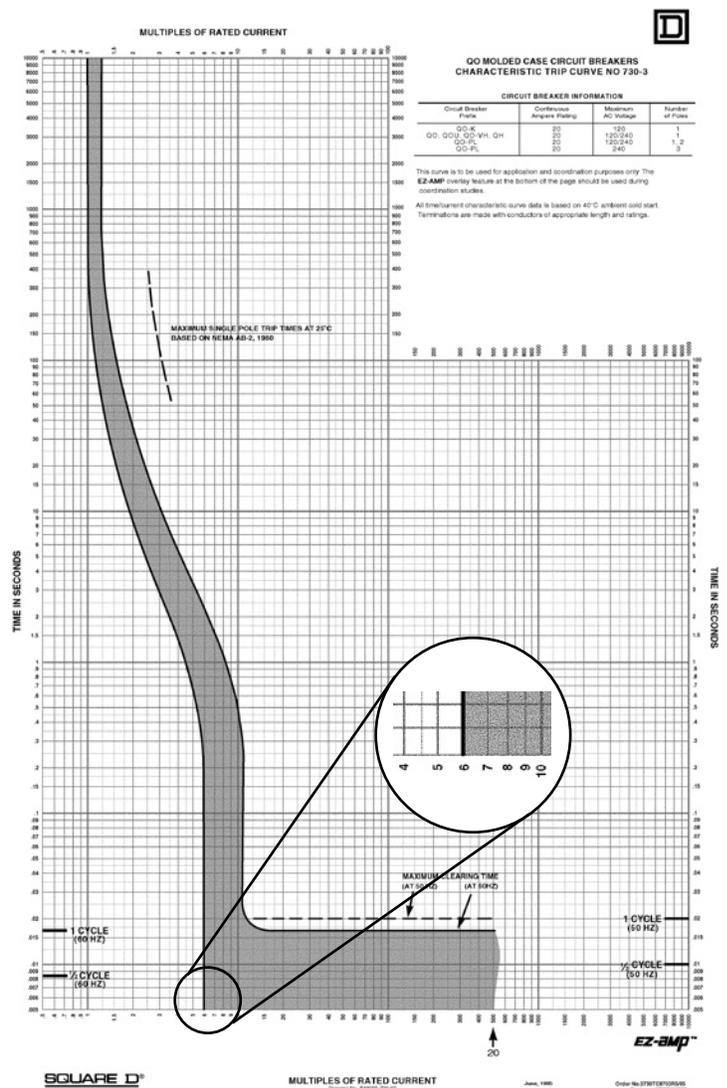
Inrush Current is the total inrush current of the electronic devices connected to the circuit breaker. The inrush for LED drivers generally lasts in the hundreds of microseconds. Most circuit breakers publish their trip curves down to the thousands of microseconds.

The trip curves charts will list the instantaneous range for the breaker. If we look at an example of a trip curve or time current curve of a 20 amp breaker we see a shaded gray area. The inside of this shaded gray area depicts the range in which the breaker may trip. Looking at the bottom we see that the instantaneous overload protection of this breaker may trip in as little as 6 times the rated current or 120 amps.

However, this is at a time duration of 0.005 seconds or 5000 microseconds.

A typical 55W LED driver, at startup, can draw 19 amps of inrush current for 300µs at 120V or 47 amps of inrush current for 300µs at 277V; this is 0.0003 seconds and below the published values of the trip curve. The 300µs duration of inrush represents the time that the driver is drawing at least 10% of the peak inrush current, the actual time at the peak current is a very small portion of the duration.

A 20 amp circuit breaker fully loaded with 16 amps of LED drivers would most likely see an inrush current that is above the minimum current that could trip the circuit breaker. However, the duration of the inrush is below what is shown in the curve, so we cannot definitively state this load would always trip the circuit breaker.



Conclusion

Extra care needs to be taken when designing a new lighting system or retrofitting an old magnetic lighting system with LED lighting. The higher inrush currents associated with LED compared to older forms of lighting is not something that should be ignored, especially at 277V.



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