

Guide to General fuses and applications Basics

For LV fuses

**COOPER** Bussmann

Fuse selection method

When selecting LV fuses certain important information must be known.

1. System Voltage

This is the voltage of the system or distribution network.

2. System Load

This is the load current on the system

3. Overload or inrush current

This is the short term allowable overload that could be seen typically at switch on or during heavy loading

4. Overload duration

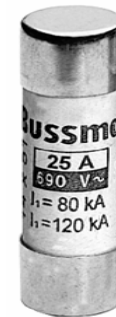
The time the overload will be present

5. Fault current

The short circuit current or low overload fault current that would be seen in the event of a fault occurring

Fuse selection

Fuse selection should be based on the electrical parameters in the system and the physical restraints or preferred fuse type



Applications can be split into various categories and allow the correct selection of the fuse type

Categories

The main categories for fuse selection are.
Low Voltage or Medium voltage

Low Voltage (1000V or less);

General purpose (known as gG/gL)

Motor protection (known as gM and aM)

High speed. (known as aR or gR)

Transformer protection (known as gTr)

Medium / High voltage (more than 1000V);

Motor protection (known as Back up protection)

Transformer protection (Back up protection)

Overhead line / general Back up protection (Back up protection)

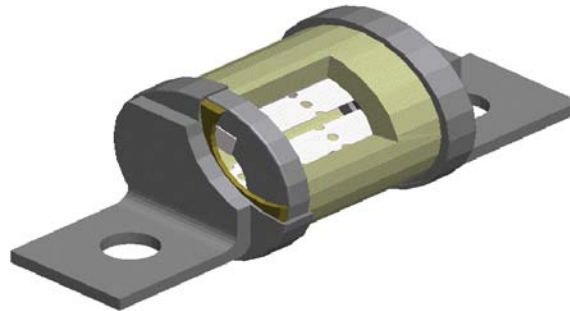
Full range fuses

Fuse types

Low Voltage types

gG / gL (Means the same thing)

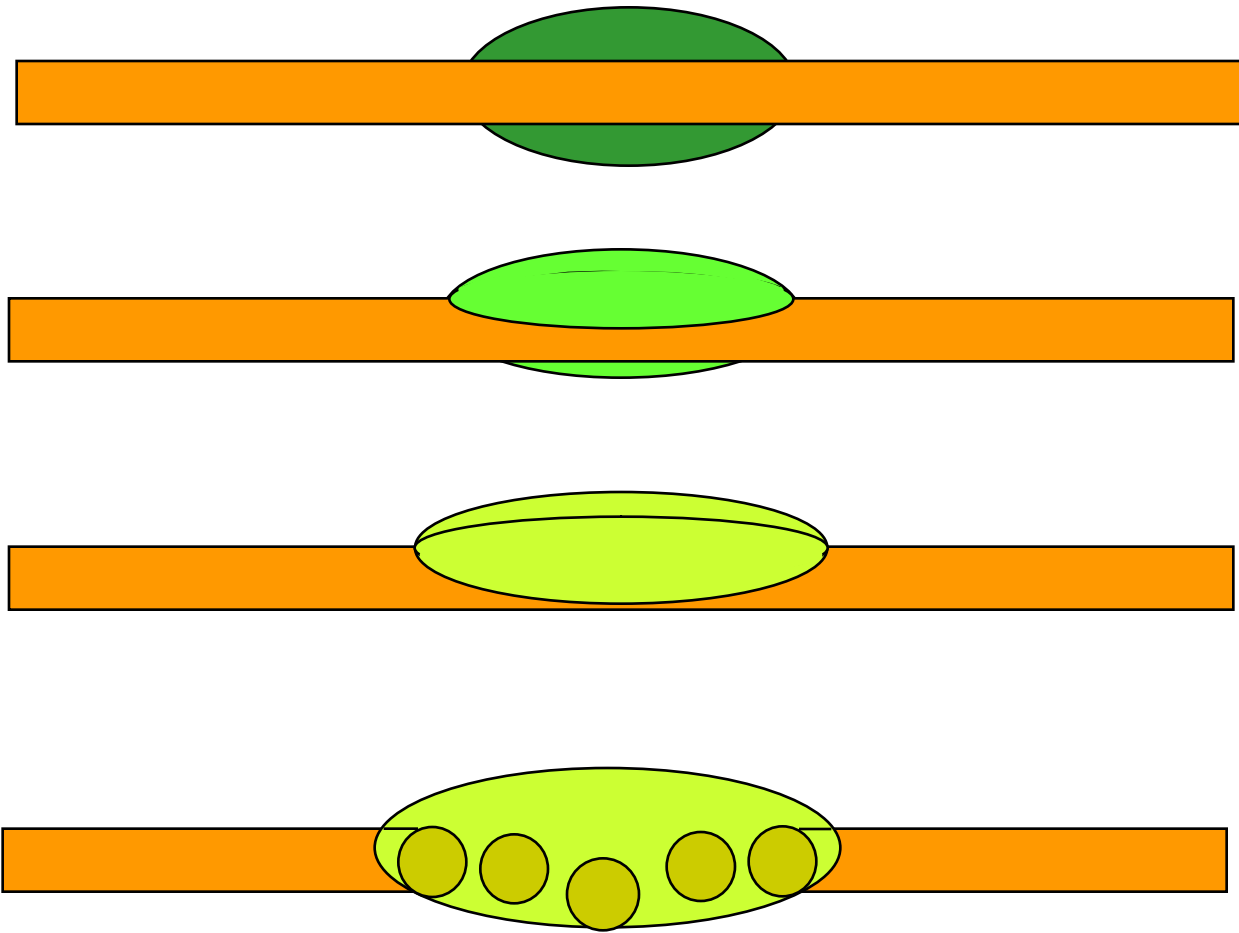
These are classed as general purpose fuse links and are the most common type of LV fuse there is



Elements are standard notched design and have M-effect element in most cases.

M effect is a small amount of solder added to the element to act as a low melting point on the element to clear low over load currents.

M effect



Fuse types

aM or gM Motor fuses

These are fuses specifically designed for motor protection only.

Thicker element for thermal stresses

aM fuses have no M effect and can only clear high short circuit faults.

gM fuse have M effect and are good for low overload faults and short circuit faults. These are the most common motor fuses.

Parts usually have a “M” in the part number eg AAO32M63

Fuse types

Some of the LV motor fuses available.



European style cylindrical fuses. Sizes 10 x 38, 14 x 51 and 22 x 58mm



British standard (BS88) type fuses



European type DIN square body fuses

Fuse types

aR types

These are known as high speed fuses and are designed specifically for the protection of semi conductors.

Very high breaking capacity

Very fast acting

For short circuit protection only

No M effect.

Huge Bussmann range, normally specific to the application

Many special types

Fuse types

gR types

These are as per the aR type fuses but can also clear low over load fault conditions.

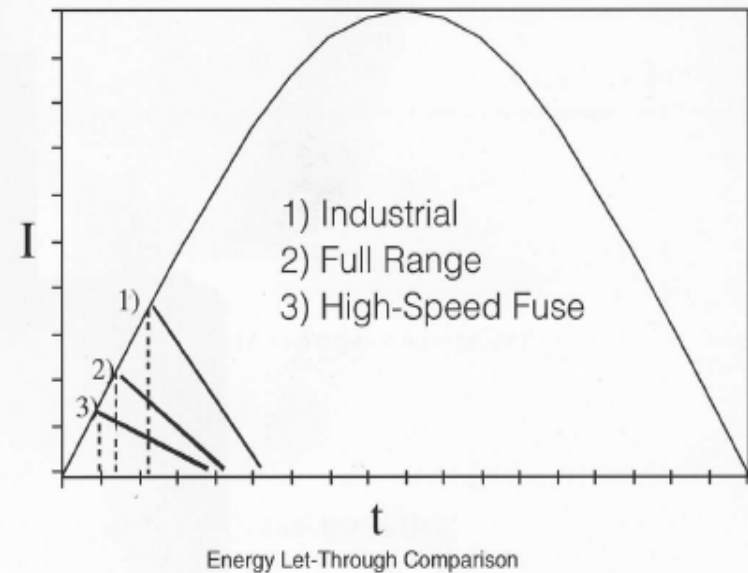
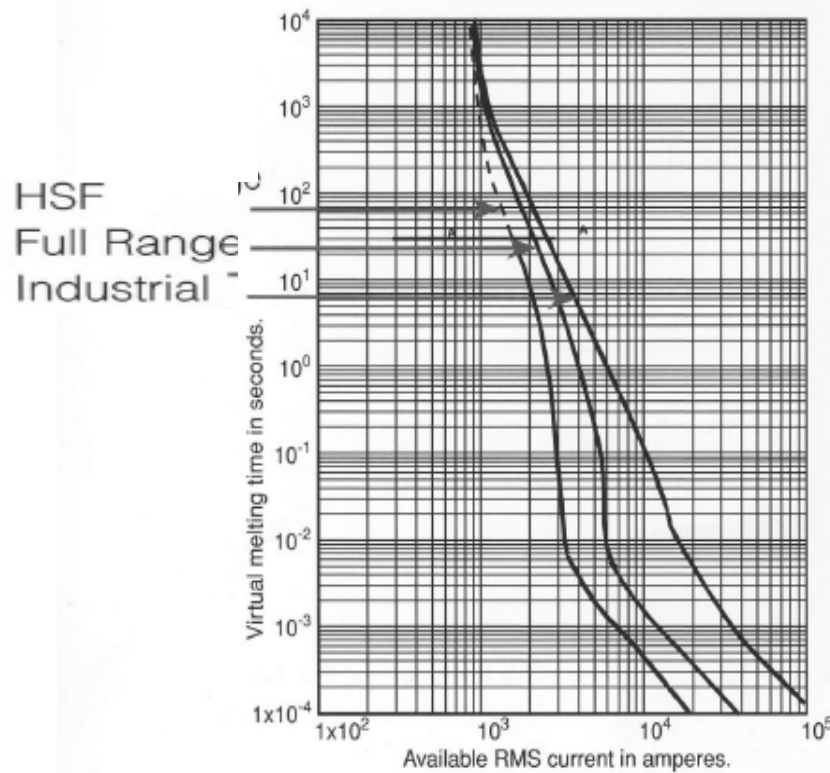
Have M effect to cope with low overload faults.

Main range is the DIN 43620 style fuses.



Fuse types

Comparison between aR and gR time current curves



Fuse types

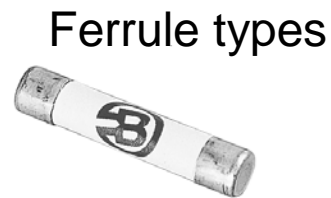
Examples of high speed fuses



BS88 type high speed fuses



DIN square bodied type



Ferrule types



North American style



Accessories available

Fuse types

Transformer Fuse.

A fuse designed to withstand the very high short term magnetising current seen at switch on of a transformer.



HV Fuse types

HV Fuses

Motors

Motor fuses are available in voltage ratings 3.6KV, 7.2KV and up to 450A

Made to IEC 60282 and BS2692 standard

Have special crinkle design element, suitable for Direct on line starting

Good for cyclic loading of motors

Many different end fixings to suite all applications

Motor HV fuses

Part Number	Voltage Rating	Current Rating	Breaking Capacity	Minimum Breaking Current	Cold resistance and watts loss in free air at rated current		Joule Integral (I ² t)		Length mm	Diameter Ø mm	Weight kg
	U _n kV	I _n A	I ₁ kA	I ₃ A	mΩ	W	A ² s				
							Minimum Pre-Arching	Maximum Total Clearing			
3.6WJON65	3.6	5	50	13	148	5	2.0X10 ¹	1.6X10 ³	192	35	0.54
3.6WJON66.3	3.6	6.3	50	24	56.3	8	1.6X10 ²	1.3X10 ³	192	35	0.54
3.6WJON610	3.6	10	50	24	56.3	8	1.6X10 ²	1.3X10 ³	192	35	0.54
3.6WJON616	3.6	16	50	56	33.1	12	1.7X10 ²	1.4X10 ³	192	35	0.54
3.6WJON620	3.6	20	50	56	22.1	12	3.9X10 ²	3.2X10 ³	192	35	0.54
3.6WJON625	3.6	25	50	70	17.7	15	6.1X10 ²	4.9X10 ³	192	35	0.54
3.6WJON631.5	3.6	31.5	50	112	10.1	14	1.2X10 ³	9.8X10 ³	192	35	0.54
3.6WJON640	3.6	40	50	112	7.54	17	2.1X10 ³	1.7X10 ⁴	192	35	0.54
3.6WJON650	3.6	50	50	140	6.03	21	3.2X10 ³	2.6X10 ⁴	192	35	0.54
3.6WDOH650	3.6	50	50	190	5.36	20	1.8X10 ³	2.4X10 ⁴	192	51	1.1
3.6WDOH663	3.6	63	50	225	3.68	21	3.8X10 ³	4.5X10 ⁴	192	51	1.1
3.6WDOH680	3.6	80	50	288	2.88	27	6.3X10 ³	8.0X10 ⁴	192	51	1.1
3.6WDOH6100	3.6	100	50	360	2.16	31	9.8X10 ³	1.1X10 ⁵	192	51	1.1
3.6WDOH6125	3.6	125	50	450	1.73	39	1.5X10 ⁴	2.2X10 ⁵	192	51	1.1
3.6WFOH6160	3.6	160	50	600	1.28	47	3.1X10 ⁴	6.2X10 ⁵	192	76	2.1
3.6WFOH6200	3.6	200	50	600	0.938	52	5.7X10 ⁴	1.1X10 ⁶	192	76	2.1
3.6WDFHO50	3.6	50	50	152	6.61	21	1.8X10 ³	2.4X10 ⁴	254	51	1.46
3.6WDFHO63	3.6	63	50	171	5.03	28	3.1X10 ³	4.5X10 ⁴	254	51	1.46
3.6WDFHO80	3.6	80	50	190	3.52	31	6.3X10 ³	8.0X10 ⁴	254	51	1.46
3.6WDFHO100	3.6	100	50	190	2.87	39	9.5X10 ³	1.2X10 ⁵	254	51	1.46
3.6WDFHO125	3.6	125	50	190	2.44	53	1.3X10 ⁴	1.8X10 ⁵	254	51	1.46
3.6WFFHO160	3.6	160	50	300	1.53	54	3.4X10 ⁴	4.1X10 ⁵	254	76	3.2
3.6WFFHO200	3.6	200	50	300	1.24	67	5.1X10 ⁴	7.2X10 ⁵	254	76	3.2
3.6WKFHO250	3.6	250	50	520	0.653	57	1.8X10 ⁵	2.4X10 ⁶	254	76	3.2
3.6WKFHO315	3.6	315	50	650	0.435	60	4.1X10 ⁵	5.0X10 ⁶	254	76	3.2
3.6WKFHO355	3.6	355	50	820	0.345	59	6.4X10 ⁵	7.0X10 ⁶	254	76	3.2
3.6WKFHO400	3.6	400	50	820	0.345	76	6.4X10 ⁵	7.0X10 ⁶	254	76	3.2
3.6WFGHO31.5	3.6	31.5	50	151	18.4	25	4.5X10 ²	6.0X10 ³	359	76	4.1
3.6WFGHO40	3.6	40	50	151	13.9	31	8.0X10 ²	1.2X10 ⁴	359	76	4.1
3.6WFGHO50	3.6	50	50	151	9.24	32	1.8X10 ³	2.2X10 ⁴	359	76	4.1
3.6WFGHO63	3.6	63	50	151	6.93	38	3.2X10 ³	4.5X10 ⁴	359	76	4.1
3.6WFGHO80	3.6	80	50	170	5.47	48	5.1X10 ³	7.5X10 ⁴	359	76	4.1
3.6WFGHO100	3.6	100	50	212	4.40	62	7.9X10 ³	1.2X10 ⁵	359	76	4.1
3.6WFGHO125	3.6	125	50	212	3.60	79	1.2X10 ⁴	1.7X10 ⁵	359	76	4.1
3.6WFGHO160	3.6	160	50	300	2.16	75	3.4X10 ⁴	4.2X10 ⁵	359	76	4.1
3.6WFGHO200	3.6	200	50	300	1.77	95	5.1X10 ⁴	7.0X10 ⁵	359	76	4.1
3.6WFGHO250	3.6	250	50	500	1.13	96	1.3X10 ⁵	1.9X10 ⁶	359	76	4.1
3.6WKGHO315	3.6	315	50	852	0.646	89	4.5X10 ⁵	6.0X10 ⁶	359	76	3.9
3.6WKGHO355	3.6	355	50	852	0.512	90	6.4X10 ⁵	8.5X10 ⁶	359	76	3.9
3.6WKGHO400	3.6	400	50	960	0.454	100	8.2X10 ⁵	1.1X10 ⁷	359	76	3.9
3.6WKGHO450	3.6	450	50	1150	0.379	108	1.2X10 ⁶	1.5X10 ⁷	359	76	3.9
7.2WFNHO25	7.2	25	40	84	38.7	34	1.4X10 ²	2.1X10 ³	403	76	4.4
7.2WFNHO31.5	7.2	31.5	40	96	25.5	35	3.1X10 ²	4.7X10 ³	403	76	4.4
7.2WFNHO40	7.2	40	40	107	18.2	40	6.1X10 ²	8.0X10 ³	403	76	4.4
7.2WFNHO50	7.2	50	40	122	13.3	46	1.2X10 ³	1.5X10 ⁴	403	76	4.4
7.2WFNHO63	7.2	63	40	133	10.4	56	1.9X10 ³	3.0X10 ⁴	403	76	4.4
7.2WFNHO80	7.2	80	40	133	7.30	65	3.8X10 ³	5.8X10 ⁴	403	76	4.4
7.2WFNHO100	7.2	100	40	262	4.92	69	9.8X10 ³	1.3X10 ⁵	403	76	4.4
7.2WFNHO125	7.2	125	40	300	2.94	63	2.4X10 ⁴	2.4X10 ⁵	403	76	4.4
7.2WFNHO160	7.2	160	40	337	2.05	72	5.0X10 ⁴	7.0X10 ⁵	403	76	4.4
7.2WKNHO200	7.2	200	40	500	1.63	90	8.8X10 ⁴	1.3X10 ⁶	403	76	4.4
7.2WKNHO224	7.2	224	40	500	1.44	98	1.1X10 ⁵	1.6X10 ⁶	403	76	4.4
7.2WKNHO250	7.2	250	40	960	1.11	105	2.2X10 ⁵	1.6X10 ⁶	403	76	4.4
7.2WKNHO315	7.2	315	40	960	0.779	107	4.5X10 ⁵	3.1X10 ⁶	403	76	4.4

Transformer Oil fuses

- Many transformers Oil filled for cooling.
- Fuses are sealed to prevent Oil ingress.
- Standard sizes
- Full range of fuses available
- Selection tables published in catalogue

Transformer kVA	Transformer Priority Voltage												
	3.3kV			6.6kV			11kV				13.8kV		
	Product Code	Current Rating (A)	Rating kV	Product Code	Current Rating (A)	Rating kV	ESI 12-8 Ref.	Product Code	Current Rating (A)	Rating kV	Product Code	Current Rating (A)	Rating kV
200	OEFMA	63	3.6	OEFMA	31.5	12	01	OEFMA	25	12	OEFMA	16	15.5
250	OEFMA	80	3.6	OEFMA	40	12	-	OEFMA	25	12	OEFMA	20	15.5
300/315	OEFMA	100	3.6	OEFMA	50	12	02	OEFMA	31.5	12	OEFMA	25	15.5
400	OEFMA	125	3.6	OEFMA	63	12	-	OEFMA	40	12	OEFMA	31.5	15.5
500	OEFMA	160	3.6	OEFMA	71	12	03	OEFMA	50	12	OEFMA	40	15.5
630	OEFMA	200	3.6	OEFMA	100	7.2	-	OEFMA	63	12	OEFMA	50	15.5
750/800	OLGMA	250	3.6	OHGMA	125	7.2	04	OHFMA	80	12	OEFMA	63	15.5
1000	OLGMA	250*	3.6	OHGMA	140	7.2	05	OGFMA	90	12	OHGMA	71	15.5
1250	-	-	-	OHGMA	160*	7.2	-	OGFMA	100	12	OHGMA	90	15.5
1600	-	-	-	-	-	-	-	OLGMA	125*	12	OLGMA	100*	15.5

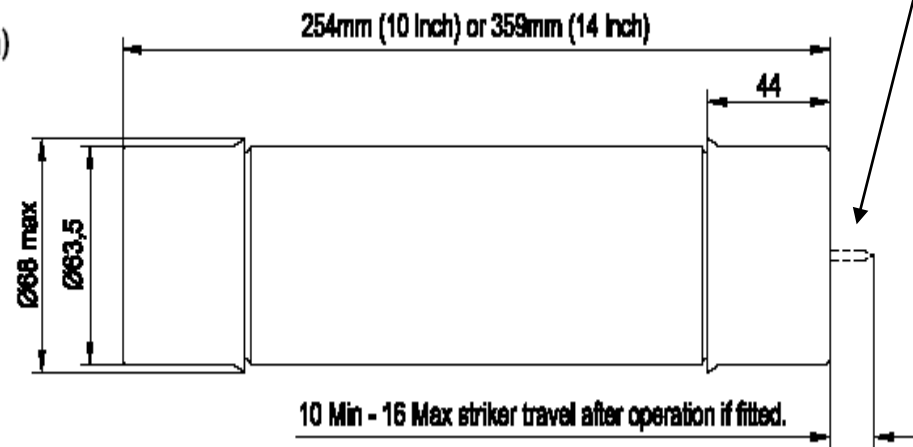
Oil Tight transformer fuses



Typical oil fuse

Striker can be seen for switch gear operated fault clearing

Dimensions (mm)



Overhead line protection

There are various designs for Overhead line / general fuse types on offer protection.

Standard Air fuses

Made to BS2962-1 dimensions in voltage ratings from 3.6KV to 72.5KV

Expulsion links

Complies with ANSI C 37-42 for slow blow, Fast acting and extra rapid characteristics

Liquid fuses

Designed for use in hot environments where fire risk needs to be eliminated. Contain arc extinguishing liquid.

HV Air fuses

Common on many distribution networks.

Good product range

History of end fixings to suit most applications

Flexible design

Good back up protection

Meet or exceed all relevant standards



Have Pyrotechnic striker fitted for switch gear operated fault clearing

Expulsion links

Cost effective fuse solution

Meet requirements of ANSI type T and K (slow and fast characteristics)

Voltage ratings up to 72KV

Current ratings from 1 to 100A

Many types available for majority of applications



Liquid Filled Fuses

Old design, first used before HV standards introduced, do not meet any standards.

Fuse body is toughened glass

Element can be replaced after fault clearing

Fuse tube contains arch quenching liquid

Fuse link sealed against the weather, indefinite service life.

Liquid fuses

Fuse element held back by spring.

When fuse element melts element and contact is pulled back by spring inside fuse through arc quenching liquid.

This ensures rapid arc quenching.

Replacement fuse element can be purchased to repair fuse.



Symbol					Meaning
Rating Voltage	Liquid Fuse Designation	Size	Characteristic	Current	
33	-	-	-	-	Fuse is rated at 33kV for use on 33kV systems
-	L	-	-	-	Denotes a Liquid fuse link
-	-	3	-	-	Indicates size
-	-	-	S	-	Indicates characteristics (F = standard; S = slow blow)
-	-	-	-	25	Current rating of the fuse link in Amps.

Fuses General

Any Questions?