

Australian Standard[®]

Low voltage fuses—Fuses with enclosed fuse-links

**Part 21.1: Supplementary requirements for fuses for use by authorized persons (fuses mainly for industrial application)—
Standardized fuse systems—
Fuses with fuse-links with blade contacts**

This Australian Standard was prepared by Committee EL/6, Industrial Switchgear and Controlgear. It was approved on behalf of the Council of Standards Australia on 2 April 1990 and published on 6 August 1990.

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Australian–British Chamber of Commerce
Australian Electrical and Electronic Manufacturers Association
Bureau of Steel Manufacturers of Australia
Electrical Contractors Association of Australia
Electricity Supply Association of Australia
Independent Electrical Switchboard Manufacturers Association
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Part 21.1: Supplementary requirements for fuses for use by authorized persons (fuses mainly for industrial application)—Standardized fuse systems—Fuses with fuse-links with blade contacts

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STANDARDS AUSTRALIA

Australian Standard

Low voltage fuses—Fuses with enclosed fuse-links

Part 21.1 — Supplementary requirements for fuses for use by authorized persons
(fuses mainly for industrial application) — Standardized fuse systems —
Fuses with fuse-links with blade contacts

SECTION 1. SCOPE AND GENERAL

1.1 SCOPE AND APPLICATION.

1.1.1 Scope. The supplementary requirements in this Standard cover fuses with fuse-links having blade contacts intended to be replaced by means of a device, for example a replacement handle, which complies with the dimensions specified in Figures 2 and 3. Such fuses have rated currents from 16 A up to and including 1250 A and rated voltages up to and including 660 V a.c. or 440 V d.c.

1.1.2 Application. Standardized fuse systems for use by authorized persons which comply with this Standard shall also comply with all clauses of AS 2005.10 and AS 2005.20, unless otherwise specified herein.

NOTE: The clause numbers and table numbers in this Standard are the same as those used in AS 2005.10 and AS 2005.20. Additional tables herein are numbered 10 to 17 to distinguish them from the table numbers in AS 2005.10 and AS 2005.20. Sections and Clauses of AS 2005.10 and AS 2005.20 not amended herein are not repeated in this Standard.

1.3 REFERENCED DOCUMENTS. The documents below are referred to in this Standard.

AS

1110	ISO metric hexagon precision bolts and screws
1939	Classification of degrees of protection provided by enclosures of electrical equipment
2005	Low voltage fuses—Fuses with enclosed fuse-links
2005.10	Part 10: General requirements
2005.20	Part 20: Supplementary requirements for fuses for use by authorized persons (fuses mainly for industrial applications)—Common requirements
3000	SAA Wiring Rules
IEC	
269	Low-voltage fuses
269-2-1	Part 2: Supplementary requirements for fuses for use by authorized persons (fuses mainly for industrial application) Sections I to III

SECTION 5 CHARACTERISTICS OF FUSES

5.2 RATED VOLTAGE. For a.c. the standard values of rated voltage are 500 V and 660 V. For d.c. the rated voltage is 440 V.

5.3.1 Rated current of the fuse-link. For each size the maximum rated currents are given in Table 10. These values depend upon the utilization categories and rated voltages.

5.3.2 Rated current of the fuse-holder. The rated current for the different sizes of the fuse-bases is given in Table 11.

5.5 RATED POWER DISSIPATION OF A FUSE-LINK AND RATED POWER ACCEPTANCE OF A FUSE-HOLDER. The maximum values of rated power dissipation for the different sizes of fuse-links are specified in Table 10. The values apply to the maximum rated currents of the fuse-links. The values of rated power acceptance of fuse-bases are given in Table 11.

TABLE 10
FUSE-LINK MAXIMUM RATED CURRENT AND MAXIMUM POWER DISSIPATION (P_n)

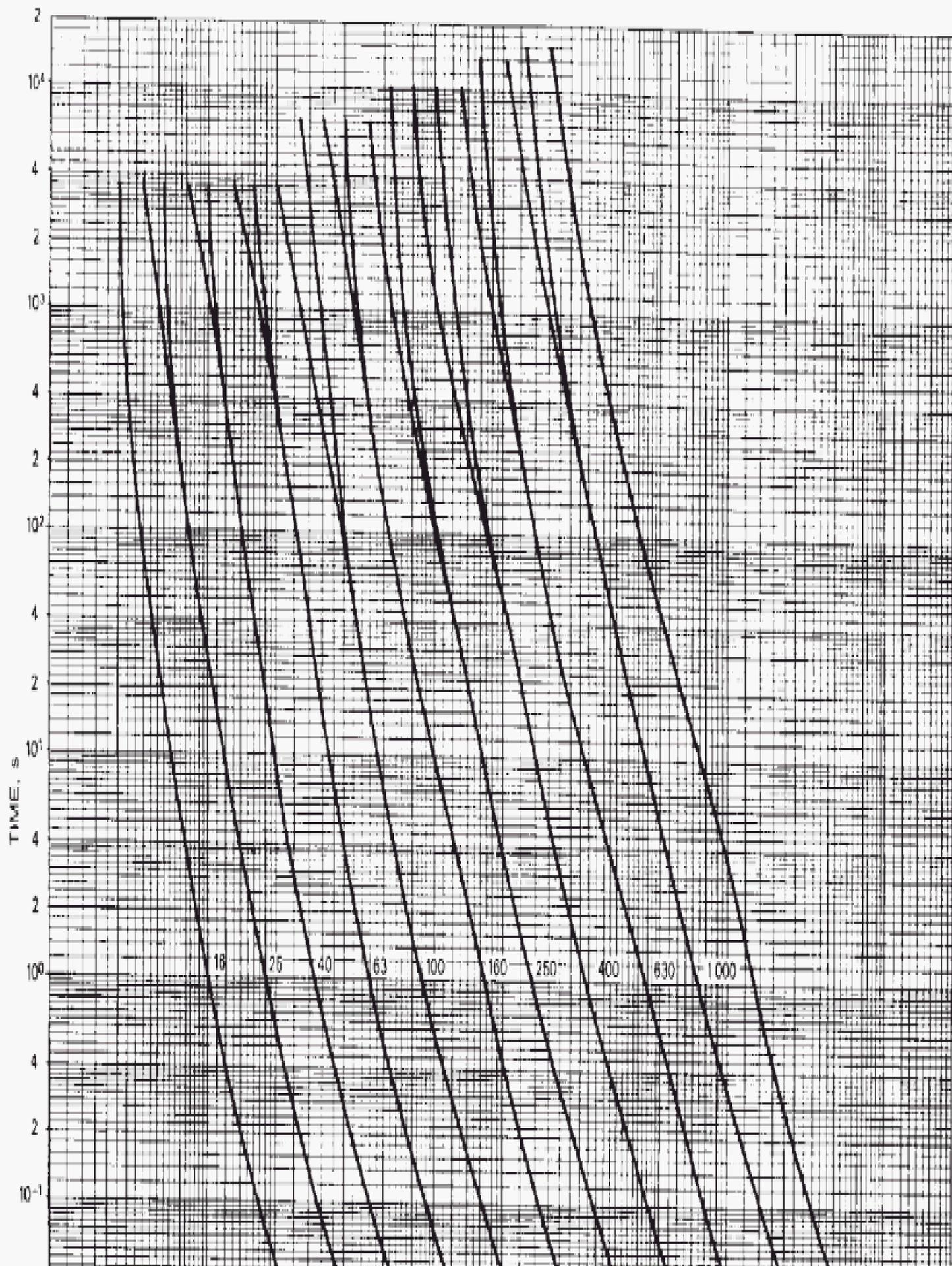
Size	gG fuse-links				aM fuse-links			
	500 V a.c.		660 V a.c.		500 V a.c.		600 V a.c.	
	Rated current (I_n) A	Dissipation max. (P_n) W	Rated current (I_n) A	Dissipation max. (P_n) W	Rated current (I_n) A	Dissipation max. (P_n) W	Rated current (I_n) A	Dissipation max. (P_n) W
00	100/160	7.5/12	100	12	100	7.5	160	12
0	160	16	100	25	160	16	160	25
1	250	23	200	32	250	23	250	32
2	400	34	315	45	400	34	400	45
3	630	48	500	60	630	48	630	60
4	1 000	90	800	90	1 000	90	1 000	90
4a	1 250	110	1 000	100	1 250	110	1 250	100

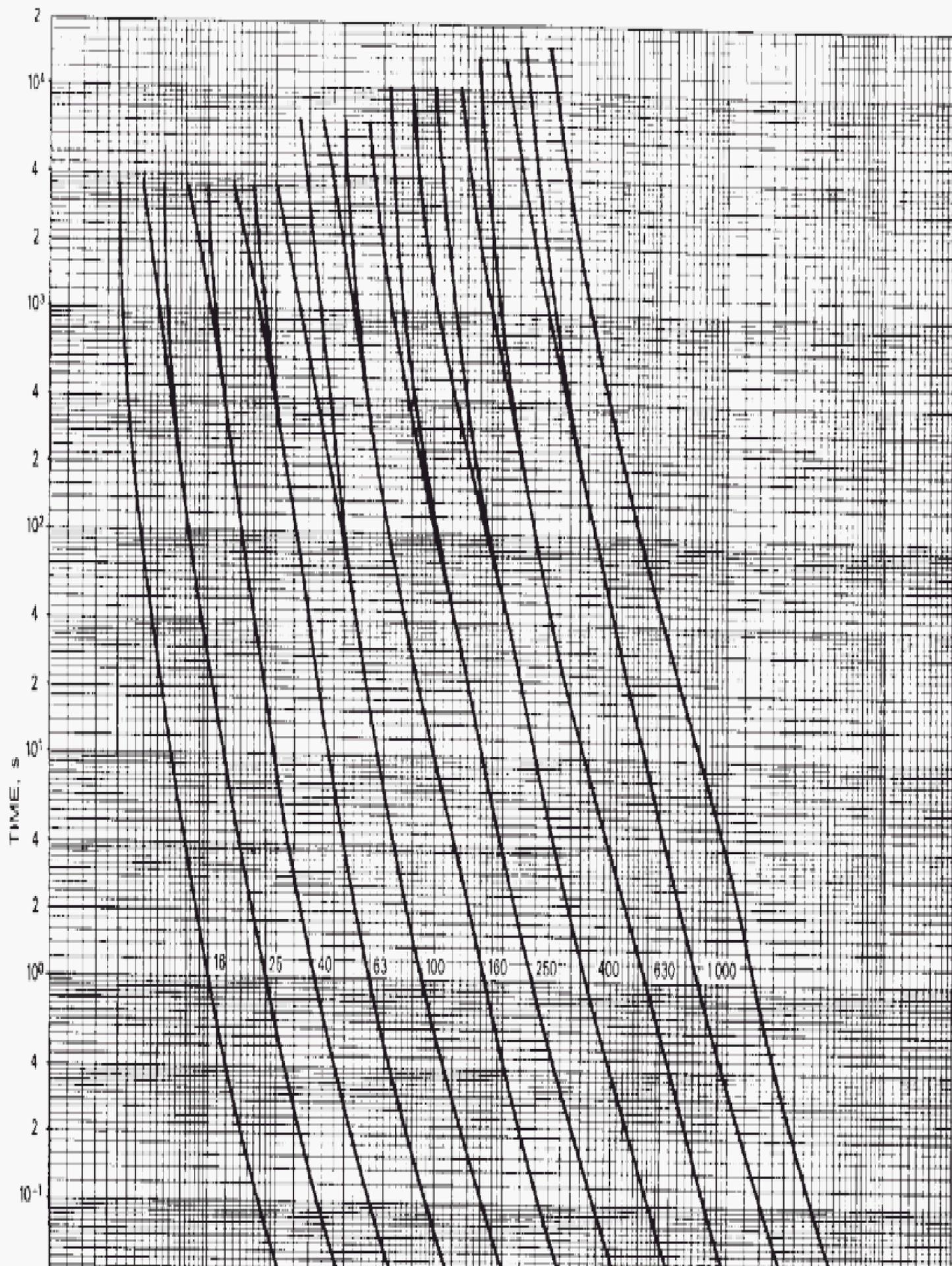
TABLE 11
FUSE-BASE RATED CURRENT AND MINIMUM POWER ACCEPTANCE

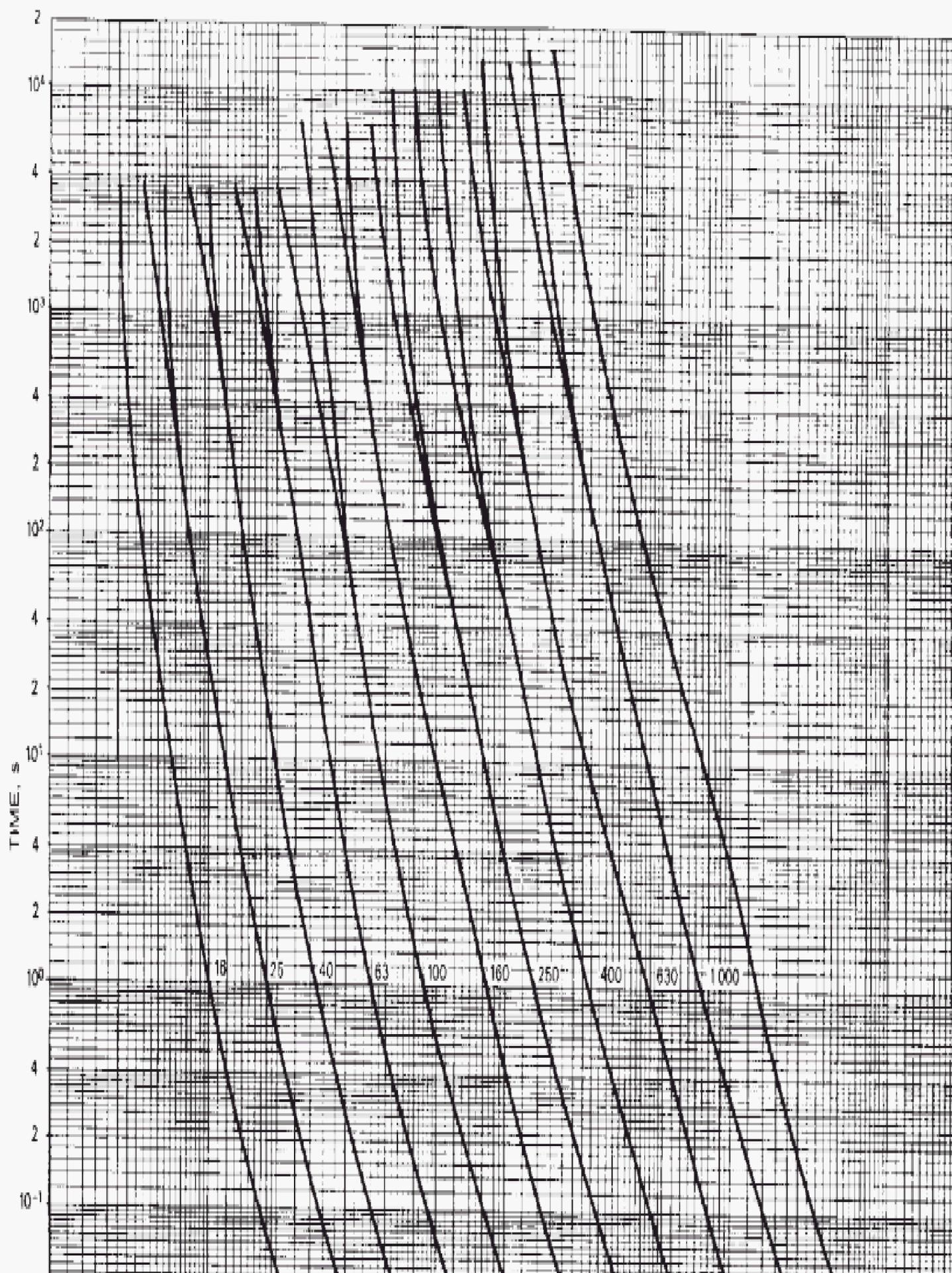
Size	Rated current A	Rated power acceptance W
00	160	12
0	160	25
1	250	32
2	400	45
3	630	60
4	1 000	90
4a	1 250	110

5.6 LIMITS OF TIME/CURRENT CHARACTERISTICS

5.6.1 Time-current characteristics, time-current zones and overload curves. The tolerance on time-current characteristics given by the manufacturer shall not deviate by more than $\pm 10\%$ in terms of current. The time-current zones given in Figure 1 including manufacturing tolerances shall be met by all pre-arcing and total times measured at the test voltage according to Clause 8.7.4 herein.

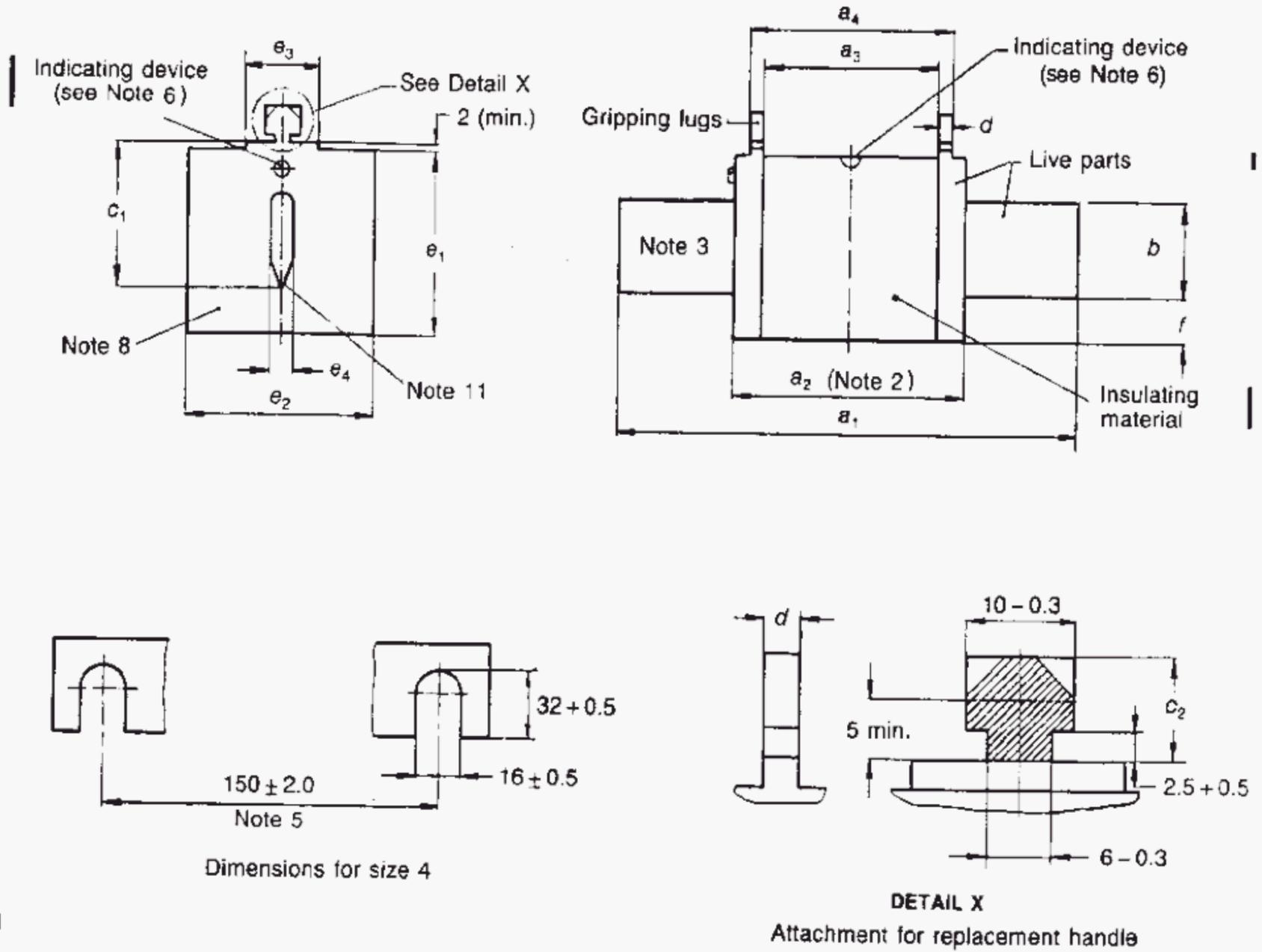






SECTION 7 STANDARD CONDITIONS FOR CONSTRUCTION

7.1 MECHANICAL DESIGN. The dimensions of fuse-links and fuse-bases are given in Figures 2 and 3 respectively.



Size	a_1 (1)	a_2 (2)	a_3 (1)	a_4 (1)	b (min.) (10)	c_1 ± 0.8	c_2	d	e_1 (max.) (4)	e_2 (max.) (4)	e_3	e_4 ± 0.2	f (max.)
(12) 00	78.5±1.5	54-6	45±1.5	49±1.5	15	35	10-1	$2^{+1.0}_{-0.5}$	48	30	20±5	6	15
0	125±2.5	68-8	$62^{+3}_{-1.5}$	$68^{+1.5}_{-3}$	15	35	11-2	$2^{+1.5}_{-0.5}$	48	40	20±5	6	15
1	135±2.5	75-10	62±2.5	68±2.5	20	40	11-2	$2.5^{+1.5}_{-0.5}$	53	52	20^{+5}_{-2}	6	15
2	150±2.5	75-10	62±2.5	68±2.5	25	48	11-2	$2.5^{+1.5}_{-0.5}$	61	60	20^{+5}_{-2}	6	15
3	150±2.5	75-10	62±2.5	68±2.5	32	60	11-2	$2.5^{+1.5}_{-0.5}$	76	75	20^{+5}_{-2}	6	18
4(7)	200±3	90 max.	62±2.5	68±2.5	49	87	11-2	$2.5^{+1.5}_{-0.5}$	110	105	20^{+5}_{-2}	8	25
(9) 4a	200±3	100 max.	84±3	90±3	49	85±2	11-2	$2.5^{+1.5}_{-0.5}$	110	102	30±10	6	30

DIMENSIONS IN MILLIMETRES

FIGURE 2 FUSE-LINK DIMENSIONS

NOTES TO FIGURE 2:

0. These drawings are not intended to cover the design of fuse-links, except with regard to the dimensions and the following notes.
1. The centres of the dimensions a_1 , a_3 and a_4 shall not deviate from the centre of a_2 by more than 1.5 mm.
2. The dimension a_2 shall be observed within the total area $b_{\min}/2$, measured from the lower edge of the blade, over a width of at least 4 mm on both sides of the blade. Outside this area, the dimension may be less than the values indicated for a_2 .
3. The contact surfaces may be plane or provided with ribs.
4. Maximum dimensions of the enclosure of the fuse-link. Within these limits, the fuse-links may be of any form, for example, square, rectangular, circular, oval, polygonal, etc.
5. The slots are mandatory for size 4 fuse-links.
6. Position of the indicating device as chosen by the manufacturer.
7. Gripping lugs can be insulated.
8. With the exception of the attachment for the replacement handle (detail X), the endplates are not permitted to protrude radially from the insulating body.
9. Only to be used with a fuse-base that allows the fuse-link to be hinged forward on one pair of blade contacts.
10. As far as overlapping of rated currents exists within the sizes 0, 1, 2 and 3, the dimension of the smaller fuse-link is permitted.
11. The edge of blade contacts can be round or of any appropriate shape.
12. A new size 000 is under consideration. The following dimensions are recommended for the fuse-links:

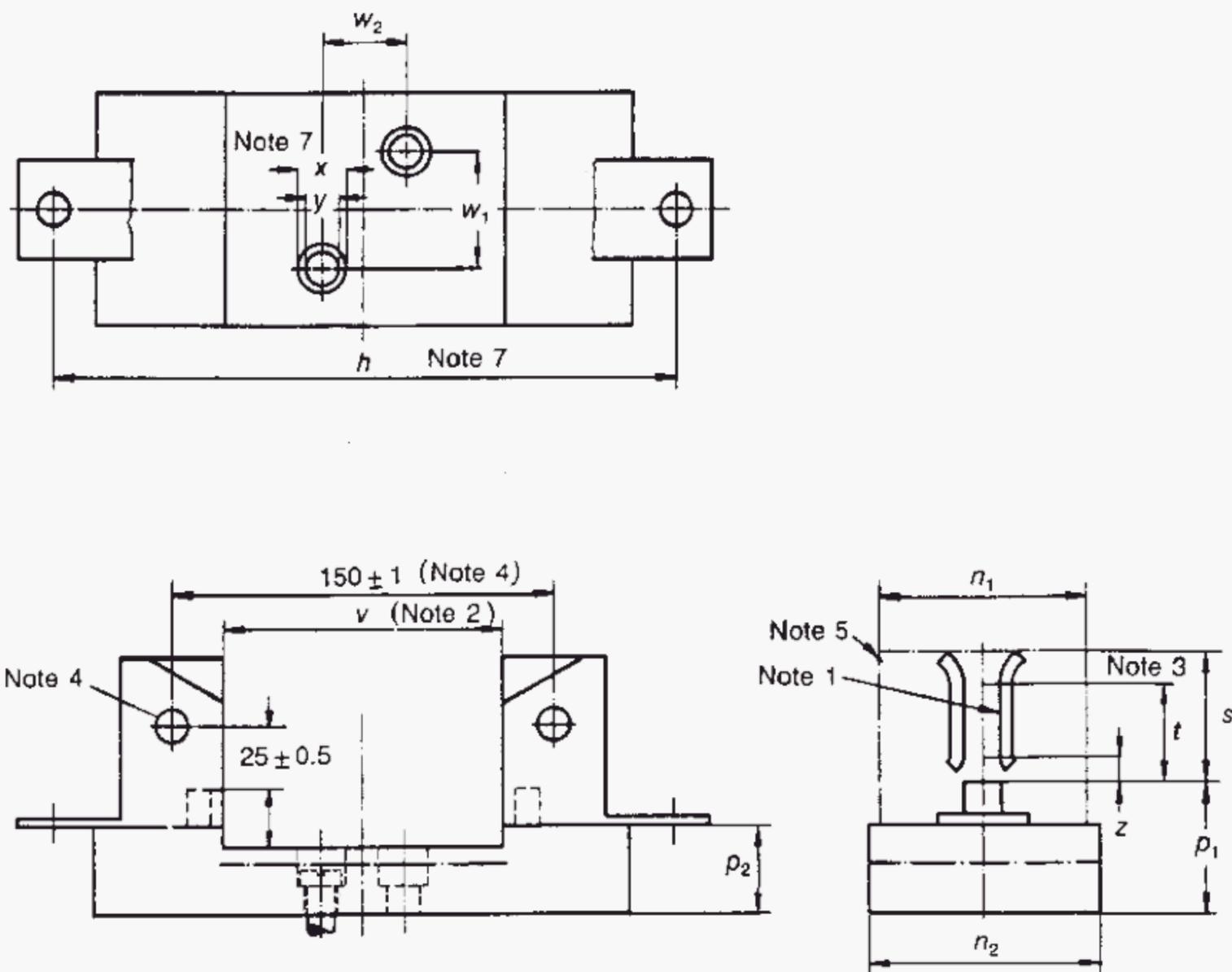
$$e_{1 \max} = 41 \text{ mm}$$

$$e_{2 \max} = 21 \text{ mm}$$

$$e_{3 \max} = 16_{-2}^{+5} \text{ mm}$$

$$f_{\max} = 8 \text{ mm}$$

Other dimensions are those as for size 00.



Size	h ± 1.5 (7)	n_1 (max.)	n_2 (max.)	p_1 (max.)	p_2 ± 1.5	r (min.)	s (max.)	t (min.)	v	w_1 (7)	w_2 (7)	x (min.) (7)	y ± 0.5 (7)	z (max.)
00	100	30	38	40	—	17	21	15	56.5 ± 1.5	0 ± 0.7	25 ± 0.7	14	7.5	3
0	150	40	48	48	—	17	25	15	74 ± 3	0 ± 0.7	25 ± 0.7	14	7.5	3
1	175	52	60	55	35	17	38	21	80 ± 3	30 ± 0.7	25 ± 0.7	20	10.5	5
2	200	60	68	60	35	17	46	27	80 ± 3	30 ± 0.7	25 ± 0.7	20	10.5	5
3	210	75	83	68	35	20	58	33	80 ± 3	30 ± 0.7	25 ± 0.7	20	10.5	5
4	—	—	—	—	—	27	84	50	97 (min.)	—	—	—	—	5
4a	270	102	115	—	40	32	84	50	$110 + 15$	45 ± 0.7	30 ± 0.7	36	14	6

DIMENSIONS IN MILLIMETRES

FIGURE 3 FUSE-BASE DIMENSIONS

NOTES TO FIGURE 3:

0. These drawings are not intended to govern the design of fuse-links except as regards the notes and dimensions shown.
1. This area is considered to be live.
2. The maximum value of dimension v is intended to define a point of contact. It shall be observed at least at one point of contact within the range of $b_{\min}/2$, measured from the lower edge of the blade contact of the fuse-link. At the upper edge of the blade contact, the value of v need not be observed.
3. Height of contact surface. It shall also be possible to insert fuse-links with blade contacts according to Figure 2, even if the contact surface is not smooth but grooved or divided.
4. Dimensions for size 4. Fixing bolts are mandatory for size 4; M12 when threaded.
5. Resilient contact surface, except for size 4. Contact force is provided by auxiliary means, to be located within the bounds indicated.
6. Only to be used with a fuse-link having slotted blades (see Figure 2, Note 9) and when the fuse-base has springs or bolts to provide contact force.
7. These values are only mandatory if interchangeability of fuse-bases is required.
8. When constructing multipole or assemblies of single-pole fuse-bases, it is necessary for reason of safety to fit insulating barriers (e.g. partition walls) compatible with the maximum dimension prescribed for n_1 .

7.1.2 Connections including terminals. There are different kinds of terminals. As far as lug-terminals are concerned, the range of cross-sections which the terminals shall be capable of accepting, results from the following ranges of rated currents of fuse-links of each size.

Terminals designed for unprepared conductors shall be capable of accepting as a minimum, conductors with the cross-sectional ranges given in Table 12. In case the terminal is a lug-terminal, the torques which shall be applied are given in Table 14. Values for other terminals are under consideration.

Connections of larger or smaller cross-sectional areas may be necessary. This can be achieved either by the construction of the terminal or by additional means of connections as recommended by the manufacturer.

Table 12 covers terminals designed for copper conductors. If the terminals are suitable for aluminium or copper and aluminium, they shall be marked accordingly.

TABLE 12
MINIMUM CROSS-SECTIONAL AREA RANGES OF CONDUCTORS

Size	Range of rated currents of the fuse-links A	Cross-sectional area ranges mm ²
00	6 to 160	10 to 70
0	6 to 160	10 to 70
1	80 to 250	70 to 120
2	125 to 400	} 95 to 240
3	315 to 630	
4	500 to 1 000	
4a	500 to 1 250	

7.1.3 Fuse-contacts. The contact surfaces of fuse-links and fuse-bases should be silver-plated, otherwise is shall be verified that contacting is not impaired in normal operation. The requirements for fuse-contacts shall be verified by the tests given in Clause 8.10 herein.

7.1.7 Construction of a fuse-link. The preferred construction is that the blade contacts be made from a single section of material. If any other construction is used for the blade contacts, the manufacturer shall demonstrate that this construction will meet all relevant requirements of this Standard.

With the exception of the attachment for the replacement handle the endplates are not permitted to protrude radially from the insulating body. For some applications it is preferable to insulate the gripping lugs from live parts.

Fuse-links shall have an indicator (see AS 2005.10).

7.8 OVERCURRENT DISCRIMINATION OF 'gG' FUSE-LINKS. Fuse-links in series, having rated current ratio of 1:1.6 and rated currents of 16 A and above, shall discriminate up to the values specified in Clause 8.7.4 herein.

For discrimination with circuit-breakers the I^2t -values in Table 13 shall be used.

TABLE 13
PRE-ARCING I^2t VALUES FOR DISCRIMINATION

Rated current (I_n) A	Prospective current A	Value $I^2t_{\text{min.}}$ A ² s
16	500	250
20	670	450
25	900	810
32	1 180	1 400
40	1 580	2 500
50	2 000	4 000
63	2 510	6 300
80	3 160	10 000
100	4 000	16 000
125	4 900	24 000
160	6 520	42 500
200	8 830	78 000

SECTION 8 TESTS

8.1.6 Testing of fuse-holders. In addition to the test specified in AS 2005.10, the fuse-holders shall be subjected to the tests set out in Table 8.2.

TABLE 8.2
SURVEY OF TESTS ON FUSE-HOLDERS AND NUMBER OF FUSE-HOLDERS TO BE TESTED
(Addition to Table 8.2 of AS 2005.10)

Test according to clause number	Number of fuse-holders to be subjected to tests (indicated)				
	1	1	1	1	1
8.5.5.1 Verification of the peak withstand current of a fuse-base				X	X
8.9 Verification of resistance to heat			X		
8.11.1.2 Mechanical strength of the fuse-base	X	X	X	X	
8.11.2.4 Non-deterioration of insulating parts of fuse-link and fuse-base	X	X			

8.3 VERIFICATION OF TEMPERATURE RISE AND POWER DISSIPATION.

8.3.1 Arrangement of the fuse. The screws or nuts of the terminals shall be tightened to the torques specified in Table 14.

TABLE 14
TORQUE TO BE APPLIED TO THE TERMINAL SCREWS

I_n A	Size	Size of screws	Torque Nm
160	00	M8	10
160	0	M8	10
250	1	M10	32
400	2	M10	32
630	3	M10/M12	32/56
1 000	4	M12	56
1 250	4a	2 × M12/M16	56

NOTE: Values of torques for other terminal screws are under consideration.

8.3.4.1 Temperature rise of the fuse-holder. A dummy fuse-link, as shown in Figure 4, shall be used for determination of temperature rise of the fuse-holder. Figure 5 shows the fuse-holder with the dummy fuse-link inserted for temperature-rise measurements at point E indicated therein.

8.3.4.2 Power dissipation of a fuse-link. The points between which the power dissipation of a fuse link is measured are marked with the letter S in Figure 5.

SECTION 8 TESTS

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TABLE 8.2
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(Addition to Table 8.2 of AS 2005.10)

Test according to clause number	Number of fuse-holders to be subjected to tests (indicated)				
	1	1	1	1	1
8.5.5.1 Verification of the peak withstand current of a fuse-base				X	X
8.9 Verification of resistance to heat			X		
8.11.1.2 Mechanical strength of the fuse-base	X	X	X	X	
8.11.2.4 Non-deterioration of insulating parts of fuse-link and fuse-base	X	X			

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I_n A	Size	Size of screws	Torque Nm
160	00	M8	10
160	0	M8	10
250	1	M10	32
400	2	M10	32
630	3	M10/M12	32/56
1 000	4	M12	56
1 250	4a	2 × M12/M16	56

NOTE: Values of torques for other terminal screws are under consideration.

8.3.4.1 Temperature rise of the fuse-holder. A dummy fuse-link, as shown in Figure 4, shall be used for determination of temperature rise of the fuse-holder. Figure 5 shows the fuse-holder with the dummy fuse-link inserted for temperature-rise measurements at point E indicated therein.

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Test according to clause number	Number of fuse-holders to be subjected to tests (indicated)				
	1	1	1	1	1
8.5.5.1 Verification of the peak withstand current of a fuse-base				X	X
8.9 Verification of resistance to heat			X		
8.11.1.2 Mechanical strength of the fuse-base	X	X	X	X	
8.11.2.4 Non-deterioration of insulating parts of fuse-link and fuse-base	X	X			

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I_n A	Size	Size of screws	Torque Nm
160	00	M8	10
160	0	M8	10
250	1	M10	32
400	2	M10	32
630	3	M10/M12	32/56
1 000	4	M12	56
1 250	4a	2 × M12/M16	56

NOTE: Values of torques for other terminal screws are under consideration.

8.3.4.1 Temperature rise of the fuse-holder. A dummy fuse-link, as shown in Figure 4, shall be used for determination of temperature rise of the fuse-holder. Figure 5 shows the fuse-holder with the dummy fuse-link inserted for temperature-rise measurements at point E indicated therein.

8.3.4.2 Power dissipation of a fuse-link. The points between which the power dissipation of a fuse link is measured are marked with the letter S in Figure 5.

Four samples are tested, two samples are tested at the r.m.s. prospective test current (I), corresponding to the minimum pre-arcing I^2t values, the other samples at the r.m.s. prospective test current (I), corresponding to the operating I^2t values.

The test voltage is $\frac{U_n}{\sqrt{3}}$

where

U_n is the fuse-link rated voltage.

TABLE 16
TEST CURRENTS AND I^2t LIMITS FOR DISCRIMINATION TEST

Rated current (I_n) A	Minimum pre-arcing I^2t		Maximum operating I^2t	
	Prospective current (I) kA (r.m.s.)	I^2t A ² s	Prospective current (I) kA (r.m.s.)	I^2t A ² s
16	0.27	291	0.55	1 210
20	0.40	640	0.79	2 500
25	0.55	1 210	1.00	4 000
32	0.79	2 500	1.20	5 750
40	1.00	4 000	1.50	9 000
50	1.20	5 750	1.85	13 700
63	1.50	9 000	2.30	21 200
80	1.85	13 700	3.00	36 000
100	2.30	21 200	4.00	64 000
125	3.00	36 000	5.10	104 000
160	4.00	64 000	6.80	185 000
200	5.10	104 000	8.70	302 000
250	6.80	185 000	11.80	557 000
315	8.70	302 000	15.00	900 000
400	11.80	557 000	20.00	1 600 000
500	15.00	900 000	26.00	2 700 000
630	20.00	1 600 000	37.00	5 470 000
800	26.00	2 700 000	50.00	10 000 000
1 000	37.00	5 470 000	66.00	17 400 000
1 250	50.00	10 000 000	90.00	33 100 000

8.9 VERIFICATION OF RESISTANCE TO HEAT.

NOTE: The tests in this Clause apply to fuse-bases and fuse-links.

8.9.1 Fuse-base.

8.9.1.0 Application. The tests specified not affected in this Clause should be applied if it is not obvious that the components are adversely affected by the specified temperatures and withdrawal forces.

8.9.1.1 Test arrangement. A dummy fuse-link in accordance with Figure 4 shall be fitted into a fuse-base and also suspended from a measuring device, as shown for example, in Figure 7. The manner in which the dummy fuse-link is fitted and secured (e.g. by locking pins), in fuse-bases shall ensure that heat dissipation is not seriously affected.

The test set-up is installed in a heating chamber or below a heatable cowl of at least 50 L capacity, care being taken to see that the bushings, etc, for the measuring facility and connections are suitably sealed. The conductor cross-section depends upon the rated current (see AS 2005.10, Table 8.4), and the connections outside the heating chamber shall be at least 1 m long.

The heaters shall be such as to ensure that, during the test sequence described below, a temperature of $80 \pm 5^\circ\text{C}$ is maintained with or without the test current, the temperature being measured at a horizontal distance of 150 mm from the dummy fuse-link centre point.

8.9.1.2 Test method. The temperature in the heating chamber is raised to $80 \pm 5^\circ\text{C}$, and maintained for 2 h. The dummy fuse-link is then loaded with 160 ± 2 percent of rated current for 2 h. The test may be carried out at reduced voltage.

Three minutes after switching off the load current, a tensile force (F_{max}) (see Table 17) shall be applied smoothly to the dummy fuse-link and maintained for a period of 15 s.

8.9.1.3 Acceptability of test results. After this test, the contact pieces of the fuse-base shall not have moved to such an extent as to affect the further use of the fuse-base. After pulling out of the dummy fuse-link the dimensions shown in Figure 2 shall be within the specified limits. The insulating mounting part of the fuse-base shall neither be broken nor shall it show any signs of cracks.

Four samples are tested, two samples are tested at the r.m.s. prospective test current (I), corresponding to the minimum pre-arcing I^2t values, the other samples at the r.m.s. prospective test current (I), corresponding to the operating I^2t values.

The test voltage is $\frac{U_n}{\sqrt{3}}$

where

U_n is the fuse-link rated voltage.

TABLE 16
TEST CURRENTS AND I^2t LIMITS FOR DISCRIMINATION TEST

Rated current (I_n) A	Minimum pre-arcing I^2t		Maximum operating I^2t	
	Prospective current (I) kA (r.m.s.)	I^2t A ² s	Prospective current (I) kA (r.m.s.)	I^2t A ² s
16	0.27	291	0.55	1 210
20	0.40	640	0.79	2 500
25	0.55	1 210	1.00	4 000
32	0.79	2 500	1.20	5 750
40	1.00	4 000	1.50	9 000
50	1.20	5 750	1.85	13 700
63	1.50	9 000	2.30	21 200
80	1.85	13 700	3.00	36 000
100	2.30	21 200	4.00	64 000
125	3.00	36 000	5.10	104 000
160	4.00	64 000	6.80	185 000
200	5.10	104 000	8.70	302 000
250	6.80	185 000	11.80	557 000
315	8.70	302 000	15.00	900 000
400	11.80	557 000	20.00	1 600 000
500	15.00	900 000	26.00	2 700 000
630	20.00	1 600 000	37.00	5 470 000
800	26.00	2 700 000	50.00	10 000 000
1 000	37.00	5 470 000	66.00	17 400 000
1 250	50.00	10 000 000	90.00	33 100 000

8.9 VERIFICATION OF RESISTANCE TO HEAT.

NOTE: The tests in this Clause apply to fuse-bases and fuse-links.

8.9.1 Fuse-base.

8.9.1.0 Application. The tests specified not affected in this Clause should be applied if it is not obvious that the components are adversely affected by the specified temperatures and withdrawal forces.

8.9.1.1 Test arrangement. A dummy fuse-link in accordance with Figure 4 shall be fitted into a fuse-base and also suspended from a measuring device, as shown for example, in Figure 7. The manner in which the dummy fuse-link is fitted and secured (e.g. by locking pins), in fuse-bases shall ensure that heat dissipation is not seriously affected.

The test set-up is installed in a heating chamber or below a heatable cowl of at least 50 L capacity, care being taken to see that the bushings, etc, for the measuring facility and connections are suitably sealed. The conductor cross-section depends upon the rated current (see AS 2005.10, Table 8.4), and the connections outside the heating chamber shall be at least 1 m long.

The heaters shall be such as to ensure that, during the test sequence described below, a temperature of $80 \pm 5^\circ\text{C}$ is maintained with or without the test current, the temperature being measured at a horizontal distance of 150 mm from the dummy fuse-link centre point.

8.9.1.2 Test method. The temperature in the heating chamber is raised to $80 \pm 5^\circ\text{C}$, and maintained for 2 h. The dummy fuse-link is then loaded with 160 ± 2 percent of rated current for 2 h. The test may be carried out at reduced voltage.

Three minutes after switching off the load current, a tensile force (F_{max}) (see Table 17) shall be applied smoothly to the dummy fuse-link and maintained for a period of 15 s.

8.9.1.3 Acceptability of test results. After this test, the contact pieces of the fuse-base shall not have moved to such an extent as to affect the further use of the fuse-base. After pulling out of the dummy fuse-link the dimensions shown in Figure 2 shall be within the specified limits. The insulating mounting part of the fuse-base shall neither be broken nor shall it show any signs of cracks.

Four samples are tested, two samples are tested at the r.m.s. prospective test current (I), corresponding to the minimum pre-arcing I^2t values, the other samples at the r.m.s. prospective test current (I), corresponding to the operating I^2t values.

The test voltage is $\frac{U_n}{\sqrt{3}}$

where

U_n is the fuse-link rated voltage.

TABLE 16
TEST CURRENTS AND I^2t LIMITS FOR DISCRIMINATION TEST

Rated current (I_n) A	Minimum pre-arcing I^2t		Maximum operating I^2t	
	Prospective current (I) kA (r.m.s.)	I^2t A ² s	Prospective current (I) kA (r.m.s.)	I^2t A ² s
16	0.27	291	0.55	1 210
20	0.40	640	0.79	2 500
25	0.55	1 210	1.00	4 000
32	0.79	2 500	1.20	5 750
40	1.00	4 000	1.50	9 000
50	1.20	5 750	1.85	13 700
63	1.50	9 000	2.30	21 200
80	1.85	13 700	3.00	36 000
100	2.30	21 200	4.00	64 000
125	3.00	36 000	5.10	104 000
160	4.00	64 000	6.80	185 000
200	5.10	104 000	8.70	302 000
250	6.80	185 000	11.80	557 000
315	8.70	302 000	15.00	900 000
400	11.80	557 000	20.00	1 600 000
500	15.00	900 000	26.00	2 700 000
630	20.00	1 600 000	37.00	5 470 000
800	26.00	2 700 000	50.00	10 000 000
1 000	37.00	5 470 000	66.00	17 400 000
1 250	50.00	10 000 000	90.00	33 100 000

8.9 VERIFICATION OF RESISTANCE TO HEAT.

NOTE: The tests in this Clause apply to fuse-bases and fuse-links.

8.9.1 Fuse-base.

8.9.1.0 Application. The tests specified not affected in this Clause should be applied if it is not obvious that the components are adversely affected by the specified temperatures and withdrawal forces.

8.9.1.1 Test arrangement. A dummy fuse-link in accordance with Figure 4 shall be fitted into a fuse-base and also suspended from a measuring device, as shown for example, in Figure 7. The manner in which the dummy fuse-link is fitted and secured (e.g. by locking pins), in fuse-bases shall ensure that heat dissipation is not seriously affected.

The test set-up is installed in a heating chamber or below a heatable cowl of at least 50 L capacity, care being taken to see that the bushings, etc, for the measuring facility and connections are suitably sealed. The conductor cross-section depends upon the rated current (see AS 2005.10, Table 8.4), and the connections outside the heating chamber shall be at least 1 m long.

The heaters shall be such as to ensure that, during the test sequence described below, a temperature of $80 \pm 5^\circ\text{C}$ is maintained with or without the test current, the temperature being measured at a horizontal distance of 150 mm from the dummy fuse-link centre point.

8.9.1.2 Test method. The temperature in the heating chamber is raised to $80 \pm 5^\circ\text{C}$, and maintained for 2 h. The dummy fuse-link is then loaded with 160 ± 2 percent of rated current for 2 h. The test may be carried out at reduced voltage.

Three minutes after switching off the load current, a tensile force (F_{max}) (see Table 17) shall be applied smoothly to the dummy fuse-link and maintained for a period of 15 s.

8.9.1.3 Acceptability of test results. After this test, the contact pieces of the fuse-base shall not have moved to such an extent as to affect the further use of the fuse-base. After pulling out of the dummy fuse-link the dimensions shown in Figure 2 shall be within the specified limits. The insulating mounting part of the fuse-base shall neither be broken nor shall it show any signs of cracks.

Four samples are tested, two samples are tested at the r.m.s. prospective test current (I), corresponding to the minimum pre-arcing I^2t values, the other samples at the r.m.s. prospective test current (I), corresponding to the operating I^2t values.

The test voltage is $\frac{U_n}{\sqrt{3}}$

where

U_n is the fuse-link rated voltage.

TABLE 16
TEST CURRENTS AND I^2t LIMITS FOR DISCRIMINATION TEST

Rated current (I_n) A	Minimum pre-arcing I^2t		Maximum operating I^2t	
	Prospective current (I) kA (r.m.s.)	I^2t A ² s	Prospective current (I) kA (r.m.s.)	I^2t A ² s
16	0.27	291	0.55	1 210
20	0.40	640	0.79	2 500
25	0.55	1 210	1.00	4 000
32	0.79	2 500	1.20	5 750
40	1.00	4 000	1.50	9 000
50	1.20	5 750	1.85	13 700
63	1.50	9 000	2.30	21 200
80	1.85	13 700	3.00	36 000
100	2.30	21 200	4.00	64 000
125	3.00	36 000	5.10	104 000
160	4.00	64 000	6.80	185 000
200	5.10	104 000	8.70	302 000
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400	11.80	557 000	20.00	1 600 000
500	15.00	900 000	26.00	2 700 000
630	20.00	1 600 000	37.00	5 470 000
800	26.00	2 700 000	50.00	10 000 000
1 000	37.00	5 470 000	66.00	17 400 000
1 250	50.00	10 000 000	90.00	33 100 000

8.9 VERIFICATION OF RESISTANCE TO HEAT.

NOTE: The tests in this Clause apply to fuse-bases and fuse-links.

8.9.1 Fuse-base.

8.9.1.0 Application. The tests specified not affected in this Clause should be applied if it is not obvious that the components are adversely affected by the specified temperatures and withdrawal forces.

8.9.1.1 Test arrangement. A dummy fuse-link in accordance with Figure 4 shall be fitted into a fuse-base and also suspended from a measuring device, as shown for example, in Figure 7. The manner in which the dummy fuse-link is fitted and secured (e.g. by locking pins), in fuse-bases shall ensure that heat dissipation is not seriously affected.

The test set-up is installed in a heating chamber or below a heatable cowl of at least 50 L capacity, care being taken to see that the bushings, etc, for the measuring facility and connections are suitably sealed. The conductor cross-section depends upon the rated current (see AS 2005.10, Table 8.4), and the connections outside the heating chamber shall be at least 1 m long.

The heaters shall be such as to ensure that, during the test sequence described below, a temperature of $80 \pm 5^\circ\text{C}$ is maintained with or without the test current, the temperature being measured at a horizontal distance of 150 mm from the dummy fuse-link centre point.

8.9.1.2 Test method. The temperature in the heating chamber is raised to $80 \pm 5^\circ\text{C}$, and maintained for 2 h. The dummy fuse-link is then loaded with 160 ± 2 percent of rated current for 2 h. The test may be carried out at reduced voltage.

Three minutes after switching off the load current, a tensile force (F_{max}) (see Table 17) shall be applied smoothly to the dummy fuse-link and maintained for a period of 15 s.

8.9.1.3 Acceptability of test results. After this test, the contact pieces of the fuse-base shall not have moved to such an extent as to affect the further use of the fuse-base. After pulling out of the dummy fuse-link the dimensions shown in Figure 2 shall be within the specified limits. The insulating mounting part of the fuse-base shall neither be broken nor shall it show any signs of cracks.

Four samples are tested, two samples are tested at the r.m.s. prospective test current (I), corresponding to the minimum pre-arcing I^2t values, the other samples at the r.m.s. prospective test current (I), corresponding to the operating I^2t values.

The test voltage is $\frac{U_n}{\sqrt{3}}$

where

U_n is the fuse-link rated voltage.

TABLE 16
TEST CURRENTS AND I^2t LIMITS FOR DISCRIMINATION TEST

Rated current (I_n) A	Minimum pre-arcing I^2t		Maximum operating I^2t	
	Prospective current (I) kA (r.m.s.)	I^2t A ² s	Prospective current (I) kA (r.m.s.)	I^2t A ² s
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80	1.85	13 700	3.00	36 000
100	2.30	21 200	4.00	64 000
125	3.00	36 000	5.10	104 000
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400	11.80	557 000	20.00	1 600 000
500	15.00	900 000	26.00	2 700 000
630	20.00	1 600 000	37.00	5 470 000
800	26.00	2 700 000	50.00	10 000 000
1 000	37.00	5 470 000	66.00	17 400 000
1 250	50.00	10 000 000	90.00	33 100 000

8.9 VERIFICATION OF RESISTANCE TO HEAT.

NOTE: The tests in this Clause apply to fuse-bases and fuse-links.

8.9.1 Fuse-base.

8.9.1.0 Application. The tests specified not affected in this Clause should be applied if it is not obvious that the components are adversely affected by the specified temperatures and withdrawal forces.

8.9.1.1 Test arrangement. A dummy fuse-link in accordance with Figure 4 shall be fitted into a fuse-base and also suspended from a measuring device, as shown for example, in Figure 7. The manner in which the dummy fuse-link is fitted and secured (e.g. by locking pins), in fuse-bases shall ensure that heat dissipation is not seriously affected.

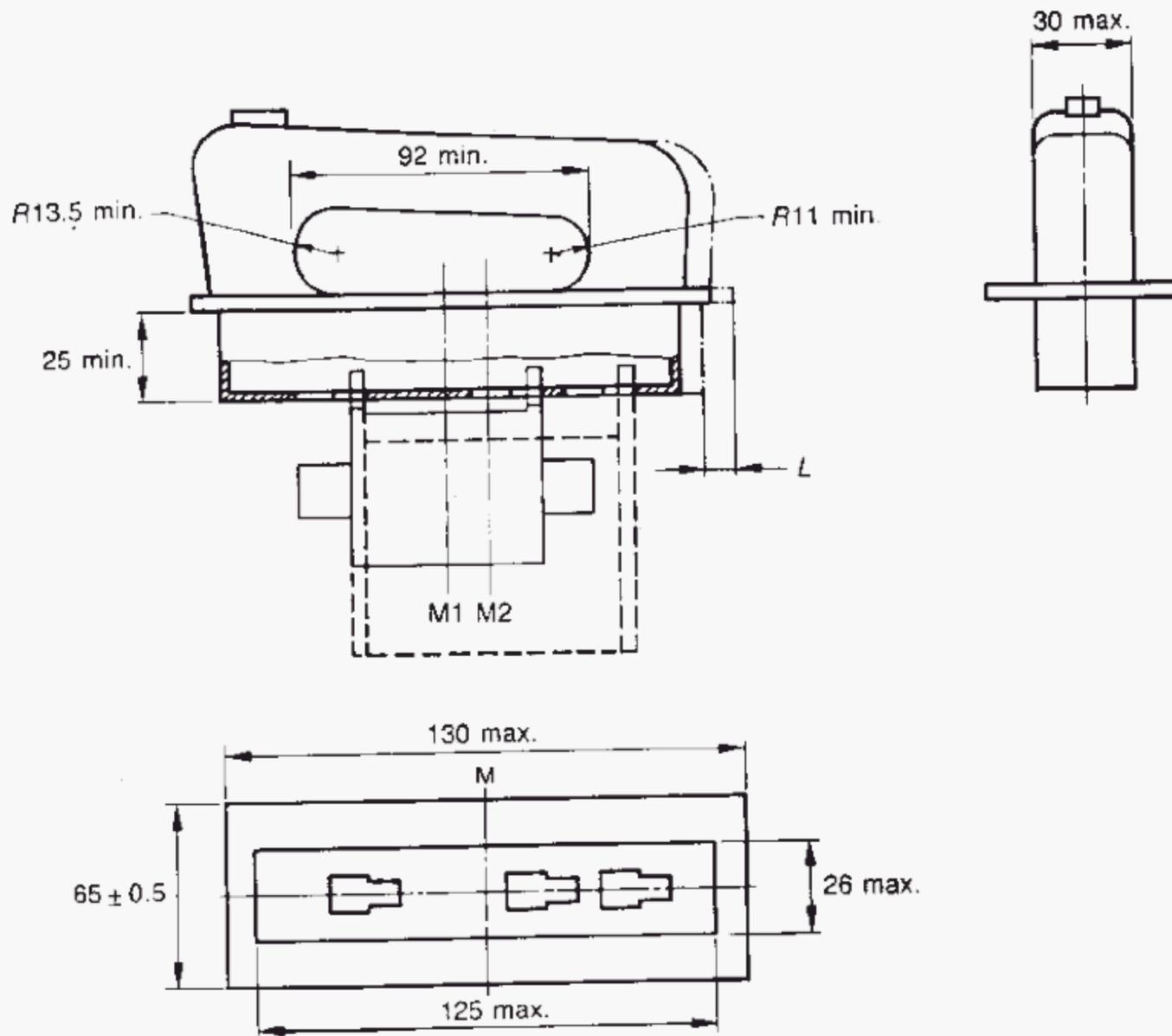
The test set-up is installed in a heating chamber or below a heatable cowl of at least 50 L capacity, care being taken to see that the bushings, etc, for the measuring facility and connections are suitably sealed. The conductor cross-section depends upon the rated current (see AS 2005.10, Table 8.4), and the connections outside the heating chamber shall be at least 1 m long.

The heaters shall be such as to ensure that, during the test sequence described below, a temperature of $80 \pm 5^\circ\text{C}$ is maintained with or without the test current, the temperature being measured at a horizontal distance of 150 mm from the dummy fuse-link centre point.

8.9.1.2 Test method. The temperature in the heating chamber is raised to $80 \pm 5^\circ\text{C}$, and maintained for 2 h. The dummy fuse-link is then loaded with 160 ± 2 percent of rated current for 2 h. The test may be carried out at reduced voltage.

Three minutes after switching off the load current, a tensile force (F_{max}) (see Table 17) shall be applied smoothly to the dummy fuse-link and maintained for a period of 15 s.

8.9.1.3 Acceptability of test results. After this test, the contact pieces of the fuse-base shall not have moved to such an extent as to affect the further use of the fuse-base. After pulling out of the dummy fuse-link the dimensions shown in Figure 2 shall be within the specified limits. The insulating mounting part of the fuse-base shall neither be broken nor shall it show any signs of cracks.



Size	L	Distance	
		M to M1	M to M2
00	14	0 ± 3	—
0 to 3	16	—	11 ± 3

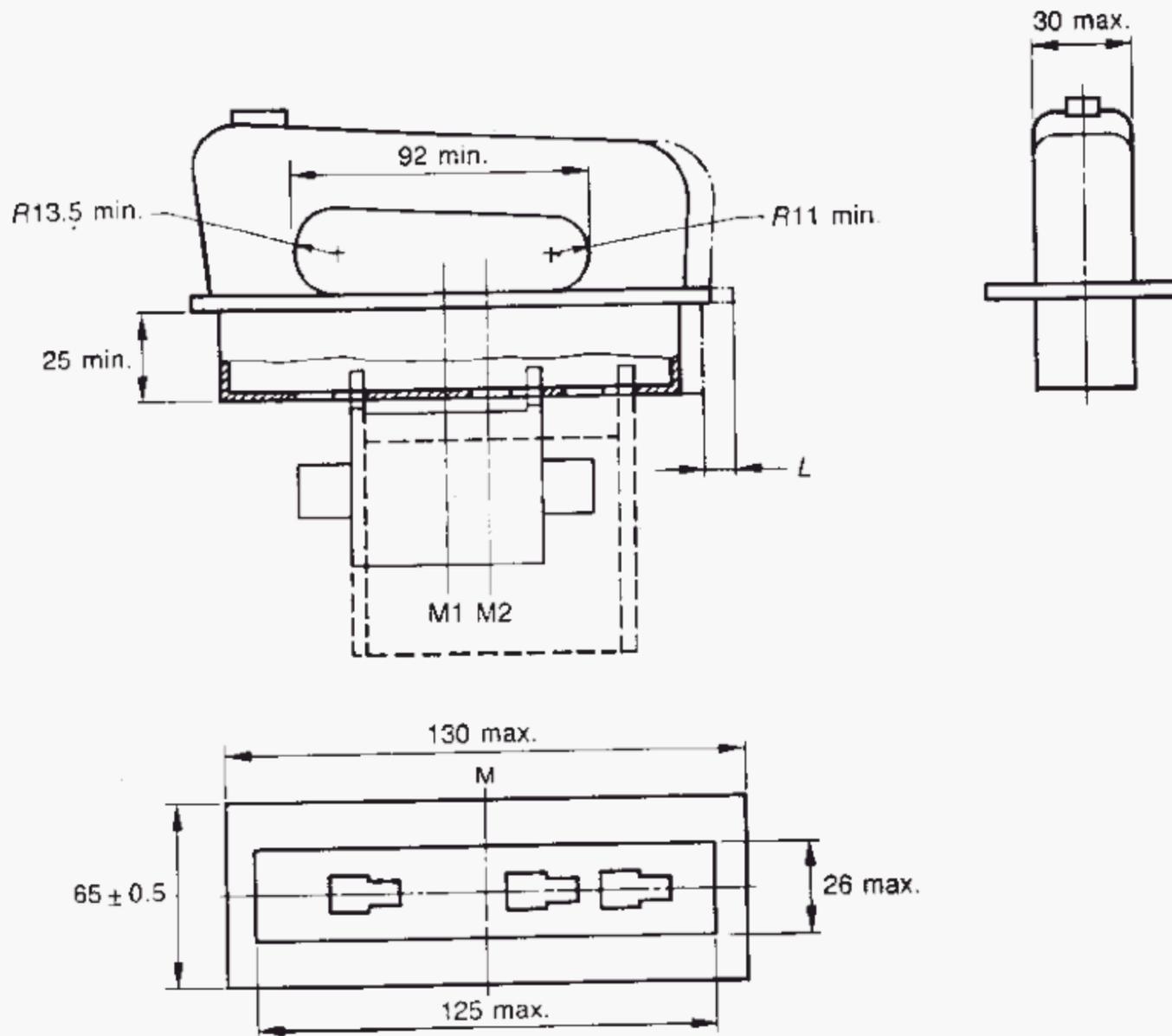
NOTE: For centre of the set-in and blocked-up fuse-link:
 L = permitted lift for setting in and taking out of the fuse-link.
 M1 for size 00
 M2 for sizes 0 to 3
 M = centre of the coupling

DIMENSIONS IN MILLIMETRES

FIGURE 9 REPLACEMENT HANDLE

(b) *Acceptability of test results.* The results of the test in above are acceptable, if -

- (i) the positions of the fuse-base contacts taking the fuse-link have not changed in a manner likely to affect the performance of the fuse-link;
- (ii) the insulating body on which the terminals are fixed shows no signs of fracture;
- (iii) the mechanical strength of cemented joints has not been impaired;
- (iv) sealing compounds have not moved so as to expose live parts;
- (v) marking remains durable and easily legible; and
- (vi) the fuse-links operate correctly.



Size	L	Distance	
		M to M1	M to M2
00	14	0 ± 3	—
0 to 3	16	—	11 ± 3

NOTE: For centre of the set-in and blocked-up fuse-link:
 L = permitted lift for setting in and taking out of the fuse-link.
 M1 for size 00
 M2 for sizes 0 to 3
 M = centre of the coupling

DIMENSIONS IN MILLIMETRES

FIGURE 9 REPLACEMENT HANDLE

(b) *Acceptability of test results.* The results of the test in above are acceptable, if -

- (i) the positions of the fuse-base contacts taking the fuse-link have not changed in a manner likely to affect the performance of the fuse-link;
- (ii) the insulating body on which the terminals are fixed shows no signs of fracture;
- (iii) the mechanical strength of cemented joints has not been impaired;
- (iv) sealing compounds have not moved so as to expose live parts;
- (v) marking remains durable and easily legible; and
- (vi) the fuse-links operate correctly.

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