A complete line of I-T-E CL-13 Current-Limiting Power Fuses for Indoor and Outdoor Applications.

For voltages from 2.4 through 14.4 kV
Interrupting ratings to 1000 MVA
Current Ratings
4.8 kV 400E Max., 14.4 kV 200E Max.
I-T-E CL-13:  
A new concept in current-limiting power fuses

The I-T-E CL-13 Fuse is a new design to meet the demand for current-limiting fuses with increased capabilities. Developed for primary voltage distribution systems with metal-clad and metal-enclosed switchgear and unit substations, this new I-T-E CL-13 Fuse line provides high interrupting current capabilities and high continuous current carrying capacities. It incorporates a number of features specifically developed to meet new higher operating requirements.

Features

- Up to 1000 MVA @ 14.4 kV; 500 MVA @ 4.8 kV
- Up to 400 amperes @ 4.8 kV; 200 amperes @ 14.4 kV
- Positive high pressure contact
- Low transient arc voltage peak 16 kV @ 4.8 kV; 44 kV @ 14.4 kV
- Better inverse time-current characteristics
- Ability to withstand severe mechanical shock
- High-strength porcelain barrel sealed for indoor and outdoor use
- Positive indication of fuse operation
New Clip Lock Fuse Design

Clip Lock Design assures positive, high-pressure contact connection. The fuse has copper tabs at each end which slide into position between the clip casting and cam. When cam is locked by moving pull ring a high-pressure contact is made between clip casting and fuse tab. This type of connection prevents slip-out or blow-out of fuse. The fuse copper tab and adjacent clip casting permits greater heat dissipation. This allows fuse to run cooler, permitting higher current ratings.

Closer Transformer Fusing

Typical time-current characteristic curves for CL-13 fuses show how the high speed ratio results in lower current ratings to withstand transformer inrush current.

Power fuse speed ratios are an indication of time-current characteristic slope and are defined in ANSI C37 for High Voltage Fuses.

Typical minimum melt curves for 2.4 and 4.8-kV CL-13 fuses.

For application to transformers, power fuses must withstand 12x transformer full load current 0.1 second. Therefore, higher speed ratios mean higher inrush withstand with lower continuous current fuses.

Complete sets of time-current characteristic curves are available on request.

a. Disengaging top fuse clip with fuse tool.

b. Disengaging bottom fuse clip.

c. Removing fuse in unlocked position.
I-T-E CL-13: 
A new concept in design and construction

Patented silver ribbon fusible elements are fitted with Ceramic control sleeves, positioned so the fuse will operate in accordance with pre-determined time-current characteristics.

High-strength, hermetically-sealed porcelain barrels provide exceptional resistance to thermal and mechanical shock. The all-around rugged construction of I-T-E CL fuses makes them suitable for indoor and outdoor application.
Patented Design Improves Shock Resistance

The I-T-E CL-13 fuse features patented silver ribbon fusible elements spirally wound around an alumina-ceramic core. The special necking design permits greater material cross section of the ribbon elements and a virtual immunity to mechanical shock.

Time-current characteristics are governed by additional control sleeves positioned in heat-transferring relation to the silver ribbon fusible elements. All ribbon elements are identical with one exception: one is shunted to the indicator assembly and equipped with heat-controlling alloy bead and hole. This is so it will be the last to fuse.

Fusible Element Controls Melting Characteristics

Patented configuration of silver ribbon elements makes it possible to control separately the melting time-current characteristics for small, medium, and large values of melting currents. Under conditions of severe overload or short circuit, total volatization of the silver ribbon immediately fuses the fine quartz-sand filler forming an insulating glass rope. On small and medium melting currents, ceramic heat concentration sleeves predetermine initiation of fusing points. As voltage sustains the arc initiated by fusing, the unique necking design of the ribbon element creates a series of arcs at reduced cross sections of ribbon, thus building resistance at a lower rate, resulting in lower transient arc voltage. The necking design further allows a much slower rate of temperature rise, since pure silver is flowing into the arc from the larger cross section of the silver ribbon, resulting in slower time-current characteristics.

Blown Fuse Indicator

I-T-E, CL-13 current-limiting fuses also are equipped with an indicator. This device is an ejectible pin which slides in its outer casing and is forced through the bottom ferrule upon operation of the fuse. The pin is equipped with a latching device so that, once ejected, it cannot be reseated.

The actuation of the pin is effected by a propellant material in the closed inner end of the casing. The indicator assembly is set into operation by means of a high-resistance wire connected to one ribbon element. The ribbon element to which this wire is connected is the last element to fuse under any overcurrent condition, and is equipped with a hole and heat-controlling alloy bead at the cool end of the element near the heat sink. Only that portion of the last ribbon element to fuse is shunted by the indicator assembly.

Thus, on overload or light fault conditions, all current is finally carried in the ribbon element with the high-resistance, shunted connection. The greater resistance in this element assures that it is the last to fuse. The indicator assembly operates on the increase in voltage across the shunt circuit to the indicator assembly. On high values of current, final fusing takes place at the reduced cross section of material caused by the hole. On low values of current, fusing takes place at the heat-controlling alloy bead. As the final ribbon element begins to run hot, the heat-controlling bead alloys with the pure silver and so lowers its melting point. The reduced cross section caused by the hole and the alloy bead assures indication of operation under any overcurrent condition, which causes the fuse to melt.

Indicator pin projects out to show blown fuse.

Fusible element assembly.
A new concept in operation and performance

The I-T-E CL-13 Fuse has passed an extensive testing program that was established to insure performance to design specifications. It is particularly well suited to industrial, hospital, school, retail and similar institutional/commercial applications normally accompanied by large numbers of people, because it is non-explosive. The CL-13 Fuse interrupts current without expulsion of gas vapor, liquid flame, metal parts or noise. As a result, it can be installed in confined spaces without special precautions or special bracing.

Control of Voltage Surge

It is inherent in any current-limiting interrupting device that it produce an arc voltage significantly higher than the system voltage in order to drive the current to zero. Such arc voltages are in the nature of a transient voltage surge similar to those produced by many kinds of switching. The voltage surge must not be higher than the basic insulation level of associated equipment. All CL-13 fuses are designed so that at rated interrupting current the transient arc voltage produced will be below the basic insulation level of dry type transformers.

Coordination with Lightning Arrester

It should be noted that fuse operation has no effect on any lightning arrester connected on the load side of fuse. Whatever effect fuse operation may have on arresters ahead of fuse is related to distance. Fuse generated surges are attenuated rapidly as they travel on open wire lines or cable circuits. The shunt resistance and capacitance of connected loads or unloaded transformers serve to diminish surge voltage magnitude. Therefore, there is no need for concern for lightning arrester operations outside the immediate fuse installation area.

Thus, the matter of lightning arrester and current-limiting fuse application reduces itself to consideration of new installations. The first consideration is whether the arrester will spark over at the expected peak transient overvoltage of the fuse. For this determination, the chart below can be used for the CL-13.

When a reduced voltage arrester is to be used having a spark over value below the expected transient overvoltage of the fuse, the arrester may be damaged if the resultant energy through the arrester exceeds its thermal ability. Since tests show that short-circuit energy is divided between the fuse and arrester in relation to their respective impedances, the arrester having the highest impedance would be the best choice.

In all cases, the CL-13 will coordinate with arresters having a voltage rating equal to the fuse voltage rating.

### Average Peak Transient Overvoltage

<table>
<thead>
<tr>
<th>5.5-kV Fuses</th>
<th>System kV</th>
<th>20,000</th>
<th>30,000</th>
<th>40,000</th>
<th>50,000</th>
<th>60,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.4 to 4.16</td>
<td>9kV</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12kV</td>
<td>10kV</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.8 to 5.5</td>
<td>13kV</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>15.5-kV Fuses</th>
<th>System kV</th>
<th>20,000</th>
<th>30,000</th>
<th>40,000</th>
<th>50,000</th>
<th>60,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.2</td>
<td>32kV</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>34kV</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.2 to 18.8</td>
<td>38kV</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17.4 to 15.5</td>
<td>40kV</td>
<td></td>
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</tbody>
</table>

*Maximum

This tabulation represents arc voltages that can occur for any degree of asymmetry up to the factor of 1.6 for currents. Circuit conditions to be such that initiation of arcing after voltage zero to be from 65 to 90° and power factor less than 7%.

Since the let-thru current of the fuse decreases with reduced prospective fault current, a transient overvoltage reduction can be expected with reduced fault current value. Some effect of transient overvoltage reduction is also noticeable with reduced system voltage application, although this is subject to variation resulting from circuit constants.
Interruption is Completely Self-Contained

One of the most desirable features of current limiting fuse operation is that interruption is completely contained. This is most important when fuses are located in highly populated areas or where space is a premium.

Typical I-T-E current limiting fuse undergoing fault current interruption test. Results: no vibration, no gas or smoke, no products of interruption deposited in cubicle, and no noise.

Fuses after testing. Substantial construction assures intact assemblies after interruption.
General Specifications
I-T-E CL-13
Current-Limiting Power Fuses

<table>
<thead>
<tr>
<th>Max. System, kV</th>
<th>Interrupting Amperes</th>
<th>Nom. Equiv. 3-Phase MVA</th>
<th>Max. Cont. Current</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rms Sym. Asym.</td>
<td>Single Barrel</td>
<td>Double Barrel</td>
</tr>
<tr>
<td>5.5</td>
<td>2.4 4.16 4.8</td>
<td>250 430 500</td>
<td>400E</td>
</tr>
<tr>
<td>15.5</td>
<td>7.2 12.47 13.2 13.8 14.4</td>
<td>500 860 910 955 1000</td>
<td>200E</td>
</tr>
</tbody>
</table>

---|---------------------|---|---|------------------|------------|
| 4.8 | 150E 400E | 16½" 22½" | 15½" 21¼" | 3" | 12 15 |
| 14.4 | 50E 200E | 19½" 22¾" | 18½" 21¾" | 3" | 13 31 |

Double-barrel fuses are electrically-matched assemblies. Each assembly is electrically a single fuse entity and their component units cannot be separated.

Ask your I-T-E representative for complete information:

Akron, Ohio  Amarillo, Texas  Anchorage, Alaska  Anchorage, Alaska  Anchorage, Alaska
Andover, Massachusetts
Atlanta, Georgia  Baltimore, Maryland  Baton Rouge, Louisiana  Beaumont, Texas  Birmingham, Alabama
Boston, Massachusetts  Buffalo, New York  Butte, Montana  Charlotte, North Carolina  Chicago, Illinois
Cincinnati, Ohio  Cleveland, Ohio  Columbia, South Carolina  Columbus, Ohio  Dallas, Texas
davenport, Iowa

Dayton, Ohio  Denver, Colorado  Detroit, Michigan  El Paso, Texas  Eugene, Oregon
Fort Worth, Texas  Grand Rapids, Michigan  Greensboro, North Carolina  Hammond, Indiana  Harrisburg, Pennsylvania
Hilo, Hawaii  Houston, Texas  Huntington, W. Va.  Indianapolis, Indiana  Jackson, Michigan
Jackson, Michigan  Jackson, Mississippi  Jacksonville, Florida  Kansas City, Missouri  Knoxville, Tennessee
Lansing, Michigan  Little Rock, Arkansas  Los Angeles, California  Louisville, Kentucky  Memphis, Tennessee
Miami, Florida  Milwaukee, Wisconsin  Minneapolis, Minnesota  Nashville, Tennessee  Newark, New Jersey
New Haven, Connecticut  New Orleans, Louisiana  New York, New York  Norfolk, Virginia  Omaha, Nebraska
Richmond, Virginia  Riverton, New Jersey  Sacramento, California  Salt Lake City, Utah  San Antonio, Texas
San Diego, California  San Francisco, California  San Jose, California  Seattle, Washington  St. Louis, Missouri
Wichita, Kansas

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