

# Fusing Equipment

Electrical Apparatus

## K-SEC 030

### Kearney™ Fuse Links

#### GENERAL

Kearney™ fuse links can be applied to a variety of applications requiring overcurrent protection of distribution systems and equipment. When properly coordinated with other overcurrent protective devices, sectionalizing to isolate faulted feeder branches or equipment can be accomplished.

Kearney fuse links are available in a variety of types offering a wide selection of operating characteristics. The links incorporate low melting temperature elements, captive washers, high-resistance strain wires, color-coded high strength tubes, and Hi-Cor® corrosion resistant cables. The low temperature melting tin elements enhance overload capability by guaranteeing non-damageability of the fuse tubes. These elements are capable of absorbing vibration as well as thermal shock due to current surges and heating and cooling throughout the daily load cycle. They can be further distinguished by their years of superb service proven by lab TCC verification of aged fuse links. Consult your Cooper sales representative for more details.

The fuse links meet the latest version of ANSI C37.42 and NEMA SG2.1 standards for fuse links.

The following are the types of fuse links offered:

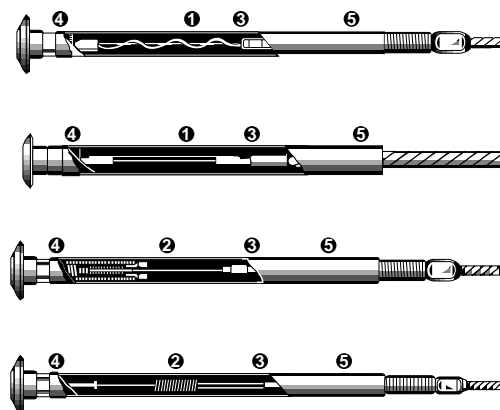
- Type K
- Type T
- Type 200 (N)
- Type KS
- Type QA
- Type X
- Secondary Indicating Fuses
- Under-oil Fuses

#### INTERNAL CONSTRUCTION

All Kearney fuse links are designed with low melting temperature element components of either tin or solder filled dual element construction. Each element material shipment from our supplier is accompanied with a certification of quality and composition. The diameter is verified in incoming



**Figure 1.**  
Fuse link packaging ensures proper selection and application.



**Figure 2.**  
Internal construction features.  
1. Tin element (in parallel with high strength strain wire to ensure mechanical strength of fuse).  
2. Solder coil and tin element.  
3. Body terminals made of pure copper.  
4. Screw terminal.  
5. High burst strength tube with fish paper liner.

inspection. Low melting temperature fuse links Types K, T, 200, X and KS have exceptional overload capability. They are designed to carry 150% of their continuous current rating continuously without damage to the fuse link itself or to the cutout fuseholder in which they are installed. (Care should be exercised so that the current rating of the cutout is not exceeded.)

#### SINGLE TIN ELEMENT

Links using pure tin elements have a precision gauged strain wire crimped in parallel to provide tension loading properties. The tin element is soldered into position providing the industry's best possible electrical connection between the element and its terminals. The low melting temperature of the tin

allows all of the fuse link components to operate at a lower temperature while providing long term reliable time-current characteristics (TCC).

### DUAL ELEMENT

There are two dual element designs. The dual element design for 1 and 2 A K, X, T, 200 (N), and QA link assemblies is composed of a heater coil mounted around a solder pot that is soldered to a fuse element. Type KS and X links above 2 A have two wire elements in series which are axially inserted into a soldered coil.

Dual element links which use solder coils are mechanically crimped to the body and screw terminals. The elements are inserted into the coil and meticulously gauged to assure that active element lengths are maintained. The soldering process then permanently sets the active elements to the proper TCC curve and guarantees positive electrical continuity.

Dual elements allow the fuse to respond as low temperature single element fuses for long time overloads, yet have superior lightning surge withstand capability. Both types of links have up to 26 times more surge withstand capability than single element fuse links.

### FINAL CONSTRUCTION

After passing in-process QA checks, high strength color coded tubes are swaged to both the single and dual element fuse links. A unique self locking washer and button is attached to the screw terminal. Every fuse link is axial pull tested to verify mechanical strength before packaging in the Kearney unique "lineman friendly" pull-tab fuse packs.

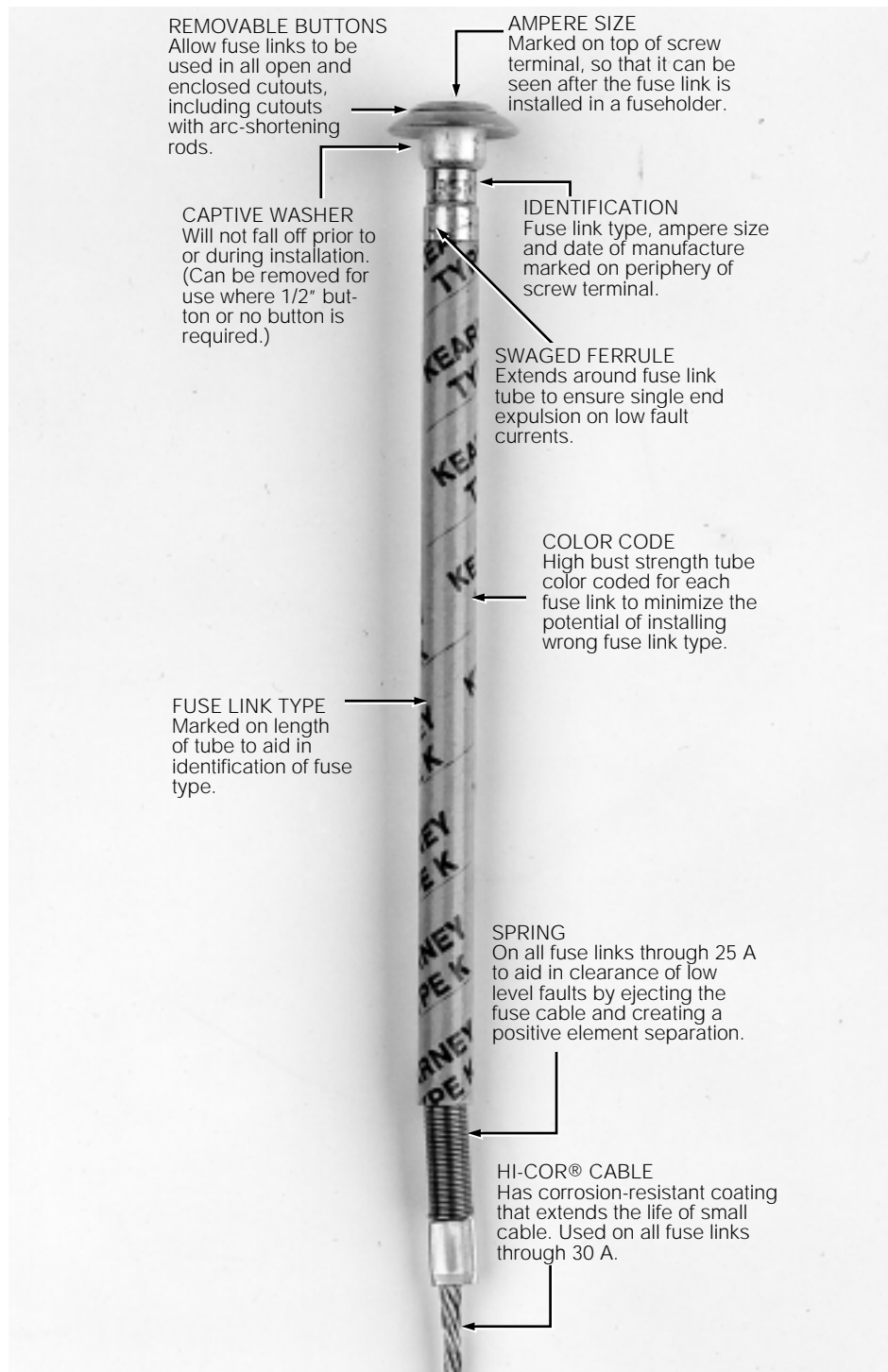
### FUSE LINK SELECTION

#### Type K

Kearney Type K fuse links meet the ANSI/NEMA requirements for a "fast" fuse. The nominal speed ratio of Type K fuse links is 7. Type K fuse links are well suited where "fast" time-current characteristics are desired such as for capacitor protection.

#### Type 200 (N)

Kearney Type 200 fuse links are classified as "medium" speed fuses, with a nominal speed ratio of 10. Type 200 fuse links provide more surge withstand capability than Type K links, and provide good coordination possibilities with relays and reclosers.



**Figure 3.**  
**Fuse link features.**

#### Type QA

Kearney Type QA fuse links are classified as "medium" speed fuse links with a nominal speed ratio of 10. Type QA fuse links will carry 100% of the rated current continuously without damage, and provide good coordination possibilities with relays and reclosers.

#### Type T

Kearney Type T fuse links meet the ANSI/NEMA requirements for a "slow" fuse link. The nominal speed ratio of Type T fuse links is 12. Type T fuse links provide slower time-current characteristics than Types K, 200, and QA, and coordinate well with relays and reclosers.

### Type KS

Kearney Type KS fuse links employ dual element construction which gives the Type KS high surge withstand capability, and a nominal speed ratio of 20. Classified as “very slow” fuse links, the Type KS has greater surge current withstand capability than the Type T, and is a good choice for line fusing and transformer protection.

### Type X

Kearney Type X fuse links are specially designed for transformer protection. Type X fuse links employ dual element construction, which allows the time-current characteristic to be carefully shaped to closely match the ANSI loading curve for transformers while providing excellent surge withstand to avoid nuisance blowing from lightning and switching surges. The nominal speed ratio of the Type X is 32.

### PACKAGING

All fuse links are packed in individual cartons for the maximum protection and ease of use. Cartons are perforated for easy opening. Fuse links can be removed with gloves on. Fuse Link Type and Ampere Ratings are clearly marked on the carton. The print will not smear or run.

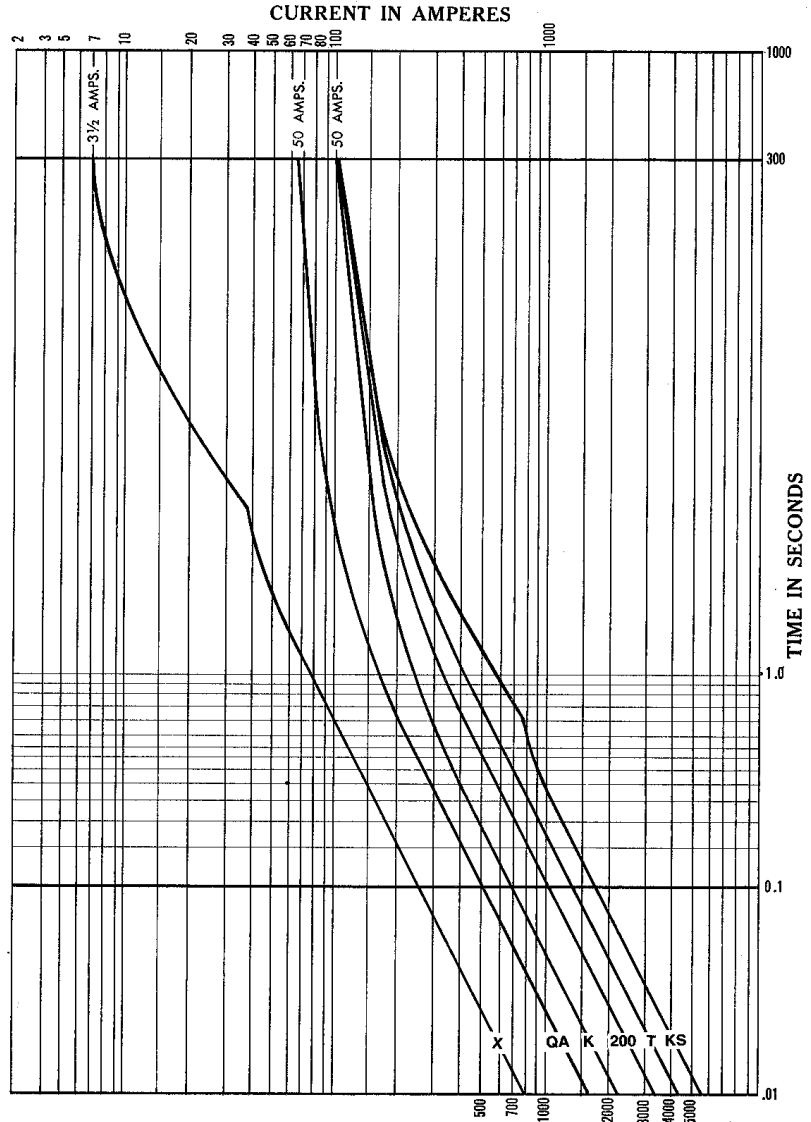
Five Pack Sleeves: Fuse Link Type and Ampere Rating are clearly marked on box front and end of cartons. Individual cartons are tabbed so that remaining fuses stay securely in the carton as others are removed.

Overcartons: All fuse links 100 A and below are packed in protective overcartons 25 per box. Catalog Number, Fuse Link Type, Ampere Rating, and Date of Manufacture are marked on the label for ease of selection.

### COMPARATIVE MELTING SPEED RATIO CHART

Electrical equipment such as transformers, switches, relays, and conductors are exposed to various levels of current during normal operation. Generally, electrical devices can withstand high currents for a short period of time and low current for longer periods of time without thermal or mechanical damage. The ability to withstand various levels of current for various periods of time is referred to as time-current characteristics.

Coordination of power systems involves the selection of fuse links to protect equipment with various time-current characteristics while coordinating with reclosers, circuit breakers, sectionalizers, relays, and



**Figure 4.** This chart compares the six speed ratios available with standard fuse link types which are fully adaptable to various coordination needs.

**TABLE 1**  
**Speed Ratio**

Designation	Single Element			Dual Element	
	Fast	Medium	Slow	Very Slow	Extra Slow
Type	K	200, QA	T	KS	X
Speed Ratio	6-8	7-11	10-13	20	32

other fuses. Kearney offers six types of fuse links with a wide range of time-current characteristics (refer to Table 1).

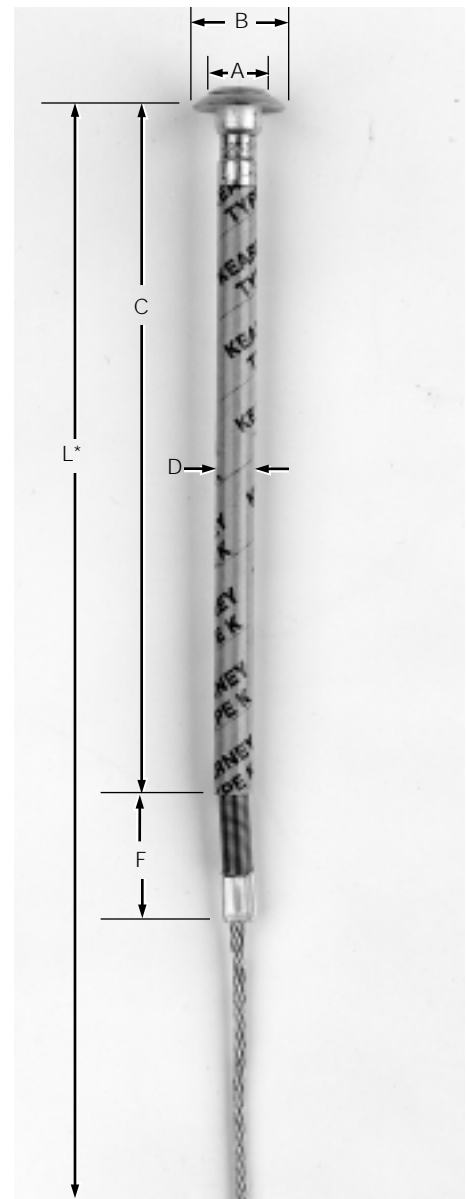
The speed ratio of all fuse link sizes 100 A and below is the ratio between the current that melts the fuse in 0.1 seconds to the current that melts

the fuse in 300 seconds. The higher the ratio, the slower the speed of melting. For fuses rated above 100 A, the speed ratio is between the melting currents at 0.1 second and 600 seconds.

CATALOG INFORMATION

**TABLE 2**  
**Fit-All® Cable Fuse Links**

Catalog Numbers						
Current Rating	Type X	Type KS	Type 200	Type QA	Type K	Type T
1/3 1/2	41033 41050					
3/4 1	41075 41100	21001	11001	6413-2T	31001	51001
1 1/4 1 1/2	41125 41150					
2 2 1/2	41200 41250	21002	11002	6414-2T	31002	51002
2 3/4 3	41275	21003	11003	6415-2T	31003	51003
3 1/2 4	41350 41400					
5 5 1/2	41550	21005	11005	6416-2T		
6 7	41007	21007	11007	6417-2T	31006	51006
8 10	41010	21010	11010	6418-2T	31008 31010	51008 51010
12 15	41015	21015	11015	6419-2T	31012 31015	51012 51015
20 25		21020 21025	11020 11025	6420-2T 6421-2T	31020 31025	51020 51025
30 40		21030 21040	11030 11040	6422-2T 6423-2T	31030 31040	51030 51040
50 60		21050	11050	6424-2T 6425-2T	31050	51050
65 75		21065	11065	6426-2T	31065	51065
80 100		21080 21100	11080 11100	6427-2T	31080 31100	51080 51100
125 140		21125	11125	6428-2T	31140	51140
150 175		21150	11150 11175	6429-2T 6724-2T		
200		21200	11200	6725-2T	31200	51200



**Figure 5.**  
**Fit-All® cable fuse links.**

\* "L" dimension extends to the end of the fuse leader.

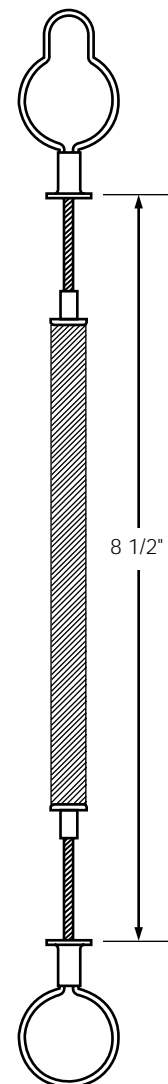
**TABLE 3**  
**Fit-All Fuse Link Dimensions**

Current Rating (A)	Fuse Link Types	A*	B*	C*	D*	F*	L*
1/2 to 2	X, KS, T, K, 200, QA	1/2"	3/4"	5 3/8"	.269"	1 1/8"	23"
2 1/2 to 15	X	1/2"	3/4"	5 3/8"	.305"	1 1/8"	23"
3 to 20	K	1/2"	3/4"	5 3/8"	.305"	1 1/8"	23"
3 to 25	200, QA, KS, T	1/2"	3/4"	5 3/8"	.305"	1 1/8"	23"
25 to 50	K	1/2"	3/4"	5 3/8"	.305"	N/A	23"
30 to 50	T, KS, 200	1/2"	3/4"	5 3/8"	.305"	N/A	23"
30 to 60	QA	1/2"	3/4"	5 3/8"	.305"	N/A	23"
65 to 100	K, T, KS, 200		3/4"	5 3/8"	.396"	N/A	23"
75 to 150	QA		3/4"	5 3/8"	.396"	N/A	23"
125 to 200	KS, 200		1"	6 3/8"	.500"	N/A	23"
140 to 200	K,T		1"	6 3/8"	.500"	N/A	23"
175 to 200	QA		1"	6 3/8"	.500"	N/A	23"

\*See Figure 5

**TABLE 4**  
**Trip-O-Link Fuse Link Ordering Information**

Current Rating	Catalog Numbers					
	Type X	Type KS	Type 200	Type QA	Type K	Type T
1/3	42033					
1/2	42050					
3/4	42075					
1	42100	22001	12001	6813	32001	52001
1 1/4	42125					
1 1/2	42150					
2	42200	22002	12002	6814	32002	52002
2 1/2	42250					
2 3/4	42275					
3		22003	12003	6815	32003	52003
3 1/2	42350					
4	42400					
5		22005	12005	6816		
5 1/2	42550					
6						
7	42007	22007	12007	6817	32006	52006
8					32008	52008
10	42010	22010	12010	6818	32010	52010
12					32012	52012
15	42015	22015	12015	6819	32015	52015
20		22020	12020	6820	32020	52020
25		22025	12025	6821	32025	52025
30		22030	12030	7482	32030	52030
40		22040	12040	7483	32040	52040
50		22050	12050	7484	32050	52050

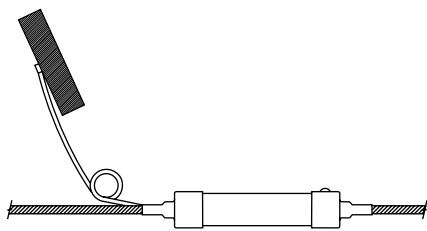


**Figure 6.**  
**Trip-o-Link fuse links.**

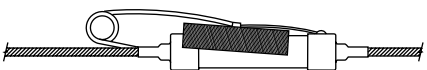
**⚠ WARNING:** Electrical shock from live electrical lines or energized equipment can cause serious bodily injury or death if persons or conductive materials they are using contact them. The time-current response of these fuse links will not protect against human injury from electrical shock. Appropriate safeguards must be used when working on or near or bringing any conductive object on or near live electrical power lines or energized equipment.

## INDICATING TYPE TUBULAR SECONDARY FUSES

Indicating type tubular secondary fuses protect transformers and capacitors from secondary overloads and faults. Each secondary fuse has a spring locked red plastic flag which springs out from the cartridge when the fuse link melts, indicating an outage. Fuses are available with insulated or non-insulated leads.



- Flag in operated position



- Flag in operational position

**Figure 7.**  
Tubular secondary fuses.

**TABLE 5**  
Ordering Information for Indicating Type Tubular Secondary Fuses

Current Rating (A)	Catalog Numbers	
	Tinned Leads	Insulated Leads
10	8316	8316-5
15	8317	8317-5
20	8318	8318-5
25	8319	8319-5
30	8320	8320-5
40	8321	8321-5
50	8322	8322-5
60	8323	8323-5
75	8324	8324-5
100	8325	8325-5
125	8326	8326-5
150	8327	—
175	8328	—
200	8329	—
300	11405	—

**TABLE 6**  
U-Adapter Assemblies\*

For Types KS, X, K, T and 200 Fuses	
Current Rating (A)	Catalog Number
1 / 3-25	14036
30-50	14036-1
65-100	14036-2
125-150	14036-3
175-200	14036-4

\* 10" length for all ampere ratings

**TABLE 7**  
U-Adapter Assemblies\*

For Type QA Fuse	
Current Rating (A)	Catalog Number
1 -25	14037
30-50	14037-1
60-100	14037-2
125-150	14037-3
175-200	14037-4

\* 10" length for all ampere ratings

## UNIVERSAL ADAPTER ASSEMBLIES

This universal adapter assembly will adapt Fit-All fuse links for use in the

cutouts that have bolt-type cable connections to connect the upper as well as the lower cable. Note from the table that only five sizes are required to adapt to any type fuse.



**Figure 8.**  
Universal Adapter assemblies.

## DUAL ELEMENT WEAK LINKS

Kearney Dual Element Weak Link (DEWL) Under-Oil Fuses are available in the following ratings: 5 kV, 8.3 kV, 15 kV, 23 kV; 5 thru 70 A. They can be sized for complete fault response, including secondary cable dig-ins. Following are features of the Kearney Weak Link:

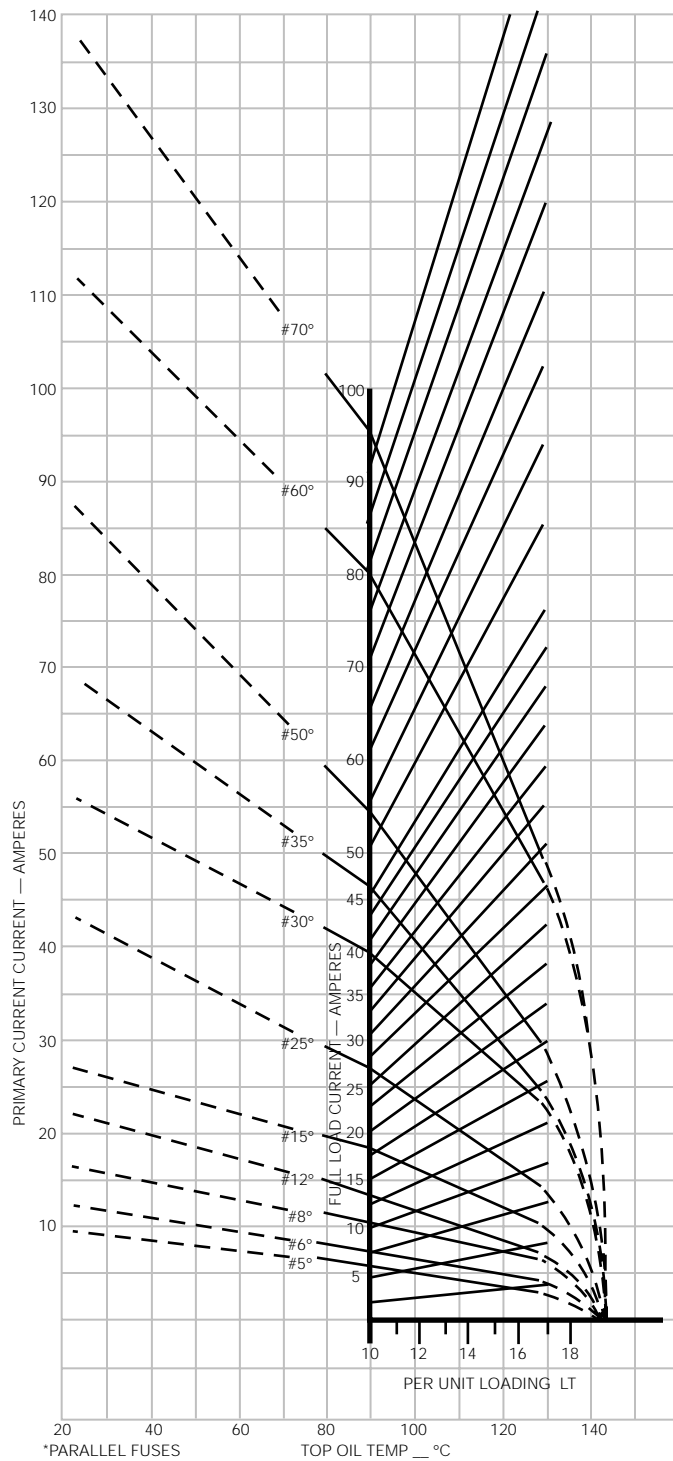
- Closely approximates ANSI safe loading curve for transformers when used to monitor transformer loads.
- Clears at 145°C, preventing thermal runaway conditions.
- Differentiates between load and fault outages permitting accurate field troubleshooting analysis.
- Has high surge withstand capability.
- Ideal for establishing composite fusing with back-up current limiting fuses.
- Has superior sensitivity when compared with a secondary breaker.
- Slower T/C characteristics permit use of lower ampere rated line fuses.
- Extremely economical.
- Common fusing system for all kVA ratings.

The Kearney line of Dual Element Fuses has been expanded to transformer Weak Links. This design has a slower speed ratio than the single

element types and more nearly approximates the slope of the ANSI safe loading curve for transformers. This characteristic lends itself well when sizing fuses to monitor transformer loads and performs a function similar to a secondary breaker.

The DEWL is designed to have a high surge current withstand capability. The user is not forced to increase the desired ampere rating as a result of high magnetizing inrush currents or lightning surges. As a matter of interest, some users choose a safe minimum fuse size which is capable of sensing secondary dig-ins for direct buried aluminum cables. The industry recognizes that this is not feasible with secondary breakers and conventional weak links.

The slower DEWL characteristic permits minimum upstream fusing where coordination of series devices might otherwise be difficult. As is indicated later, the slow speed of the DEWL TC curves combines best with the fast speed of the current-limiting fuses to form a desirable composite fusing scheme. This provides a minimum crossover area for positive fuse selection and enables the weak link to sense faults external to the transformer and low internal faults. Since most faults are external, only the inexpensive weak link need be replaced, preserving the integrity of the back up current-limiting fuse.



**Figure 9.**  
Loading Guide for all DEWL Types, all voltages.

One of the two elements in the DEWL is a eutectic metal which will melt at 145°C. Therefore, if the transformer top oil temperature reaches this level the fuse will melt and operate. This is beneficial since this temperature would be indicative of a possible thermal runaway condition.

In an effort to simplify the determination of the DEWL fuse's overload capability, a family of curves was developed (Figure 9). They show the loading effects on top oil temperatures which in turn affects the fuse loading characteristic. The transformer loading curves assume a preload condition of 90°C top oil and the overload

conditions were extracted from curves used for secondary breaker calibrations. The values may be conservative since the fuse curves are plotted to minimum, the fuse may not physically be located exactly near the top oil hot spot and most transformers would generally have a lower preload condition. The curves were plotted for long term overload limit capability 15± hours from which a short term overload limit can easily be determined. The NELPA load cycle with a 3 hour peak is considered a short term overload condition.

The DEWL is available in the conventional style weak link fiberglass reinforced "Horn Fiber" lined tube or the bay-o-net style with "Teflon" tube. The fuses are available in sizes 5 through 70 A at maximum voltages of 5, 8.3, 15 and 23 kV. The standard DEWL interrupting capability is 3.5 kA @ 8.3 kV, 2 kA @ 15.5 kV, 1.0 kA @ 23 kV, and the bay-o-net type performs at the bay-o-net rating.

### LOADING GUIDE

#### Purpose

To provide a simplified means for determining the upper limit of cyclic loading for all DEWL types in a varying oil ambient temperature environment.

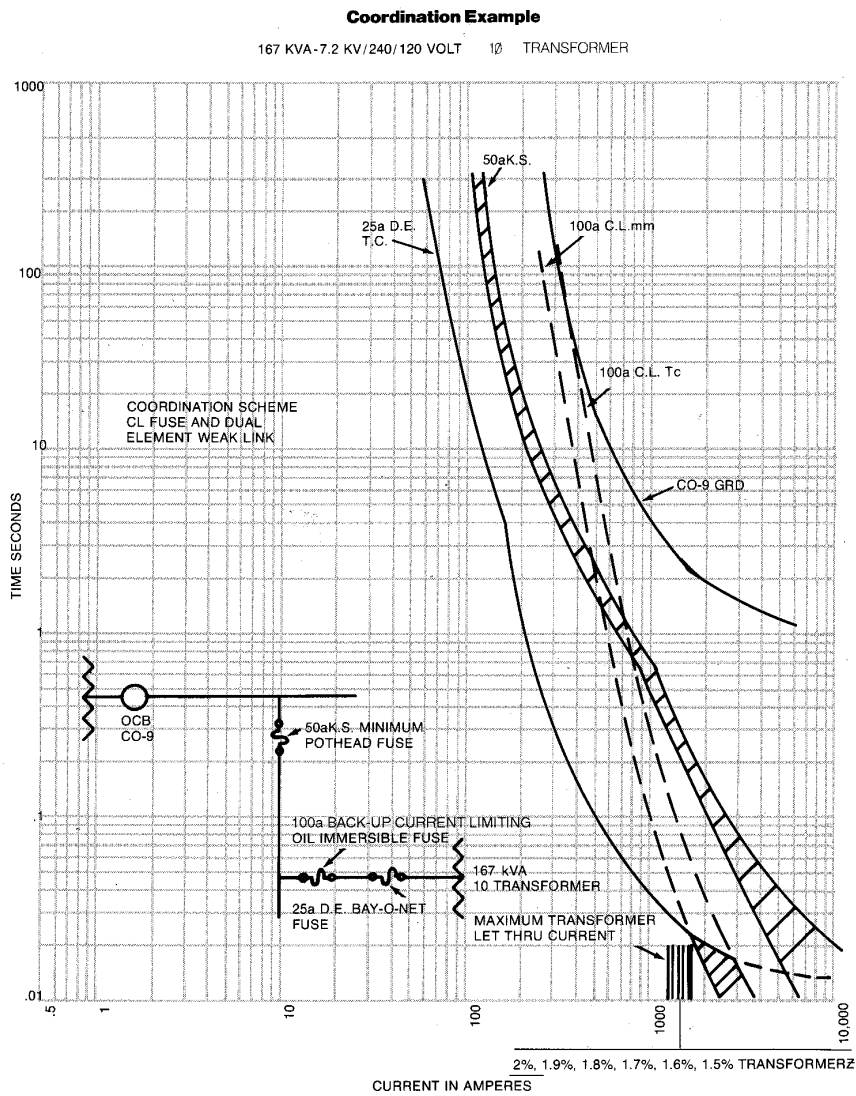
#### Curves

Transformer overload curves (increasing slope) effecting top oil temperatures superimposed on the DEWL melting curves (decreasing slope) in a variable top oil temperature environment.

#### Application

- Locate transformer full load current on the 1 PU loading ordinate and follow along appropriate loading curve (interpolate) to the point of intercept on the appropriate DEWL curve - Read the long term (LT) 15± hour peak loading cycle limit by dropping vertically from this point.
- Short term (ST) 3 hour peak loading cycle limit may be calculated from the (LT) values as follows:  
ST = 1 + 2 (LT-1)
- May safely add one tenth PU to LT obtained for padmounts 1Ø/3Ø respectively 25/75, 37/112, 50/150 and dual ratio or tap changer type units due to their relatively large tank size.

Note: Any thermal runaway is prevented because the DEWL will melt and clear for 145°C oil temperatures.



**Figure 10.**  
**100 A back-up current-limiting oil immersible fuse.**

## TWO FUSE SYSTEM COORDINATION

Expulsion fuses have advantages at low fault current levels but have great limitations at high fault current levels. Conversely, current-limiting fuses have limitations at low faults but enormous advantages at high fault current levels. The two fuse system combines the best of both for the first truly "full range" system fault protection. This benefit applies even if system faults

increase in the future. A pressure relief device is complimentary to the fuse protection system.

Figure 10 illustrates a typical distribution system. If only a current-limiting fuse were used, full coordination could not be obtained with upstream devices. Adding a DEWL fuse provides an effective composite protective curve. This indicates how the "Back-up CLF" can be used effectively with existing expulsion fusing schemes

without upsetting system coordination. The back-up fuse only operates for fault conditions at and beyond the intercept of the expulsion and CLF curves. Since most faults are of a low magnitude the inexpensive expulsion fuse will clear and leave the CLF intact for operation at high fault currents. It should be understood that the back-up fuse can be used with any expulsion fuse whether in a cutout or a weak link. The text will make reference to the Dual Element Weak Link (DEWL) since more applications will fall in this category.

Selective crossing of the composite two fuse curves provides additional benefits. Figure 10 shows a cross-over current value (TC/DEWL and MM/CLF) which is greater than the Let-Thru Current of a bolted secondary fault. Access under these conditions is not necessary since a CLF operation would indicate a serious internal fault requiring a transformer replacement in any case.

This now permits locking the CLF in the transformer, the least cost approach. Since the fuse is not influenced by overvoltages due to possible secondary delta load, the CLF voltage rating for three phase application is a L-G value, an additional cost savings. (Note, however, that the expulsion fuse must have a L-L voltage rating because of the secondary influence).

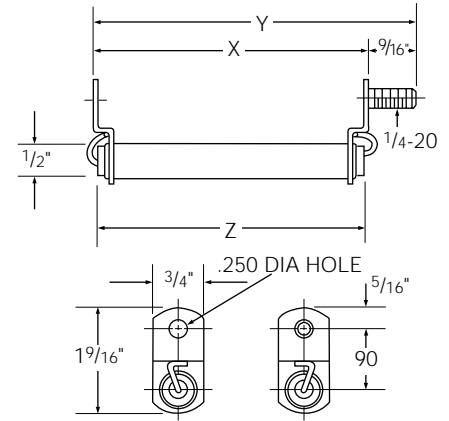
Recommended fusing combinations are available in the tables in this section. The selections are for use with Kearney's DEWL and oil immersible back-up CLF. Recommendations are made for both padmount and pole mount units; the pole mount CLF sizes are slightly larger to protect against damage from lightning surges.



ORDERING INFORMATION  
AND DIMENSIONS

**TABLE 8**  
Conventional Dual Element Weak Link (DEWL) Fuse

Catalog Number	Max. kV	Ampere ** Ratings	Dimensions (inches)		
			X	Y	Z
124090-5 124090-6 124090-8 124090-12 124090-15 124090-25 124090-30 124090-35 124090-50* 124090-60* 124090-70*	15.5	5 6 8 12 15 25 30 35 50 60 70	3-7/8	4-7/16	3-3/4
124092-5 124092-6 124092-8 124092-12 124092-15 124092-25 124092-30 124092-35 124092-50* 124092-60* 124092-70*	23	5 6 8 12 15 25 30 35 50 60 70	6-1/16	6	5-15/16



**Figure 12.**  
Fuse dimensions.

**TABLE 9**  
Conventional, Single Element Weak Link (SEWL) Fuse

Catalog Number	Max. kV	Ampere Ratings	Dimensions (inches)		
			X	Y	Z
8.3 and 15 kV 124084-13 124084-14 124084-15 124084-16	15.5	NA NA NA NA	3-7/8	4-7/16	3-3/4

Note: NA-Not Applicable (See 124030 TC Curves)

**TABLE 10**  
Bay-O-Net Dual Element Weak Link Fuse

Catalog Number	Max. kV	Ampere ** Ratings
124080-5 124080-6 124080-8 124080-12 124080-15	22	5 6 8 12 15
124080-25 124080-30 124080-35	15.5	25 30 35



**Figure 11.**  
Bay-O-Net fuse link.

\* Consists of 2 fuses requiring parallel connection by user.

\*\* Loading-See "Loading Guide for all DEWL types, all voltages".







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