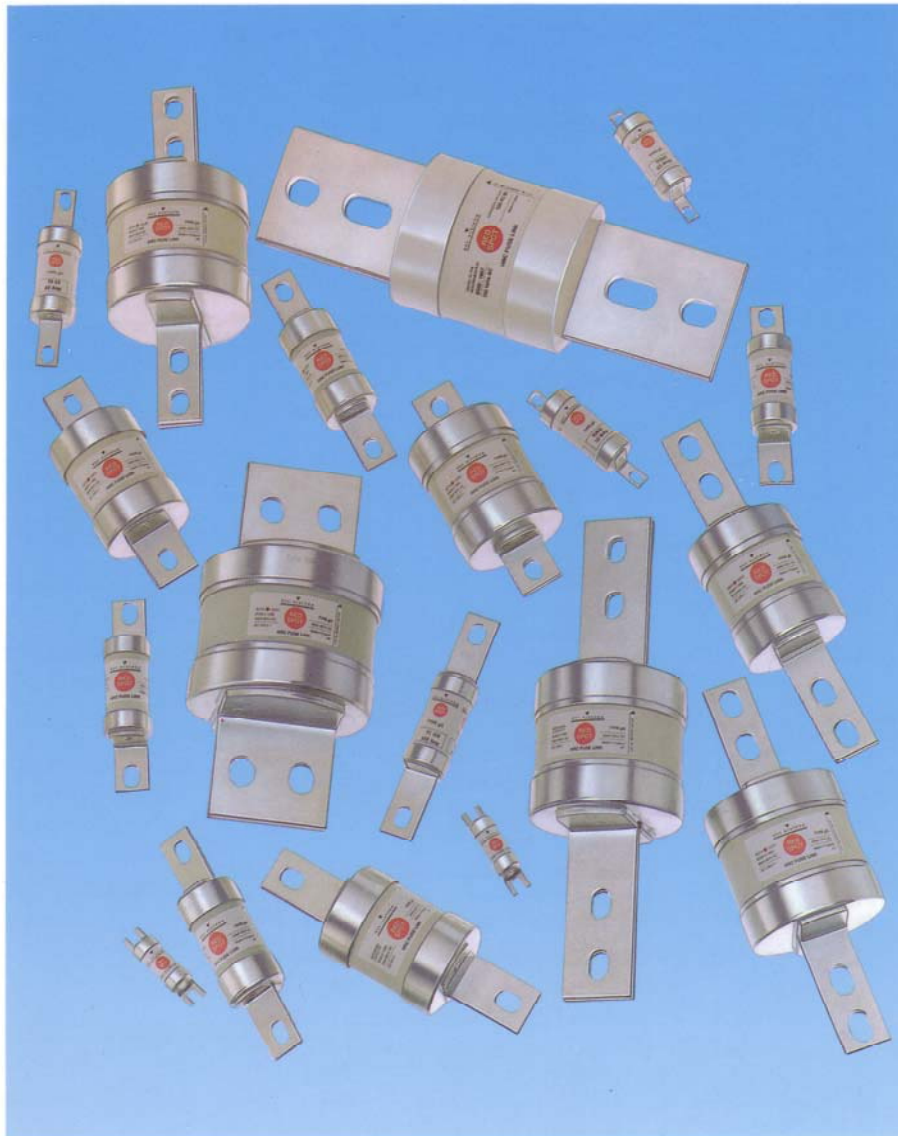


Industrial Fuse Links




GEC ALSTHOM

LOW VOLTAGE EQUIPMENT

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'RED SPOT' HRC Fuse Links

for industrial and
general applications

1/2

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The contents of BS 88:Part 2:1988 (and the associated IEC 269-2) were taken into consideration by GEC ALSTHOM when the complete range of 'RED SPOT' fuse links was re-designed some time ago.

There are therefore no changes in the electrical characteristics of the fuse links detailed in this publication – an important point to note for those users who have approved equipment or engineered installations based on their use. 'RED SPOT' fuse links meet all the requirements of BS 88:Part 2:1988 and this publication details changes in terminology and practice resulting from the issue of that standard.

A.C. Performance

ASTA 20 certified to 80kA, generally at 660 Volt, to BS 88:Part 2:1988 (See page 1/3).

D.C. Performance

ASTA certified at 40kA, to BS 88:Part 2:1988 (See page 1/3).

Protection of PVC insulated cables

Class 'gG' ratings provide complete protection, and enable cables to be fully rated in accordance with IEE Wiring Regulations (See pages 1/7 and 1/8).

Discrimination

'RED SPOT' fuse links will discriminate with each other at fault levels up to 80kA, 415 Volt when the ratio between 'major' and 'minor' current ratings is 1.6:1 (See page 1/9).

Motor Starting ability

All 'RED SPOT' fuse links are suitable for use in motor circuits and have superior motor starting ability. The availability of class 'gM' fuse links enhances this capability (See pages 1/7, 1/12 & 1/13).

Motor Circuit Protection

'RED SPOT' fuse links combined with the contactors and relays of leading manufacturers, provide ASTA certified co-ordination of motor starters to the latest International Standards (See page 1/12).

Protection against electric shock

'RED SPOT' fuse links protect against electric shock when used in accordance with the IEE Wiring Regulations (See page 1/10).

Energy conservation

All 'RED SPOT' fuse links have low power loss values, well within the limits specified in BS 88:Part 2:1988.

Approvals

Approved by leading Authorities, including Lloyds, Power Generation Companies, and Ministry of Defence, as being made to recognised standards of quality assurance (including BS 5750:Part 1:1987).

Performance Data

Type	Ratings	Utilisation category*	BS88-2 Dimension reference	Maximum voltage rating	
	Amp			a.c	d.c
NIT	2-20	gG	A1	550	250
NIT	20M25, 20M32	gM	A1	415	–
TIA	2-32	gG	A2	660	460
TIA	32M35-32M63	gM	A2	660	460
TIS	35-63	gG	A3	660	460
TIS	63M80, 63M100	gM	A3	660	–
TCP‡	80, 100	gG	A4	660	350
TCP‡	100M125-100M200	gM	A4	660	350
TFP	125-200	gG	–	660	350
TB	2-63	gG	–	660	460
TBC	2-63	gG	–	660	460
TC‡	80, 100	gG	B1	660	350
TC‡	100M125-100M200	gM	B1	660	350
TF‡	125-200	gG	B2	660	350
TF	200M250	gM	B2	660	460
TF	200M315	gM	B2	550	–
TKF	250, 315	gG	B3	660	460
TKF	315M355	gM	B3	660	460
TKM	250, 315	gG	–	660	460
TMF	355, 400	gG	B4	660	460
TMF	400M450	gM	B4	660	460
TM	355, 400	gG	C1	660	460
TM	400M450	gM	C1	660	460
TMT	355, 400	gG	–	660	460
TTM	450-630	gG	C2	660	450
TTM	630M670	gM	C2	660	450
TT	450-630	gG	–	660	450
TLM‡	670-800	gG	C3	660	350
TLT	670-800	gG	–	660	350
TLU	560-800	gG	–	660	350
TXU	1000, 1250	gG	D1	660	300

Notes

A range of TUV fuse links up to 1600Amp are also available. These are outside the scope of BS 88. See page 1/6. Details on request.

'ASTA20 Certified' endorsement on a low voltage fuse link indicates that the design has been proved and Certified by ASTA to the relevant BS and that the fuse links are examined periodically under the ASTA surveillance scheme.

* See page 1/7

‡ 'RED SPOT' TZC, TZCP, TZF and TZLM fuse links proved at 460 Volt d.c are available for users who need superior d.c. performance in these dimensional references.

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List numbers & Dimensions

Off-set tags
2-hole fixing

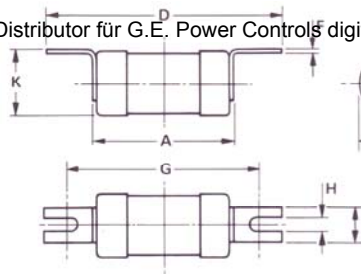
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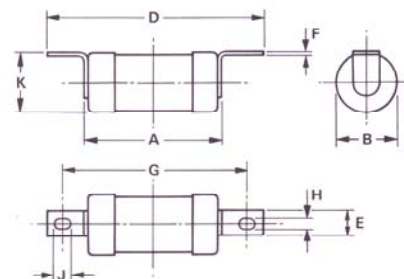
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Type	Rating	List number	Dimensions in millimetres							
			A	B	D	E	F	G	H	K
	Amp							Fixing centres		
NIT 2-20 Amp	2	NIT2								
<i>Extended Motor</i>	4	NIT4								
<i>Range 20M25</i>	6	NIT6								
<i>& 20M32†</i>	10	NIT10	36.50	14.10	55.60	11.10	0.80	44.50	4.70	14.30
	16	NIT16	BS 88:1988 Dimensional Ref. A1							
	20	NIT20								
	20M25	NIT20M25†								
	20M32	NIT20M32†								

Off-set tags
2-hole fixing



Type	Rating	List number	Dimensions in millimetres								
			A	B	D	E	F	G Fixing centres	H	J	K
	Amp										
TIA 2-32 Amp	2	TIA2									
<i>Extended Motor</i>	4	TIA4									
<i>Range 32M35</i>	6	TIA6									
<i>- 32M63†</i>	10	TIA10									
	16	TIA16									
	20	TIA20	56.40	23.80	85.80	8.70	1.20	73.00	5.20	8.10	24.90
	25	TIA25	BS 88:1988 Dimensional Ref. A2								
	32	TIA32									
	32M35	TIA32M35†									
	32M40	TIA32M40†									
	32M50	TIA32M50†									
	32M63	TIA32M63†									
TIS 35-63 Amp	35	TIS35									
<i>Extended Motor</i>	40	TIS40	56.40	23.80	85.80	8.70	1.20	73.00	5.20	8.10	24.90
<i>Range 63M80</i>	50	TIS50									
<i>- 63M100†</i>	63	TIS63									
	63M80	TIS63M80†	†58.00	26.20	90.50	12.70	1.20	73.00	5.20	7.50	27.80
	63M100	TIS63M100†	BS 88:1988 Dimensional Ref. A3								
TCP 80 & 100 Amp	80	TCP80	58.00	26.20	111.00	19.10	2.40	93.70	8.70	11.90	27.50
<i>Extended Motor</i>	100	TCP100									
<i>Range 100M125</i>	100M125	TCP100M125†	†70.00	34.90	111.00	19.10	2.40	93.70	8.70	11.90	34.90
<i>- 100M200†</i>	100M160	TCP100M160†	BS 88:1988 Dimensional Ref. A4								
	100M200	TCP100M200†									
TFP 125-200 Amp	125	TFP125									
	160	TFP160	70.00	34.90	111.00	19.10	2.40	93.70	8.70	11.90	34.90
	200	TFP200									

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† Fuse links from the Extended Range for Motor Circuits - See pages 1/7 & 1/13.

Central tags
2-hole fixing

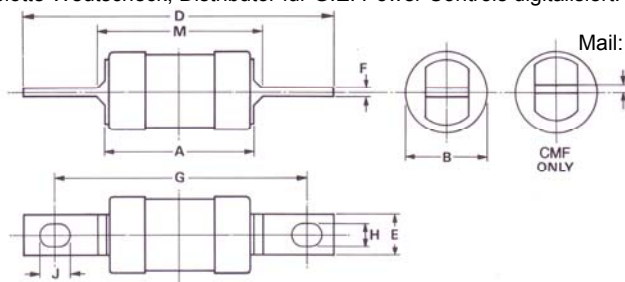
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Type	Rating	List number	Dimensions <i>in millimetres</i>								
			A	B	D	E	F	G Fixing centres	H	J	M
	Amp										
TB 2-63 Amp	2	TB2									
	4	TB4									
	6	TB6									
	10	TB10									
	16	TB16									
	20	TB20	58.00	26.20	111.90	12.70	1.60	96.90	7.10	10.30	61.90
	25	TB25									
	32	TB32									
	35	TB35									
	40	TB40									
	50	TB50									
	63	TB63									
TBC 2-63 Amp	2	TBC2									
	4	TBC4									
	6	TBC6									
	10	TBC10									
	16	TBC16									
	20	TBC20	58.00	26.20	128.70	14.30	1.60	111.00	8.70	11.90	61.90
	25	TBC25									
	32	TBC32									
	35	TBC35									
	40	TBC40									
	50	TBC50									
	63	TBC63									
TC 80 & 100 Amp <i>Extended Motor Range 100M125- 100M200†</i>	80	TC80	58.00	26.20	136.50	19.10	3.25	111.00	8.70	11.90	58.80
	100	TC100									
	100M125	TC100M125†	†70.00	34.90	136.50	19.10	3.20	111.00	8.70	11.90	79.40
	100M160	TC100M160†	BS 88:1988 Dimensional Ref. B1								
	100M200	TC100M200†									
TF 125-200 Amp <i>Extended Motor Range 200M250 & 200M315†</i>	125	TF125									
	160	TF160	70.00	34.90	136.50	19.10	3.20	111.00	8.70	11.90	79.40
	200	TF200									
	200M250	TF200M250†	†77.00	41.30	136.50	19.10	3.20	111.00	8.70	11.90	79.40
	200M315	TF200M315†	BS 88:1988 Dimensional Ref. B2								
TKF 250 & 315 Amp <i>Extended Motor Range 315M355†</i>	250	TKF250	77.00	54.00	136.50	25.40	3.20	111.00	8.70	11.90	82.00
	315	TKF315	BS 88:1988 Dimensional Ref. B3								
	315M355	TKF315M355†									
TKM 250 & 315 Amp	250	TKM250	77.00	54.00	160.20	25.40	3.20	133.40	10.30	13.50	82.00
	315	TKM315									
TMF 355 & 400 Amp <i>Extended Motor Range 400M450†</i>	355	TMF355	83.00	61.10	136.50	25.40	6.30	111.00	8.70	11.90	85.80
	400	TMF400	BS 88:1988 Dimensional Ref. B4								
	400M450	TMF400M450†									

† Fuse links from the Extended Range for Motor Circuits - See pages 1/7 & 1/13.

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**Central tags
4-hole fixing**

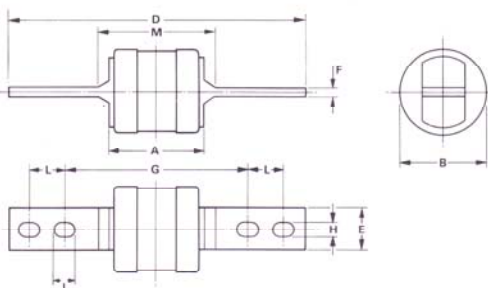
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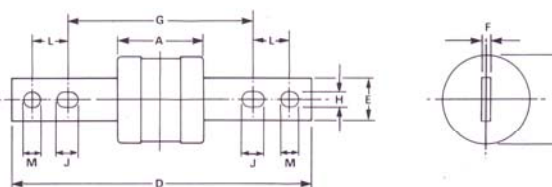
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1/6

Type	Rating	List number	Dimensions in millimetres									
			A	B	D	E	F	G	H	J	L	M
	Amp							Fixing centres				
TM 355 & 400-Amp	355	TM355	83.00	61.10	211.00	25.40	6.30	133.00	10.30	11.90	25.40	95.00
<i>Extended Motor Range 400M450†</i>	400	TM400	BS 88:1988 Dimensional Ref. C1									
	400M450	TM400M450†										
TMT 355 & 400 Amp	355	TMT355	83.00	61.10	255.40	25.40	6.30	165.00	10.30	13.50	31.80	95.00
	400	TMT400										
TTM 450-630 Amp	450	TTM450										
<i>Extended Motor Range 630M670†</i>	500	TTM500	81.80	76.20	209.60	25.40	6.30	133.00	10.30	11.90	25.40	95.00
	560	TTM560	BS 88:1988 Dimensional Ref. C2									
	630	TTM630										
	630M670	TTM630M670†										
TT 450-630 Amp	450	TT450										
	500	TT500	81.80	76.20	266.70	38.10	6.30	165.00	10.30	15.10	31.80	108.00
	560	TT560										
	630	TT630										
TLM 670-800 Amp	670	TLM670	88.10	82.50	209.60	25.40	9.50	133.00	10.30	15.10	25.40	100.10
	710	TLM710	BS 88:1988 Dimensional Ref. C3									
	750	TLM750										
	800	TLM800										
TLT 670-800 Amp	670	TLT670										
	710	TLT710	88.10	82.50	266.70	38.10	7.80	165.00	10.30	15.10	31.80	114.30
	750	TLT750										
	800	TLT800										

**Central tags
4-hole fixing**



Type	Rating	List number	Dimensions in millimetres									
			A	B	D	E	F	G	H	J	L	M
	Amp							Fixing centres				
TUV*	1000	TUV1000	95.3	88.9	273.1	69.9	12.7	158.8	15.8	28.5	39.7	19.0
1000-1600 Amp	1250	TUV1250	* For use at 415 Volt a.c. Details available on request.									
	1600	TUV1600										

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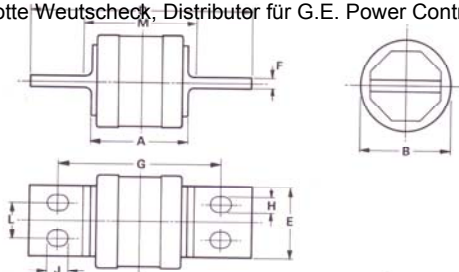
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Type	Rating Amp	List number	Dimensions in millimetres									
			A	B	D	E	F	G Fixing centres	H	J	L	M
TLU 560-800 Amp	560	TLU560	90.50	83.30	200.00	63.50	9.50	149.00	13.50	15.90	31.80	101.60
	630	TLU630										
	670	TLU670										
	710	TLU710										
	750	TLU750										
	800	TLU800										
TXU 1000 & 1250 Amp	1000	TXU1000	88.90	101.60	200.00	63.50	9.50	149.00	13.50	16.70	31.80	95.00
	1250	TXU1250	BS 88:1988 Dimensional Ref. D1									

Utilisation Categories 'gG' and 'gM'

Some of the fuse link types used in certain European Countries have only partial range breaking capacity (ie, they interrupt short circuit fault currents, but are unable to interrupt overload currents safely). To distinguish these types from the much more widely used general purpose fuse links, the concept of 'utilisation category' has been introduced in the international standard IEC 269.

Since BS 88 is based upon IEC 269, it includes the same utilisation classes, each of which is defined by a two letter code. The first letter indicates the breaking range of the fuse link, as follows:

'g' - full range breaking capacity fuse link.

'a' - partial range breaking capacity fuse link.

The second letter indicates utilisation category, as follows:

'G' - Fuse link for general application, including the protection of motor circuits.

'M' - Fuse link for protection of motor circuits.

The standards combine these letters to recognise three classes, ie., gG, gM and aM.

All 'RED SPOT' fuse links are classified as either gG or gM, and so have a full range breaking capacity.

A class gM fuse link has a dual basis of current rating, the smaller one of which is its continuous rating (I_n), whilst the larger one is its rating with respect to its time/current characteristics (I_{ch}) and is thus an indication of its ability to withstand motor starting surges. The two ratings are separated by an 'M' in list numbers, eg., 32M63.

A class gG fuse link has only one, continuous, rating.

BS 88:Part 2:1988 specifies a time/current zone for each current rating within which its published time/current characteristics must lie. The time/current zone for a gM type is defined according to its larger current rating, and thus the characteristics of a 32M63 rating must fall within the same zone as a 63 Amp class gG rating.

Class gM fuse links exist only to enable economies to be achieved in the size of equipment used in motor circuits, eg., 32M63 fuse links can be fitted in 32 Amp fuseholders in a 15kW, 415 Volt, direct on line motor circuit, instead of 63 Amp gG fuse links in 63 Amp fuseholders, because although the motor starting surge requires the use of fuse links with 63 Amp time/current characteristics, the motor FLC is less than 32 Amp (about 28 Amp).

It should therefore be noted that gM fuse links complement the standard gG range of ratings, ie., gG types are also used in many motor circuits, with gM ratings applied only when there is an economic advantage to be gained from their use.

Application Notes

Circuit loading

The HRC fuse link selected for any circuit should have a continuous current rating not less than the full load current of the circuit.

Complete cable protection

A standard rating of 'RED SPOT' fuse link (classified as type gG to BS 88:Part 1:1988, and marked accordingly) will protect an associated PVC insulated cable against both overload and short circuit if its current rating (I_n) is equal to, or less than, the current rating of the cable (I_z). This is in accordance with rule 433-02 of 16th Edition, IEE Wiring Regulations for Electrical Installations.

Short circuit energy limitation

'RED SPOT' fuse links limit the peak current and energy let through to circuits which experience major short circuit faults. This limitation is so great that equipment manufacturers exploit it to produce economic designs which, when used in combination with 'RED SPOT' fuse links, can withstand very high fault levels.

Such users have to prove their equipment under the worst possible conditions (i.e., at maximum breaking capacity, at 110% rated voltage, very low power factor, and with faults initiated at the most onerous points on the voltage wave), and they require relevant data from the fuse link manufacturer. For 'RED SPOT' fuse links this is given in the form of the cut-off current and I^2t characteristics shown on pages 1/14 to 1/19 inclusive.

Protection of cables against short circuit faults

In some circuits (eg., motor circuits) it is not economical practice to match fuse link and cable ratings to provide complete cable protection in the manner described previously, because the circuits produce significant overcurrents during switching. In such cases the fuse links are chosen to withstand the transient conditions, and provide only short circuit protection to the associated cables and other circuit components, the necessary overload protection then being provided by other

means. In a motor circuit, for example, the contactor and its overload relays afford overload protection to motor windings and cables, and the fuse links are chosen to protect all the circuit components against damage when a short circuit fault occurs (See section on motor circuit protection on page 1/12).

The short circuit protection of cables is covered by rule 434-03 of the IEE Wiring Regulations, and the table shows how 'RED SPOT' fuse links relate to this rule in protecting PVC insulated copper conductors.

Conductor cross sectional area	Maximum current carrying capacity		Maximum current rating of 'RED SPOT' fuse link that can be used with this conductor †
	'Open' conditions	'Enclosed' conditions	
	Ratings as Column 7 of IEE Table 4D1A Method 1 : 3 or 4 single core cables in 'clipped direct' conditions	Ratings as Column 5 of IEE Table 4D1A Method 3 : 3 or 4 single core cables in 'enclosed' conditions	
mm ²	Amp	Amp	Amp
1	14	12	16*
1.5	18	15.5	25
2.5	25	21	35
4	33	28	50
6	43	36	63
10	59	50	100
16	79	68	160
25	104	89	200
35	129	110	315
50	167	134	355
70	214	171	500
95	261	207	630
120	303	239	750

Notes:

The formula given in rule 434-03 is: $I^2t = k^2S^2$,

Where I = current which causes fuse to operate in 5 seconds

t = 5 seconds

k = 115, the constant for PVC insulated copper conductors, when cables run at maximum current carrying capacity

S = conductor cross sectional area

* A 20 Amp fuse link can also protect a 1mm cable provided that it is run continuously at not more than 6.5 Amp.

† Where a fuse link from the extended range of motor circuit fuse links is used (ie. one classified and marked gM) the larger of its rated ICB or 100% can be used with the cable.

Discrimination between fuse links

In service, the short circuit fault conditions encountered are usually less exacting than those produced in proving tests on fuse links and associated equipment. BS 88:Part 1:1988 states that fuse links experience fault currents which produce pre-arcing times longer than 0.01 second in most cases, and on that basis fuse links complying with the standard are deemed to discriminate with each other when the ratio between the current ratings of 'major' and 'minor' fuse links is 1.6:1 (See Figure 1).

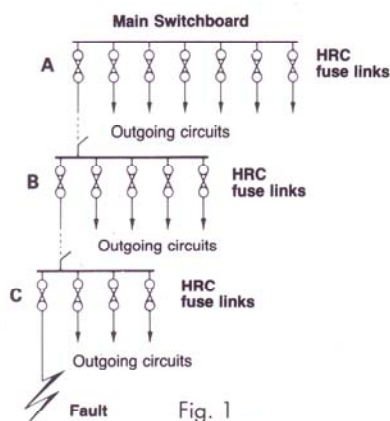


Fig. 1
Typical 3 phase
(shown single line)
distribution system

With properly selected
GEC ALSTHOM HRC
fuse links 'minor' fuse link
'C' operates and 'major'
fuse links 'A' & 'B' remain
unaffected

Whilst the BS 88 statement is reasonable in relation to 240 Volt applications, fault currents in major installations can be much greater. However, even in the latter cases, conditions are less onerous than those encountered in test stations (in particular, the circuits are usually three phase with relatively high power factors).

In practice therefore, the I^2t values of 'RED SPOT' fuse links are significantly less than the ones listed on pages 1/14-1/17 and they will discriminate with each other at fault levels up to 80kA, 415 Volt, if the relationship between 'major' and 'minor' ratings is as given in the table. In most cases the discrimination ratio is 1.6:1, or less, and this provides economic benefits in modern installations. Tests have been taken to prove this level of performance. The table also gives details of combinations which will discriminate at 550 Volt and 660 Volt.

'Minor' fuse link rating	Minimum rating (Amp) of 'Major' fuse link that will discriminate with the 'minor' fuse link at the voltage shown at prospective currents up to 80kA		
Amp	415 Volt	550 Volt	660 Volt
800	1250	—	—
750	1250	1250	—
710	1250	1250	1250
670	1250	1250	1250
630	1000	1250	1250
560	800	800	1000
500	750	800	1000
450	670	750	800
400	630	670	750
355	630	630	670
315	500	500	630
250	400	450	500
200	315	400	400
160	250	315	315
125	200	200	250
100	160	200	200
80	125	160	160
63	100	160	160
50	80	100	125
40	63	63	100
35	50	63	80
32	40	50	63
25	40	40	40
20	32	32	35
16	25	25	32

Protection against electric shock

To provide an adequate degree of protection against electric shock in a final circuit, Section 413 of the 16th Edition of the IEE Wiring Regulations for Electrical Installations requires a circuit protective device in a fixed installation to interrupt an earth fault current within 5 seconds.

Maximum permitted earth loop impedance values (Z_s) are specified for each circuit, the values being dependent on the type of protective device used. Table 41D(a) of the Regulations specifies values of Z_s when fuse links to BS 88:Parts 2 and 6 are used with a nominal voltage to earth (U_0) of 240 Volt. These are generally higher than those specified for MCBs, and the superior performance of fuse links in this respect, enables economies to be made in the sizes of protective conductor installed.

Z_s = Circuit maximum earth loop impedance.

'RED SPOT' rating	Earth loop impedance maximum value (Z_s) for circuits supplying fixed equipment
Amp	Ohm
6	14.10
10	7.74
16	4.36
20	3.04
25	2.40
32	1.92
40	1.41
50	1.09
63	0.86
80	0.60
100	0.44
125	0.35
160	0.27
200	0.20

Capacitor circuits

Three phase power factor correction capacitors can be protected against case rupture, and their associated cables and equipment protected against damage, by 'RED SPOT' fuse links in the event of a capacitor failure. A fuse link with a current rating not less than 1.5 times rated capacitor current will be needed to withstand the associated switching transients capacitor tolerance and circuit harmonics.

Effect of high enclosure temperatures

In accordance with BS 88:Part 1:1988 'RED SPOT' fuse links are suitable for use in ambient air temperatures (T_a) not exceeding 40°C with a mean value measured over 24 hours of not more than 35°C.

When fuse links are fitted in enclosures, it is the temperature within the enclosure (T_e)* which determines whether it is necessary to derate fuse links.

No derating is needed in the following cases:

'RED SPOT' fuse link current rating	Maximum value of T_e * at which fuse links may be used with no derating
25A or less	80°C
32A to 63A	75°C
80A to 160A	65°C#
200A & 250A	60°C#
315A to 450A	55°C#
500A to 1250A	50°C#

See table opposite for derating required at higher values of T_e .

Please consult GEC ALSTHOM Low Voltage Equipment Ltd, for advice on applications not covered in this publication.

Nominal fuse rating Amp	Maximum load current at these fluid environment temperatures (T_e)*				
	55°	60°	65°	70°	75°
80	Fuse links can be fully rated			75	70
100				95	90
125				120	110
160				145	135
200				180	170
250			190	225	210
315		300	285	270	255
355		350	330	315	295
400		400	380	360	340
450		425	405	380	360
500	475	450	425	400	380
560	540	520	495	465	440
630	600	570	540	510	480
670	650	615	585	550	520
710	700	665	630	595	560
750	750	710	670	630	590
800	760	720	680	640	600
1000	950	900	850	800	750
1250	1140	1070	1020	960	900

* Fluid environment temperature (T_e) is the temperature inside the enclosure containing the fuse link.

Motor Circuit Protection

All 'RED SPOT' fuse links have excellent ability to protect motor circuits. When selected in the manner shown below, they not only withstand motor starting surges and full load currents without deteriorating, but also provide superior short circuit protection to associated motor starter components.

Leading manufacturers of motor starters have recognised this and can offer ASTA Certified type '2' co-ordination to IEC 947-4 and type 'C' co-ordination to the earlier IEC 292-1 by using 'RED SPOT' fuse links in combination with their chosen contactors and overload relays. Please consult GEC ALSTHOM Low Voltage Equipment for further information on this subject.

Selecting HRC fuse links to protect 3-phase induction motor circuits

- 1 Table 1 opposite, gives motor full load currents at various system voltages. In the absence of specific information obtain the motor FLC from this table.
- 2 The motors are assumed to produce the starting conditions shown in Table 2.
- 3 Choose the recommended fuse link for the motor FLC and starting condition from Table 3 (DOL start) or Table 4 (assisted start).
- 4 Ensure voltage rating of fuse link is adequate for the application (See table page 1/3).

Table 1 Full load currents of typical 3-phase induction motors at voltages shown

Motor rating		Voltage					
kW	HP	220	380	415	440	550	660
0.37	0.5	2.0	1.15	1.05	1.0	0.8	0.7
0.55	0.75	2.7	1.6	1.5	1.4	1.1	0.9
0.75	1	3.9	2.3	2.0	1.9	1.5	1.3
1.1	1.5	4.7	2.8	2.5	2.4	1.9	1.6
1.5	2	6.5	3.8	3.5	3.3	2.6	2.2
2.2	3	9.3	5.4	5.0	4.7	3.8	3.2
3	4	12	7.1	6.5	6.1	4.9	4.1
4	5.5	15.4	9.0	8.4	7.9	6.4	5.3
5.5	7.5	20.7	11.9	11	10.3	8.2	6.9
7.5	10	28	16.1	14.4	14	11.2	9.3
11	15	39.1	23	21	19.8	15.8	13.2
15	20	52.8	30.5	28	26.4	21.1	17.6
18.5	25	66	38	35	33	26.4	22
22	30	77	45	41	39	31	26
30	40	103	60	55	52	42	35
37	50	128	75	69	65	52	43.3
45	60	151	87	80	75	60	50
55	75	185	107	98	92	74	62
75	100	257	148	136	128	102	85
90	120	308	180	164	154	123	102
110	150	370	214	196	185	148	123
132	175	426	247	226	213	170	142
150	200	500	292	268	252	202	168
160	215	—	300	275	260	207	173
200	270	—	391	358	338	270	225
240	320	—	467	428	404	323	269
280	375	—	533	488	460	368	307
300	400	—	573	525	495	396	330
320	425	—	587	538	507	406	338

Table 2 Assumed starting conditions

Motor rating	Direct-on-line starting conditions	Assisted start conditions
Up to 1kW	5 x FLC for 5 secs	3.5 x FLC for 20 secs
1.1 to 7.5kW	6 x FLC for 10 secs	
7.6 to 75kW	7 x FLC for 10 secs	
Greater than 75kW	6 x FLC for 15 secs	

Special motor conditions:

Suitable adjustments to the recommended ratings may be necessary if any of the following conditions occur singly or in combination:

- a) Starting currents in excess of the assumed ones.
- b) Long run up times due to high inertia loads.
- c) Larger number of starts per operating cycle (the recommendations below allow for two starts in rapid succession and up to eight starts per hour).
- d) High enclosure temperature.

Table 3 Direct-on-line starting

Motor FLC Amp		Recommended fuse link Type gG	Alternative motor circuit rating Type gM
From	to		
0	0.7	2	
0.8	1.4	4	
1.5	2.0	6	
2.1	3.0	10	
3.1	6.1	16	
6.2	9.0	20	
9.1	11.0	25	20M25
11.1	14.4	32	20M32
14.5	15.4	35	32M35
15.5	18.0	40	32M40
18.1	22.0	50	32M50
22.1	28.0	63	32M63
28.1	45	80	63M80
45.1	58	100	63M100
58.1	80	125	100M125
80.1	99	160	100M160
99.1	128	200	
128.1	180	250	200M250
180.1	216	315	200M315*
216.1	270	355	315M355
270.1	328	400	
328.1	385	450	400M450
385.1	430	500	
430.1	500	560	
500.1	560	630	
560.1	620	670	630M670

Notes

† See page 1/7 for information on definitions of gG and gM.

* Type 'TF' - if motor FLC does not exceed 200 Amp.

Table 4 Assisted starting
(Star/delta, auto-transformer, etc.)**

Motor FLC Amp		Recommended fuse link Type gG	Alternative motor circuit rating Type gM
From	to		
0	1.4	2	
1.5	2.1	4	
2.2	3.1	6	
3.2	5.5	10	
5.6	10	16	
10.1	14	20	
14.1	18	25	20M25
18.1	22	32	
22.1	28	35	32M35
28.1	32	40	32M40
32.1	40	50	
40.1	51	63	
51.1	80	80	
80.1	100	100	
100.1	125	125	
125.1	160	160	
160.1	200	200	
200.1	250	250	
250.1	315	315	
315.1	355	355	
355.1	400	400	
400.1	450	450	
450.1	500	500	
500.1	560	560	
560.1	630	630	

** These recommendations apply for ambient temperatures up to 35°C.

At higher ambient temperatures, some fuse links need to be de-rated as indicated on page 1/11.

The decreased rating then becomes the maximum motor FLC at that temperature, e.g. at 50°C a 630 Amp fuse link is used for motor FLC up to 340 Amp.

Characteristics

'RED SPOT' Type NIT Time/Current Characteristics
(including gM ratings)

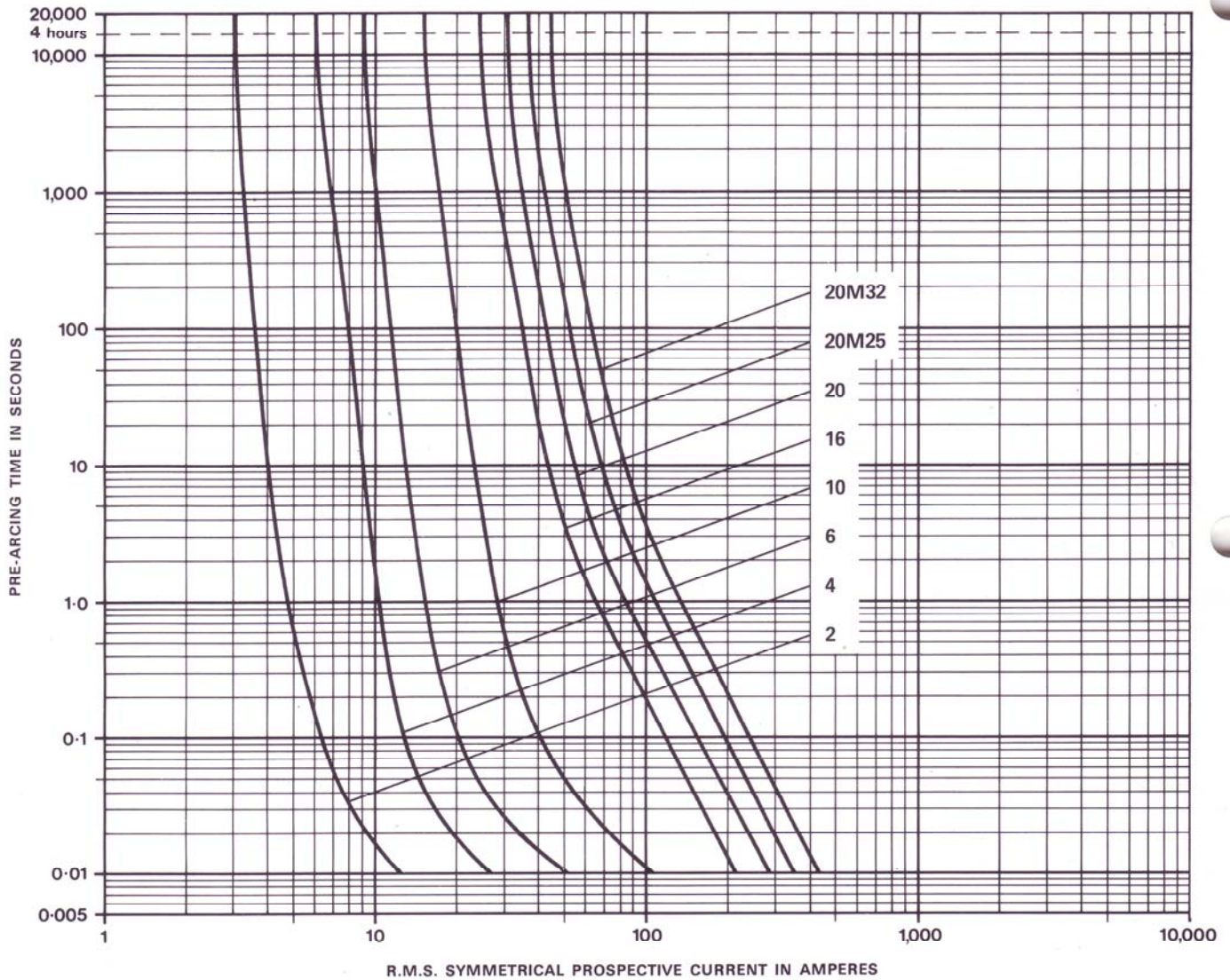
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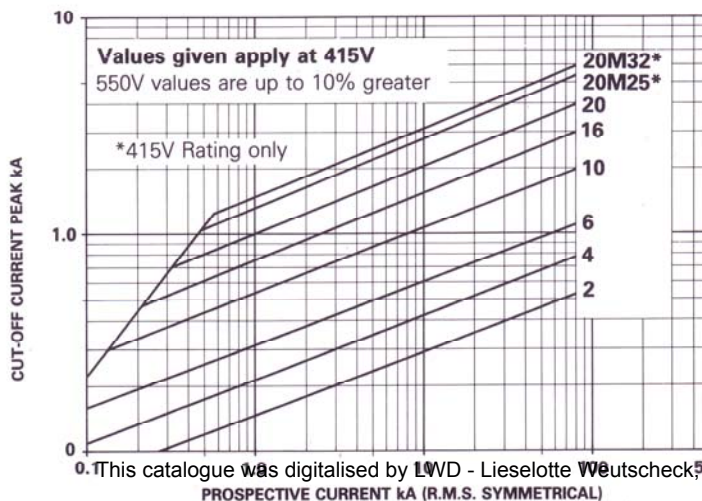
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'RED SPOT' Type NIT Cut-off Current Characteristics



'RED SPOT' Type NIT I²t Values

Current rating	Pre-Arcing I ² t (A ² sec)	Total I ² t (A ² sec) at:	
		415 Volt	550 Volt
Amp			
2	2.2	5.4	31
4	7.2	18	70
6	21	60	400
10	100	280	1000
16	300	850	2000
20	540	1000	3500
20M25	900	1500	5000
20M32	1100	4000	-

'RED SPOT' Time/Current Characteristics

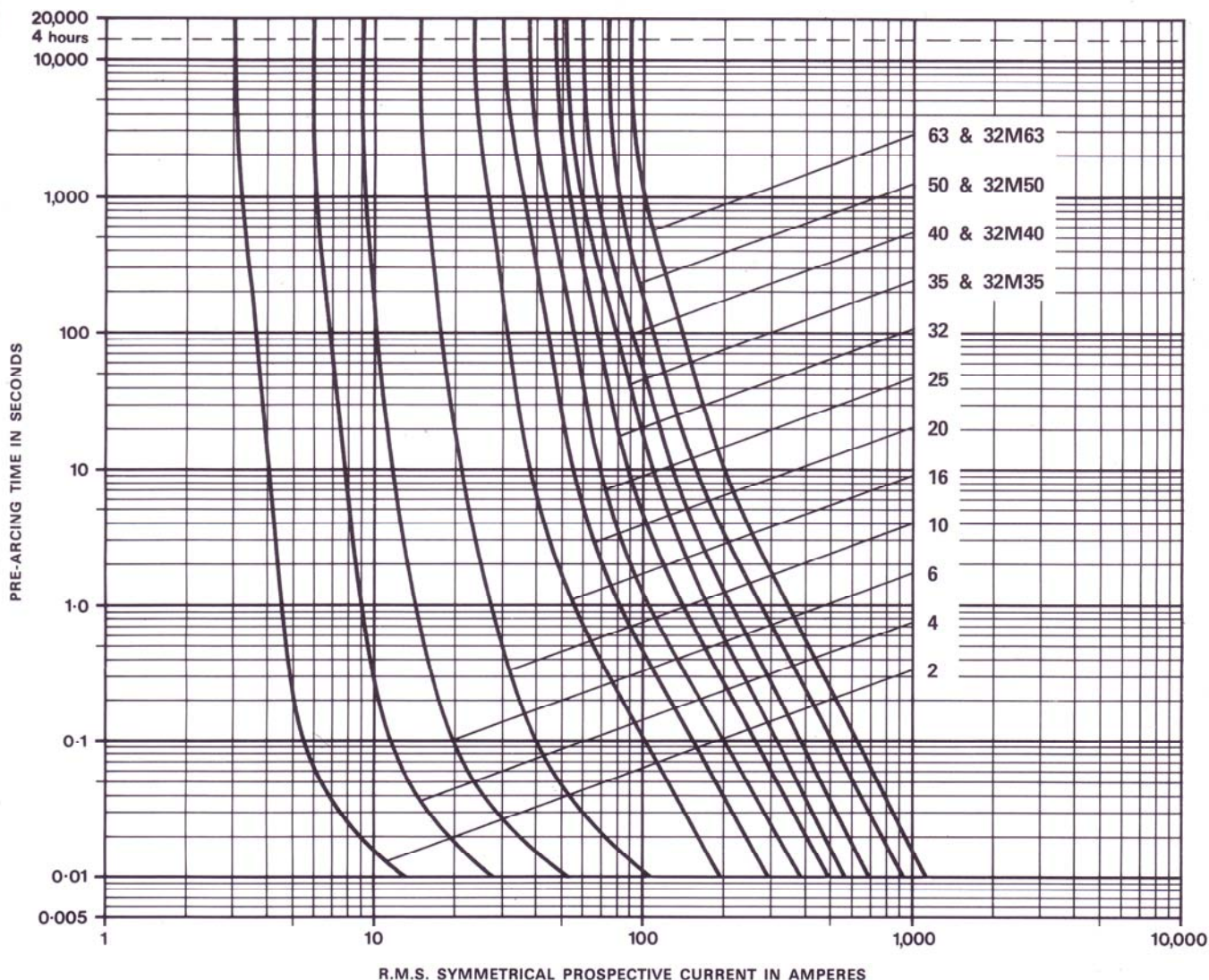
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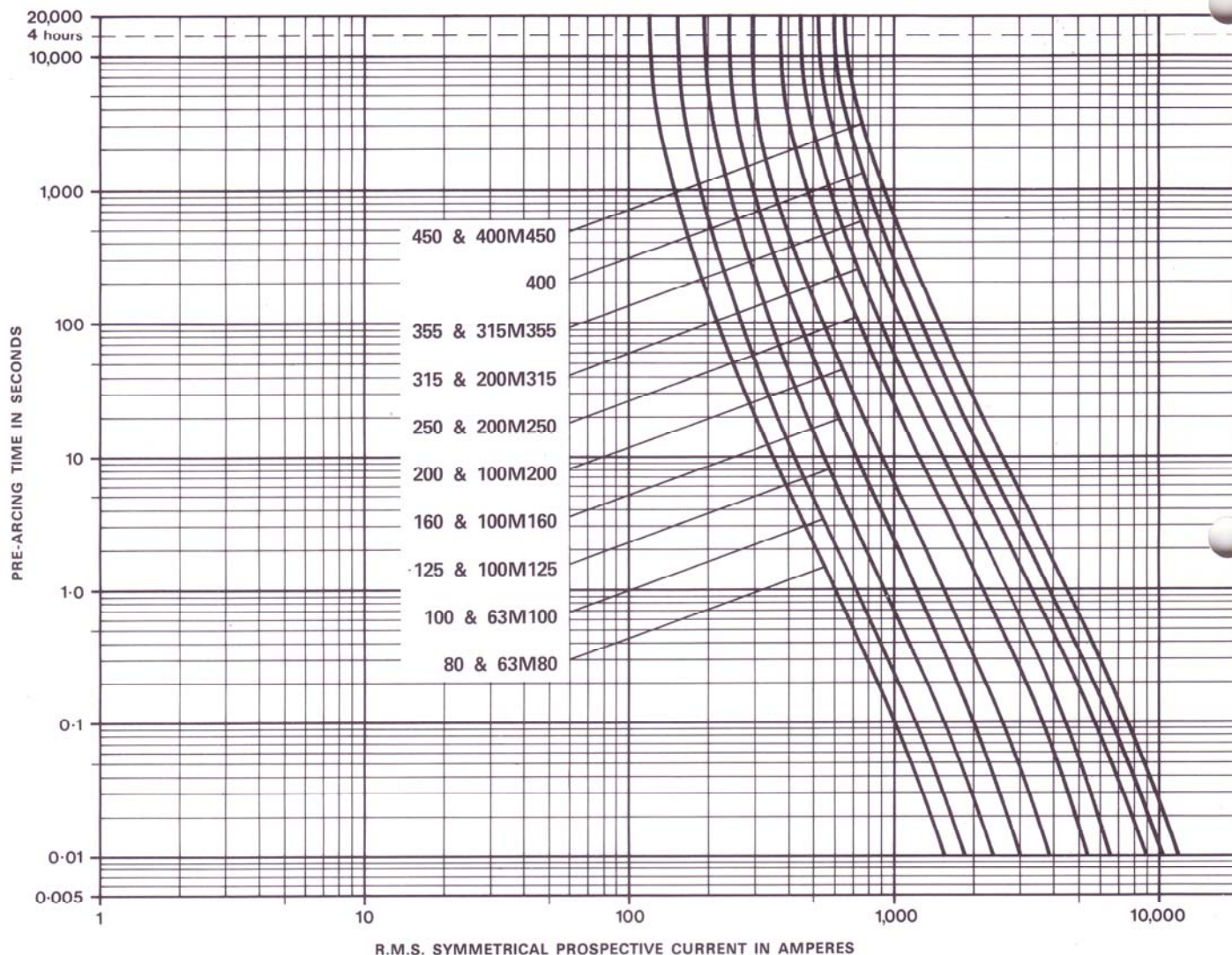
'RED SPOT' I^2t Values

2 - 63Amp†

Current rating	Pre-Arcing I^2t (A ² sec)	Total I^2t (A ² sec) at:		
		415 Volt	550 Volt	660 Volt
Amp				
2	2.2	5.5	7.4	15
4	7	18.5	23	50
6	21	60	80	150
10	100	280	370	700
16	250	550	740	1800
20	540	1100	1400	2500
25	850	1850	2300	3700
32	1600	3400	5400	8700
35 & 32M35	2700	5300	8000	15000
40 & 32M40	4000	8500	11000	20500
50 & 32M50	6300	13500	18500	28000
63 & 32M63	11000	24000	35000	50000

† See pages 1/18 & 1/19 for

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'RED SPOT' I^2t Values

80-450 Amp†

Current rating	Pre-Arcing I^2t (A ² sec × 10 ³)	Total I^2t (A ² sec × 10 ³) at:		
		415 Volt	550 Volt	660 Volt
Amp				
80 & 63M80	14	40	52	66
100 & 63M100	17	60	80	100
125 & 100M125	25	85	110	140
160 & 100M160	62	160	210	270
200 & 100M200	105	260	330	430
250 & 200M250	200	550	700	870
315 & 200M315*	300	800	1050	1350
355 & 315M355	500	1400	1850	2250
400	640	1800	2500	3000
450 & 400M450	800	2200	3000	3800

* Maximum rating of 200M315 at 550 Volt

'RED SPOT' Time/Current Characteristics

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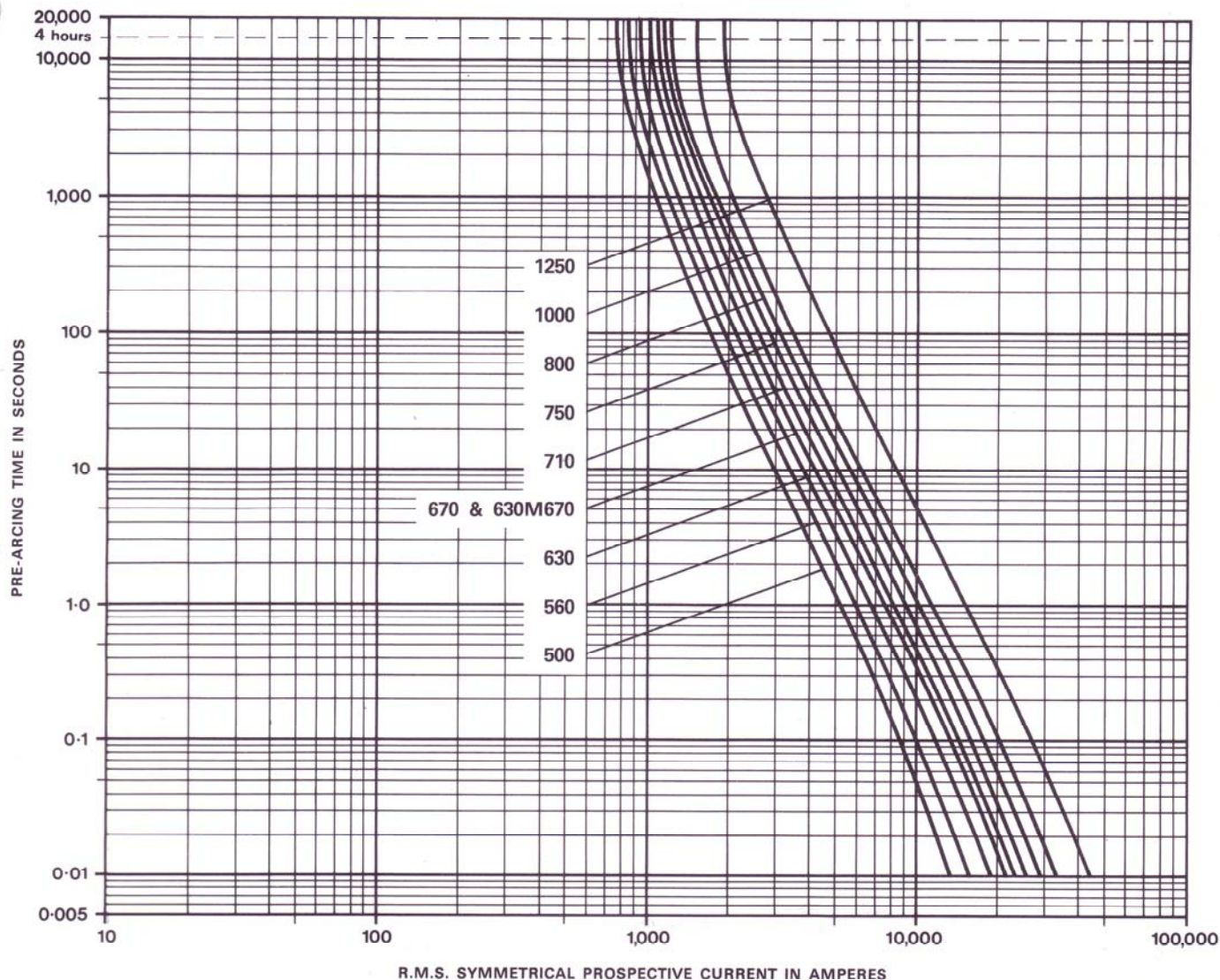
500-1250 Amp (including gM rating)

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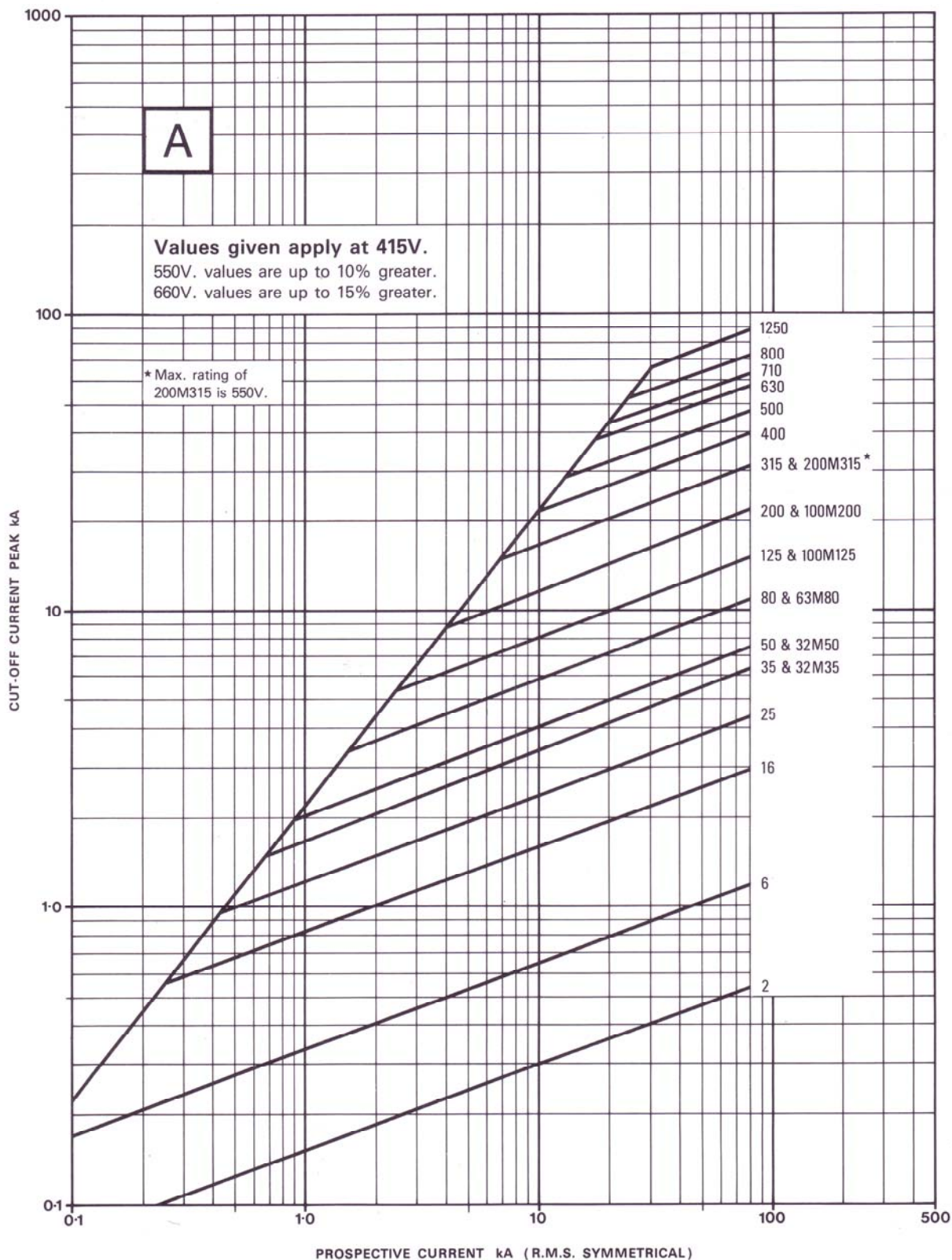
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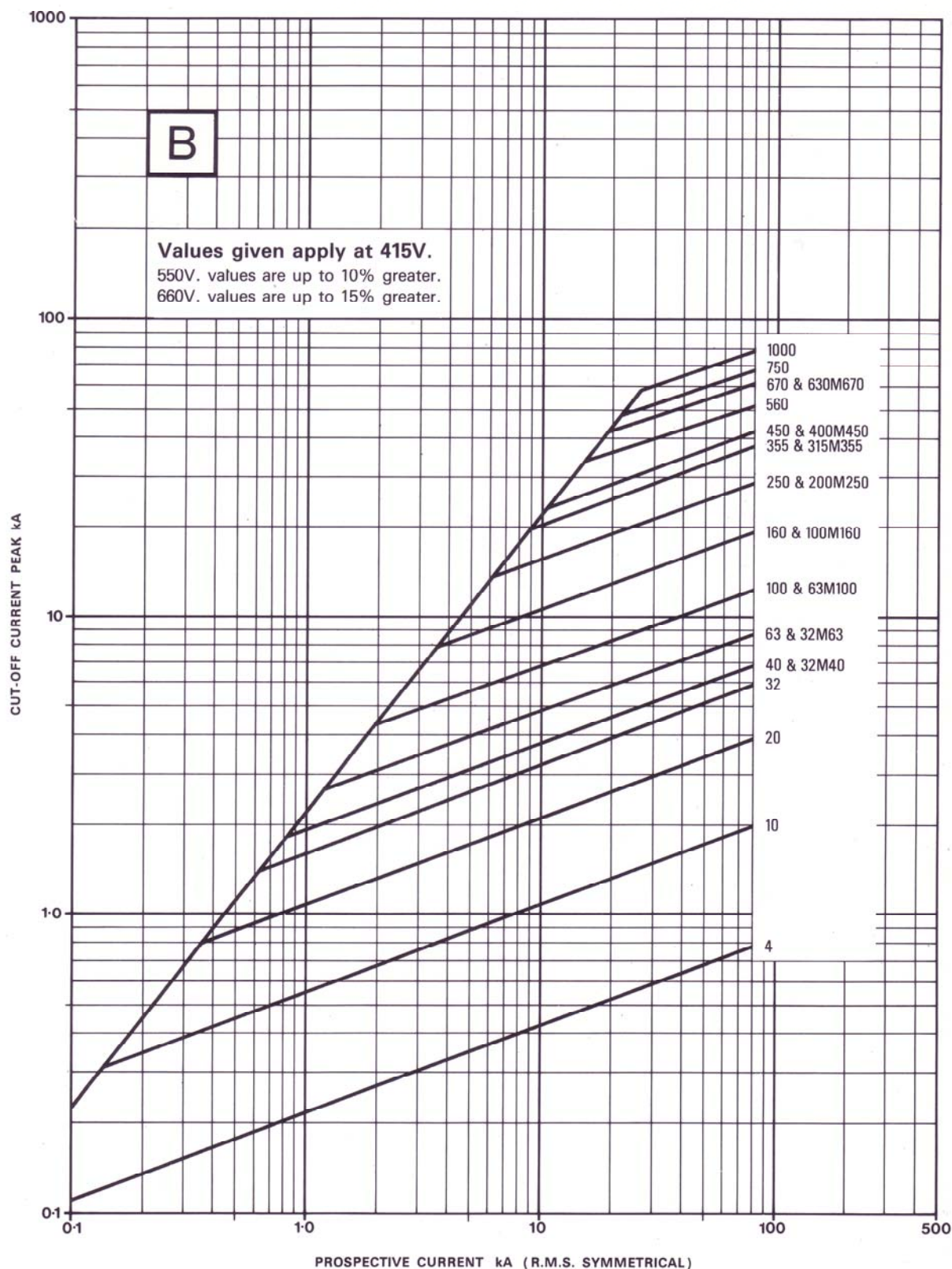
'RED SPOT' I²t Values

500-1250 Amp†

Current rating	Pre-Arcing I ² t (A ² sec × 10 ³)	Total I ² t (A ² sec × 10 ³) at:		
		415 Volt	550 Volt	660 Volt
Amp				
500	1050	3000	3800	4500
560	1400	3800	4250	5400
630	2000	5200	6000	7500
670 & 630M670	2400	6400	7400	9000
710	2800	7000	8000	9700
750	3700	7500	10000	12000
800	4400	9600	12500	15000
1000	5300	12000	15000	17500
1250	10000	20000	25000	29000

To aid reference, alternate ratings have been shown on tables A & B





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