



BULLETIN 14.1-1A

# 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:

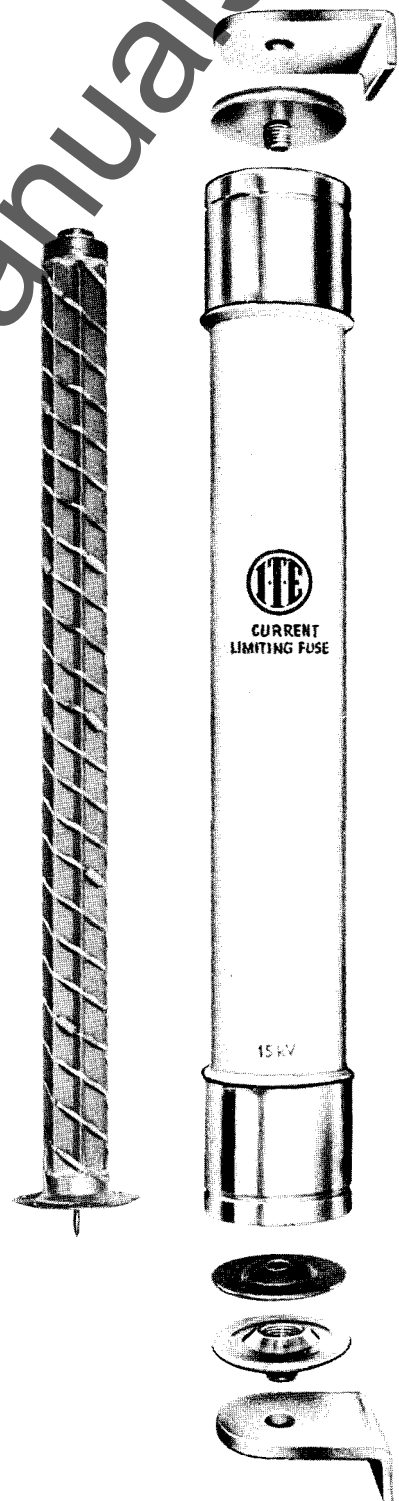
## A new concept in current-limiting power fuses

The I-T-E CL-13 Fuse . . . 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.

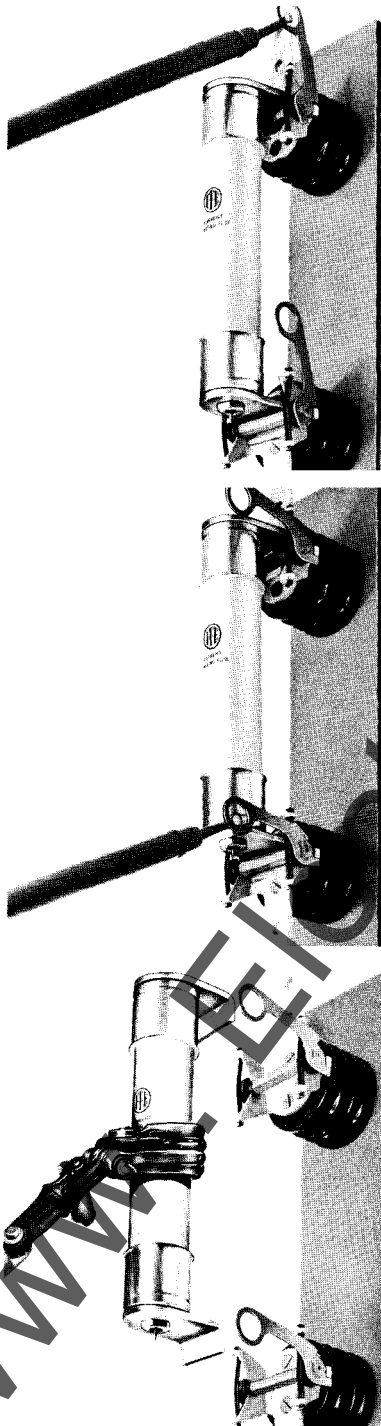
### Features

- 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

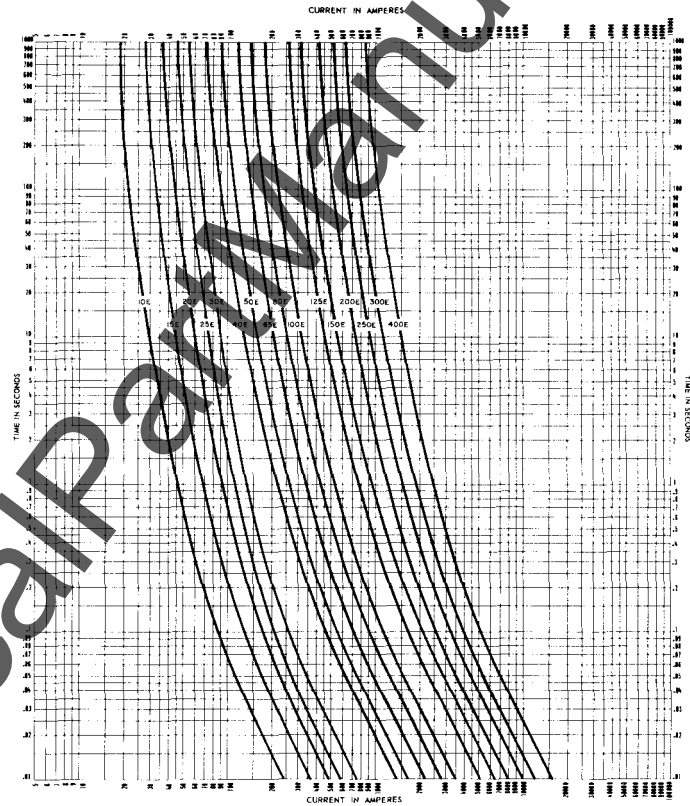
Clip Lock Design assures positive, high-pressure contact connection. The fuse has copper tabs at each end which slide into position between the clip casting and cam. When cam is locked by moving pull ring a high-pressure contact is made between clip casting and fuse tab. This type of connection prevents 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.

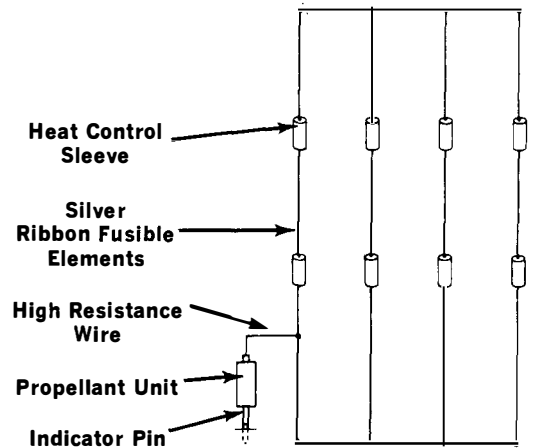
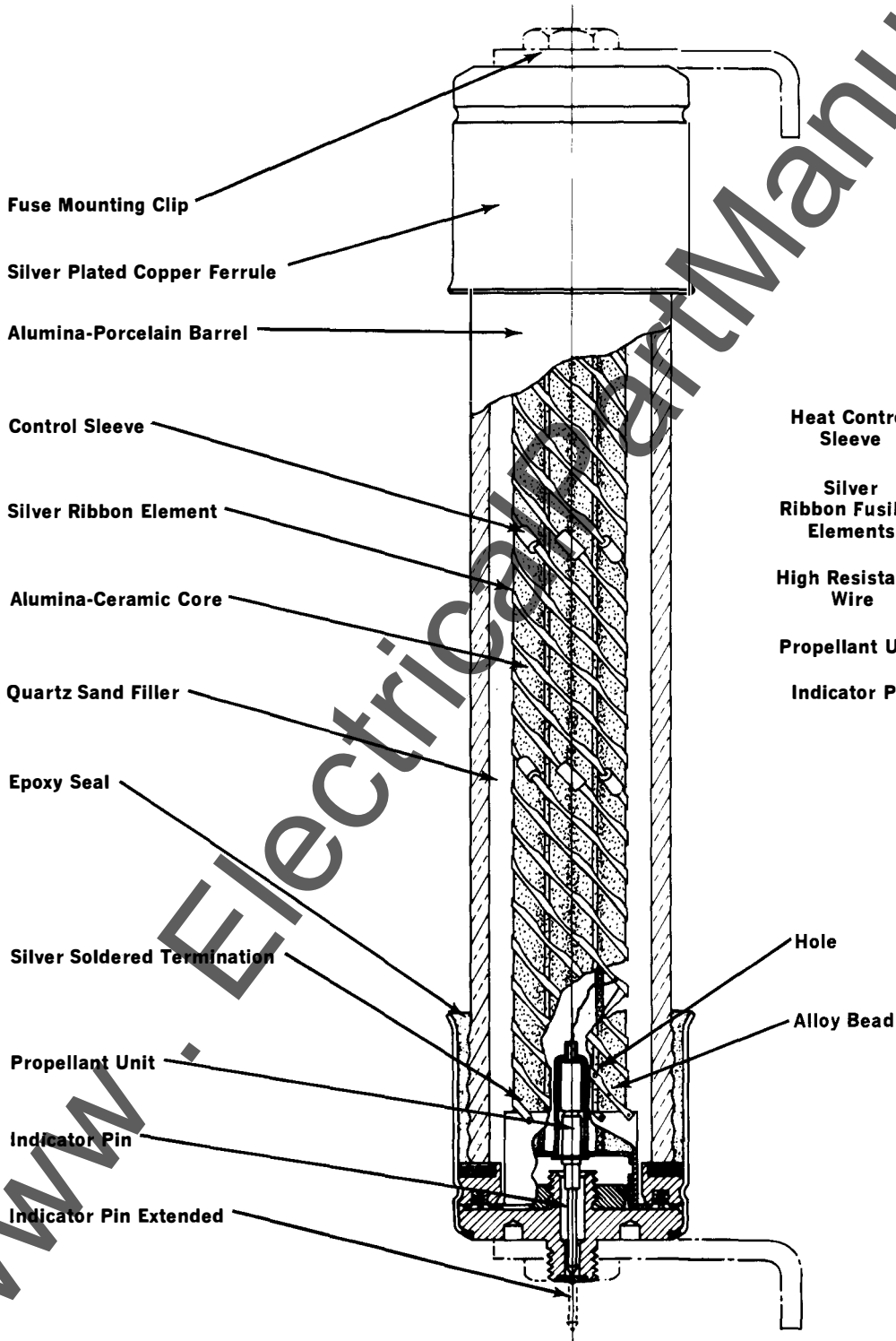
- a. Disengaging top fuse clip with fuse tool.
- b. Disengaging bottom fuse clip.
- c. Removing fuse in unlocked position.

# 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.



Schematic of CL-13

## 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

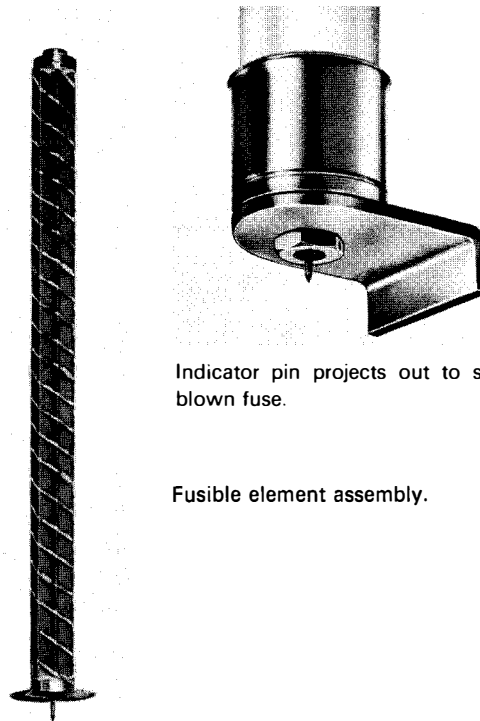
Patented configuration of silver ribbon elements makes it possible to control separately the melting time-current characteristics for small, medium, and large values of melting currents. Under conditions of severe overload or short circuit, total volatilization of the silver ribbon immediately fuses 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 reset.

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.

# I-T-E CL-13:

## 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**

5.5-kV Fuses	Prospective Current Rms Symmetrical Amperes				
	20,000	30,000	40,000	50,000	60,000
System kV	20,000	30,000	40,000	50,000	60,000
2.4 to 4.16	9kV	10kV	11kV	12kV	13kV
4.8 to 5.5	12kV	13kV	14kV	15kV	16kV*
15.5-kV Fuses	Prospective Current Rms Symmetrical Amperes				
	20,000	30,000	40,000	50,000	60,000
System kV	20,000	30,000	40,000	50,000	60,000
7.2	32kV	33kV	34kV	—	—
12	34kV	35kV	36kV	—	—
13.2 to 13.8	38kV	39kV	40kV	—	—
14.4 to 15.5	40kV	42kV	44kV*	—	—

\*Maximum

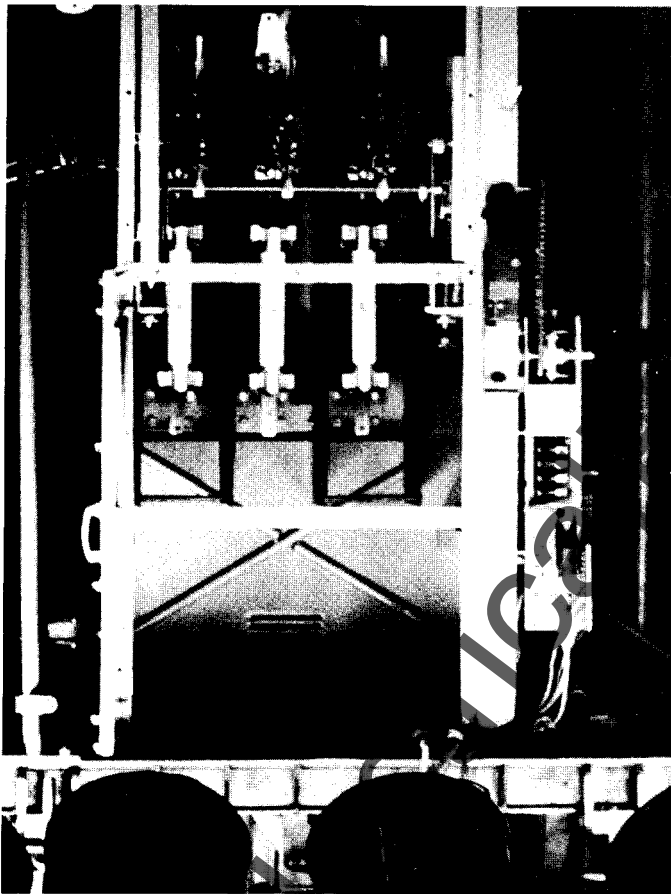
This tabulation represents arc voltages that can occur for any degree of asymmetry up to the factor of 1.6 for currents.

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.



AFTER TEST

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Fuses after testing. Substantial construction assures intact assemblies after interruption.

# General Specifications

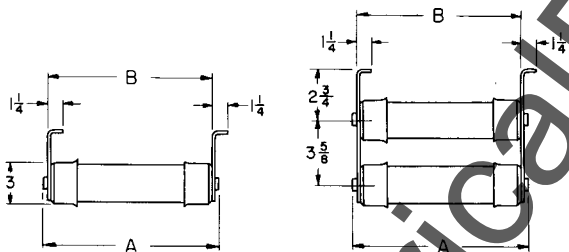
## I-T-E CL-13

### Current-Limiting Power Fuses

Max. Design, kV	System, kV	Interrupting			Max. Cont. Current	
		Amperes		Nom. Equiv. 3-Phase MVA	Single Barrel	Double Barrel
		Rms Sym.	Asym.			
5.5	2.4	60,000	96,000	250	400E	—
	4.16			430		
	4.8			500		
15.5	7.2	40,000	64,000	500	100E	200E
	12.47			860		
	13.2			910		
	13.8			955		
	14.4			1000		

Nominal Service Voltage, kV	Max. Cont. Current	A	B	Ferrule Diameter	Weight, lb.
4.8	150E	16 $\frac{1}{8}$ "	15 $\frac{1}{4}$ "	3"	12
	400E	22 $\frac{1}{8}$ "	21 $\frac{1}{4}$ "		15
14.4	50E	19 $\frac{1}{8}$ "	18 $\frac{1}{4}$ "	3"	13
	200E	22 $\frac{1}{8}$ "	21 $\frac{1}{4}$ "		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:

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 Anaheim, California  
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 Baltimore, Maryland  
 Baton Rouge, Louisiana  
 Beaumont, Texas  
 Birmingham, Alabama  
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 Buffalo, New York  
 Butte, Montana  
 Charlotte, North Carolina  
 Chicago, Illinois  
 Cincinnati, Ohio  
 Cleveland, Ohio  
 Columbia, South Carolina  
 Columbus, Ohio  
 Dallas, Texas  
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 Detroit, Michigan  
 El Paso, Texas  
 Eugene, Oregon  
 Flint, Michigan  
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 San Diego, California  
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 Spokane, Washington  
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**I-T-E Imperial Corporation**