There are many advantages to using these fuses. Unlike single-element fuses, the Cooper Bussmann dual-element, time-delay fuses can be sized closer to provide both high performance short circuit protection and reliable overload protection in circuits subject to temporary overloads and surge currents. For AC motor loads, a single-element fuse may need to be sized at 300% of an AC motor current in order to hold the starting current. However, dual-element, time-delay fuses can be sized much closer to motor loads. For instance, it is generally possible to size Fusetron dual-element fuses, FRS-R and FRN-R and Low-Peak dual-element fuses, LPS-RK_SP and LPN-RK_SP, at 125% and 130% of motor full load current, respectively. Generally, the Low-Peak dual-element fuses, LPJ_SP, and CUBEFuse™, TCF, can be sized at 150% of motor full load amps. This closer fuse sizing may provide many advantages such as: (1) smaller fuse and block, holder or disconnect amp rating and physical size, (2) lower cost due to lower amp rated devices and possibly smaller required panel space, (3) better short circuit protection – less short-circuit current let-through energy, and (4) potential reduction in the arc-flash hazard.

When the short-circuit current is in the current-limiting range of a fuse, it is not possible for the full available short-circuit current to flow through the fuse – it’s a matter of physics. The small restricted portions of the short circuit element quickly vaporize and the filler material assists in forcing the current to zero. The fuse is able to “limit” the short-circuit current.

Overcurrent protection must be reliable and sure. Whether it is the first day of the electrical system or thirty, or more, years later, it is important that overcurrent protective devices perform under overload or short circuit conditions as intended. Modern current-limiting fuses operate by very simple, reliable principles.
Advantages of Cooper Bussmann Dual-Element, Time-Delay Fuses

Cooper Bussmann dual-element, time-delay fuses have four distinct advantages over single-element, non-time-delay fuses:

1. Provide motor overload, ground fault and short circuit protection.
2. Permit the use of smaller and less costly switches.
3. Give a higher degree of short circuit protection (greater current limitation) in circuits in which surge currents or temporary overloads occur.
4. Simplify and improve blackout prevention (selective coordination).

Motor Overload and Short Circuit Protection

When used in circuits with surge currents such as those caused by motors, transformers, and other inductive components, the Cooper Bussmann Low-Peak and Fusetron dual-element, time-delay fuses can be sized close to full-load amps to give maximum overcurrent protection. Sized properly, they will hold until surges and normal, temporary overloads subside. Take, for example, a 10 HP, 200 volt, three-phase motor with a full-load current rating of 32.2A.

<table>
<thead>
<tr>
<th>Fuse and Switch Sizing for 10 HP Motor (200V, 38, 32.2 FLA)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fuse Type</strong></td>
</tr>
<tr>
<td>Dual-Element, Time-Delay</td>
</tr>
<tr>
<td>Low-Peak</td>
</tr>
<tr>
<td>LPS-RK_SP or LPN-RK_SP</td>
</tr>
<tr>
<td>Fusetron</td>
</tr>
<tr>
<td>FRS-R or FRN-R</td>
</tr>
<tr>
<td>Single-Element, Non-Time-Delay Limitron</td>
</tr>
</tbody>
</table>

*Per NEC* 430.32.
†Per NEC* 430.62.

The preceding table shows that a 40A, dual-element fuse will protect the 32.2A motor, compared to the much larger, 100A, single-element fuse that would be necessary. It is apparent that if a sustained, harmful overload of 200% occurred in the motor circuit, the 100A, single-element fuse would never open and the motor could be damaged. The non-time-delay fuse, thus, only provides ground fault and short-circuit protection, requiring separate overload protection per the NEC®. In contrast, the 40A dual-element fuse provides ground fault, short circuit and overload protection. The motor would be protected against overloads due to stalling, overloading, worn bearings, improper voltage, single-phasing, etc.

In normal installations, Cooper Bussmann dual-element fuses of motor-running, overload protection size, provide better short circuit protection plus a high degree of back up protection against motor burnout from overload or single-phasing should other overload protective devices fail. If thermal overloads, relays, or contacts should fail to operate, the dual-element fuses will act independently and thus provide "back-up" protection for the motor.

When secondary single-phasing occurs, the current in the remaining phases increases to a value of 173% to 200% of rated full-load current. When primary single-phasing occurs, unbalanced voltages that occur in the motor circuit also cause excessive current. Dual-element fuses sized for motor overload protection can help protect motors against the overload damage caused by single-phasing. See the section “Motor Protection–Voltage Unbalance/Single-Phasing” for discussion of motor operation during single-phasing.

Permit the Use of Smaller and Less Costly Switches

Aside from only providing short-circuit protection, the single-element fuse also makes it necessary to use larger size switches since a switch rating must be equal to or larger than the amp rating of the fuse. As a result, the larger switch may cost two or three times more than would be necessary were a dual-element Low-Peak or Fusetron fuse used. The larger, single-element fuse itself could generate an additional cost. Again, the smaller size switch that can be used with a dual-element fuse saves space and money. (Note: where larger switches already are installed, fuse reducers can be used so that fuses can be sized for motor overload or back-up protection.)

Better Short Circuit Component Protection (Current-Limitation)

The non-time-delay, fast-acting fuse must be oversized in circuits in which surge or temporary overload currents occur. Response of the oversized fuse to short-circuit currents is slower. Current builds up to a higher level before the fuse opens...the current-limiting action of the oversized fuse is thus less than a fuse whose amp rating is closer to the normal full-load current of the circuit. Therefore, oversizing sacrifices some component protection.
In the table above, it can be seen that the 40A Low-Peak dual-element fuse used to protect a 10Hp (32.2 FLA) motor keeps short-circuit currents to approximately half the value of the non-time-delay fuse.

**Better Selective Coordination (Blackout Prevention)**

The larger an upstream fuse is relative to a downstream fuse (for example, feeder to branch), the less possibility there is of an overcurrent in the downstream circuit causing both fuses to open (lack of selective coordination). Fast-acting, non-time-delay fuses require at least a 3:1 ratio between the amp rating of a large upstream, line-side Low-Peak time-delay fuse and that of the downstream, load-side Limitron fuse in order to be selectively coordinated. In contrast, the minimum selective coordination ratio necessary for Low-Peak dual-element fuses is only 2:1 when used with Low-Peak loadside fuses.

### Better Motor Protection in Elevated Ambients

The derating of dual-element fuses based on increased ambient temperatures closely parallels the derating curve of motors in an elevated ambient. This unique feature allows for optimum protection of motors, even in high temperatures.

![Image](image.png)

Affect of ambient temperature on operating characteristics of Fusetron® and Low-Peak dual-element fuses.

Below is a rerating chart for single element fuses or non dual element fuses.

![Image](image.png)

Ambient affect chart for non-dual element fuses.