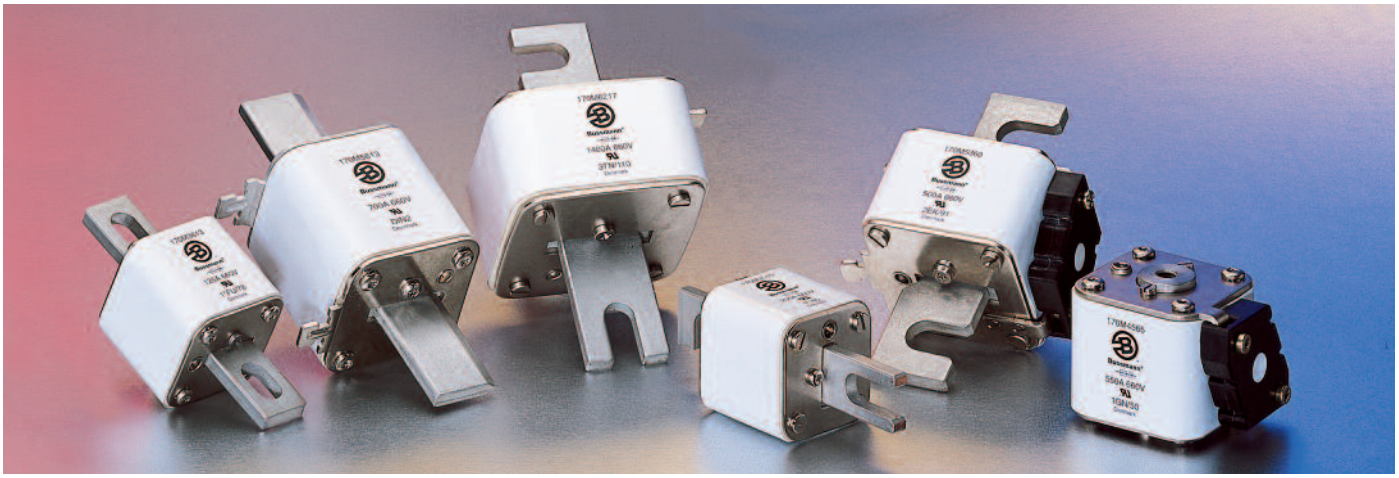
Square Body Fuses



Introduction

Square Body Fuse Ranges

Amps	Volts	AC	DC
10-7500	690	X	—
50-1400	1250	X	—

General Information

Designed and tested to:
- IEC 60269: Part 4
- UL Recognized

Bussmann offers a complete range of square body style fuses and accessories. Their unique design and construction provide:
- Minimal energy let-through (I^2t)
- Low operating temperature
- Low watts loss

Square body style fuses are a very attractive solution for high power applications which require a compact design with superior performance. The construction and design of square body style fuses make it easy for Bussmann to manufacture custom products. Our cataloged offering provides only a sample of the wide variety of product which is available.

Each square body style fuse is available with a number of different end fittings. Options include:
- DIN 43 653
- DIN 43 620
- Flush End (Metric/US)
- French Style
- US Style

Voltage Rating

All Bussmann square body style fuses are tested to IEC 60269: Part 4. This standard requires a test voltage which is 5% higher than the rated voltage. In North America, fuses are required to clear only their rated voltage.

Accessories

Square Body style fuses are available with three different open fuse indicator systems. Options include visual indication and indication utilizing a microswitch. Fuse blocks are also available for most applications.

Square Body Applications

Maximum Permissible Load Current

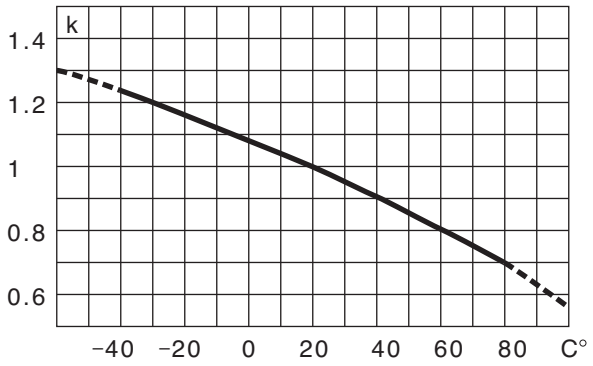
The rated current value of Bussmann fuses is based on the ambient temperature in the space immediately below the fuse of 20°C. The following graph gives correction factors (k) for a range of temperatures (–40°C to +80°C). Maximum permissible continuous load currents can be calculated by applying the following formula:

$I_b \leq I_n \approx k \approx (1 + 0.05\ V) \times K_b$

where

I_b = Maximum permissible continuous load current
I_n = Rated current of fuse
k = Temperature correction factor
v = Velocity of cooling air in m/s (max. 5 m/s).
K_b = Fuse load constant 1.0

Temperature Correction Curve



The maximum permissible continuous load current Ib of a fuse can be checked empirically (i.e., by satisfying the formula below) by making simple voltage and temperature measurements under actual operating conditions after the fuse has been installed in its operating location and loaded at the calculated Ib value:

$\frac{E_2}{E_1} \approx (0.92 + 0.004t) \leq N$

where

E_1 = Voltage drop across fuse after 5 seconds
E_2 = Voltage drop across fuse after 2 hours
t = Air temperature at start of test (°C)
N = Constant

Fuse Rated Voltage (IEC)	N
690	1.5
1250	1.6

Body Cross Section

Standard fuse program includes barrels with different cross sections.

Size	000	00	1	1	2	3	4
Maximum Cross-section (mm)	21 × 36	30 × 47	45 × 45	53 × 53	61 × 61	76 × 76	105 × 105

Square Body Applications

Example Application of Square Body High Speed Fuses Subject to Overload and Impulse Loading

Select a short-blade indicating fuse with indicator/adapter to permit the use of a single-pole microswitch for remote indication and determine if the fuse selected will meet the following application parameters.

Application Parameters

Load Currents Expected

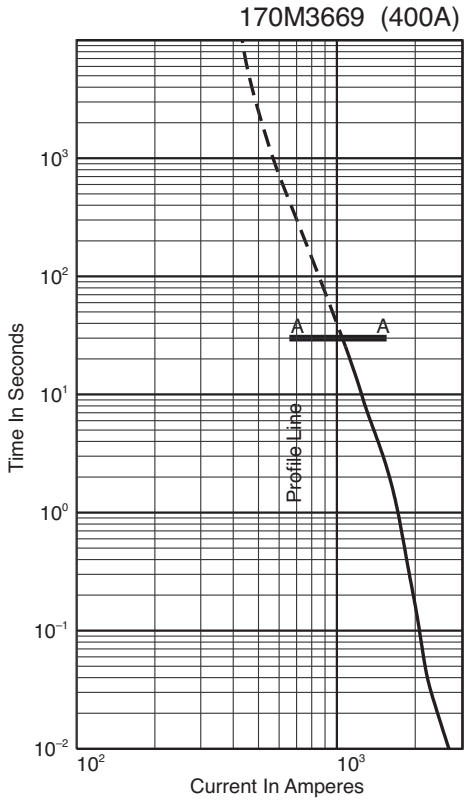
Load Type	Duration	Frequency of Occurrence	Amps
(1) Normal	Continuous	—	300A
(2) Overload	60 Seconds	Once Per Hour	500A
(3a) (3b) Overload	10 Seconds 20 Seconds (max.)	2-3 Times Per Week Once Per Month	700A
(4) Impulse	0.5 Seconds	Less Than Once Per Month	1100A
Voltage Data			
(5) Voltage Applied to Fuse During Fault Conditions (+10%)			400V
Temperature Data			
(6) Temperature Inside Cubicle in Which Fuse is Located (Natural Convection Cooling Only) 60°C			
Thyrister Data			
(7) Thyrister Peak Voltage Withstand			1000V
(8) Thyrister I^2t Withstand at 10 Milliseconds*			90,000A²s

*Note: The I^2t withstand of the thyrister may be given for other impulse durations (i.e., 1.5 ms, 3.5 ms, or 8.3 ms); however, the stated fuse I^2t is valid for all impulse durations of 10 ms or less.

Application Procedure

Step	Procedure	Remarks
(1) Select a short-blade fuse to permit mounting of microswitch 170H0069	1.1 Taking into consideration only the continuous load current and ambient temperature, from Table on page 127 tentatively select fuse 170M3669 400A, 690V).	—
(2) Determine I^2t (total clearing) at 440V.	2.1 See Table, page 127. Note I^2t is 105,000A²s at rated voltage of 690V. 2.2 From the figure on page 126, note that correction factor K = 0.65. 2.3 $I^2t_{660V} \times K = I^2t_{440V}$ 105,000 × 0.65 = 68,250	OK
(3) Determine maximum arc voltage at 440V	3.1 From the figure on page 126, note that maximum voltage at 440V is 900V	OK
(4) Determine maximum permissible continuous load current I_b.	4.1 Per page 115 data, $I_b = I_n \times k \times (1 + 0.05V) \times K_b$ I_b = 400A × 0.8 × (1 + 0) × 1 I_b = 320A	—
(5) Plot a "line profile" showing the expected load and overload currents. Determine that overload and impulse load currents do not exceed their maximum permissible values.	5.0 Calculate I_{max} per Table, High Speed Fuse Application Guide page 16, for each overload and impulse load.	—
(Item 2)	5.1 $I_{max} < 60\% \times I_t$ 500A < 60% × 950A 500A < 570A	OK
(Item 3a)	5.2 $I_{max} < 60\% \times I_t$ 700A < 60% × 1360A 700A < 780A	OK
(Item 3b)	5.3 $I_{max} < 70\% \times I_t$ 700A < 70% × 1150A 700A < 805A	OK
(Item 4)	5.4 $I_{max} < 70\% \times I_t$ 1100A < 70% × 1800A 1100A < 1260A	OK

The tentatively selected fuse 170M3669 with microswitch 170H0069 meets all application parameters; no further selection would be necessary.



Calculation of Watt Loss

From the Table on page 127, watt loss at 400 amps is 60 watts. The continuous load current of 300A is 75% of rated current (400A). From page 126, the correction factor K_p = 0.5.

$$\text{Watt Loss}_{75\%} = \text{Watt Loss}_{100\%} \times K_p$$
$$= 60\text{W} \times 0.5$$
$$= 30 \text{ watts}$$

Special Fuses

Other high speed fuses are available from Bussmann with voltage ratings of 380 to 10,000V and current ratings up to 10,000A in a single unit configuration. Fuses can be supplied with open fuse, "pin" indicators. Various types of microswitches are also available (see page 212).

Square Body DIN 43 653 — 690V/700V (IEC/UL): 40-2000A

690V/700V (IEC/UL) 40-2000A

Specifications
Description: Square body DIN 43 653 stud-mount high speed fuses.

Dimensions: See dimensions illustration.

Ratings:

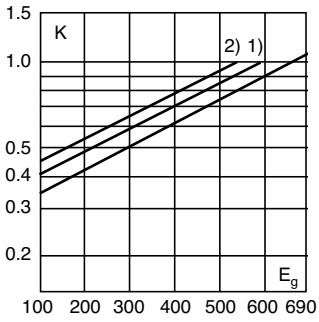
Volts: — 690Vac (IEC)
— 700Vac (UL)
Amps: — 40-2000A
IR: — 200kA RMS Sym.

Agency Information: CE, Designed and tested to IEC 60269: Part 4. UL Recognized E125085.JFHR2, CSA Certified: Class 53787, File 1422-30.

Electrical Characteristics

Total Clearing I²t

The total clearing I²t at rated voltage and at power factor of 15% are given in the electrical characteristics. For other voltages, the clearing I²t is found by multiplying by correction factor, K, given as a function of applied working voltage, E_g, (rms).



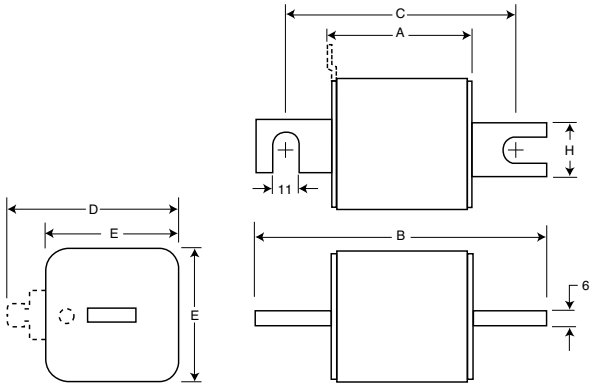
1) Rated voltage 600V
2) Rated voltage 550V

Dimensions - mm

Size	A	B	B**	C	C**	D***	E	H
1*	50	104	134	78	108	58	45	22
1	50	108	138	78	108	66	53	25
2	50	108	138	78	108	75	61	25
3	51	109	139	78	108	90	76	30

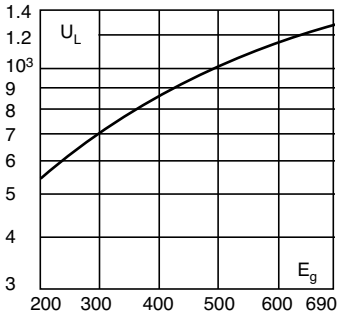
**Valid for fuses type -/110, -TN/110.
***Microswitch.
1mm = 0.0394" / 1" = 25.4mm

Type -/80, -TN/80, -/110, -TN/110.



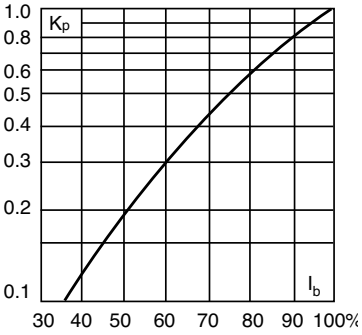
Arc Voltage

This curve gives the peak arc voltage, U_L, which may appear across the fuse during its operation as a function of theapplied working voltage, E_g, (rms) at a power factor of 15%.



Power Losses

Watts loss at rated current is given in the electrical characteristics. The curve allows the calculation of the power losses at load currents lower than the rated current. The correction factor, K_p, is given as a function of the RMS load current, I_b, in % of the rated current.



Features and Benefits

- Excellent DC performance
- Low arc voltage and low energy let-through (I²t)
- Low watts loss
- Superior cycling capability

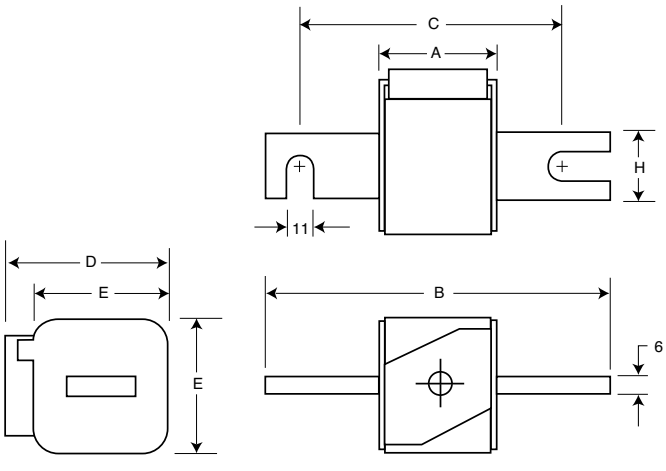
Typical Applications

- DC Common bus
- DC Drives
- Power converters/rectifiers
- Reduced voltage starters

For Other Voltage Ratings in This Body Style

• See pages 174 (1000V) and 187 (1250V/1300V)

Type -KN/80, -KN/110



Square Body DIN 43 653 — 690V/700V (IEC/UL): 40-2000A

Catalog Numbers

Catalog Numbers						Size	Electrical Characteristics			
-/80 Visual Watts Indicator	-TN/80 Type T Indicator for Micro	-KN/80 Type K Indicator for Micro	-/110 Visual for Micro	-TN/110 Type T Indicator for Micro	-KN/110 Type K Indicator -KN/80		Rated RMS-Amps	I²t (A² Sec) Current Pre-arc	I²t (A² Sec) at 660V	Clearing Loss
170M3008	170M3058	170M3108	170M3158	170M3208	170M3258		40	40	270	9
170M3009	170M3059	170M3109	170M3159	170M3209	170M3259		50	77	515	11
170M3010	170M3060	170M3110	170M3160	170M3210	170M3260		63	115	770	14
170M3011	170M3061	170M3111	170M3161	170M3211	170M3261		80	185	1250	18
170M3012	170M3062	170M3112	170M3162	170M3212	170M3262		100	360	2450	21
170M3013	170M3063	170M3113	170M3163	170M3213	170M3263		125	550	3700	26
170M3014	170M3064	170M3114	170M3164	170M3214	170M3264		160	1100	7500	30
170M3015	170M3065	170M3115	170M3165	170M3215	170M3265		200	2200	15000	35
170M3016	170M3066	170M3116	170M3166	170M3216	170M3266	1*	250	4200	28500	40
170M3017	170M3067	170M3117	170M3167	170M3217	170M3267		315	7000	46500	50
170M3018	170M3068	170M3118	170M3168	170M3218	170M3268		350	10000	68500	55
170M3019	170M3069	170M3119	170M3169	170M3219	170M3269		400	15000	105000	60
170M3020	170M3070	170M3120	170M3170	170M3220	170M3270		450	21000	140000	65
170M3021	170M3071	170M3121	170M3171	170M3221	170M3271		500	27000	180000	70
170M3022	170M3072	170M3122	170M3172	170M3222	170M3272		550	34000	230000	75
170M3023	170M3073	170M3123	170M3173	170M3223	170M3273		630	48500	325000	80
170M4008	170M4058	170M4108	170M4158	170M4208	170M4258		200	1650	11500	45
170M4009	170M4059	170M4109	170M4159	170M4209	170M4259		250	3100	21000	55
170M4010	170M4060	170M4110	170M4160	170M4210	170M4260		315	6200	42000	58
170M4011	170M4061	170M4111	170M4161	170M4211	170M4261		350	8500	59000	60
170M4012	170M4062	170M4112	170M4162	170M4212	170M4262		400	13500	91500	65
170M4013	170M4063	170M4113	170M4163	170M4213	170M4263		450	17000	120000	70
170M4014	170M4064	170M4114	170M4164	170M4214	170M4264	1	500	25000	170000	72
170M4015	170M4065	170M4115	170M4165	170M4215	170M4265		550	34000	230000	75
170M4016	170M4066	170M4116	170M4166	170M4216	170M4266		630	52000	350000	80
170M4017	170M4067	170M4117	170M4167	170M4217	170M4267		700	69500	465000	85
170M4018	170M4068	170M4118	170M4168	170M4218	170M4268		800	105000	725000	95
170M4019	170M4069	170M4119	170M4169	170M4219	170M4269		‡900	155000	‡850000	100
170M5008	170M5058	170M5108	170M5158	170M5208	170M5258		400	11000	74000	65
170M5009	170M5059	170M5109	170M5159	170M5209	170M5259		450	15500	105000	70
170M5010	170M5060	170M5110	170M5160	170M5210	170M5260		500	21500	145000	75
170M5011	170M5061	170M5111	170M5161	170M5211	170M5261		550	28000	190000	80
170M5012	170M5062	170M5112	170M5162	170M5212	170M5262		630	41000	275000	90
170M5013	170M5063	170M5113	170M5163	170M5213	170M5263	2	700	60500	405000	95
170M5014	170M5064	170M5114	170M5164	170M5214	170M5264		800	86000	575000	105
170M5015	170M5065	170M5115	170M5165	170M5215	170M5265		900	125000	840000	110
170M5016	170M5066	170M5116	170M5166	170M5216	170M5266		1000	180000	1250000	115
170M5017	170M5067	170M5117	170M5167	170M5217	170M5267		1100	245000	1600000	120
170M5018	170M5068	170M5118	170M5168	170M5218	170M5268		1250	365000	2400000	130
170M6008	170M6058	170M6108	170M6158	170M6208	170M6258		500	14000	95000	95
170M6009	170M6059	170M6109	170M6159	170M6209	170M6259		550	19500	135000	100
170M6010	170M6060	170M6110	170M6160	170M6210	170M6260		630	31000	210000	105
170M6011	170M6061	170M6111	170M6161	170M6211	170M6261		700	44500	300000	110
170M6012	170M6062	170M6112	170M6162	170M6212	170M6262		800	69500	465000	115
170M6013	170M6063	170M6113	170M6163	170M6213	170M6263		900	100000	670000	120
170M6014	170M6064	170M6114	170M6164	170M6214	170M6264	3	1000	140000	945000	125
170M6015	170M6065	170M6115	170M6165	170M6215	170M6265		1100	190000	1300000	130
170M6016	170M6066	170M6116	170M6166	170M6216	170M6266		1250	290000	1950000	140
170M6017	170M6067	170M6117	170M6167	170M6217	170M6267		1400	370000	2450000	155
170M6018	170M6068	170M6118	170M6168	170M6218	170M6268		1500	460000	3100000	160
170M6019	170M6069	170M6119	170M6169	170M6219	170M6269		1600	580000	3900000	160
170M6020	170M6070	170M6120	170M6170	170M6220	170M6270		†1800	880000	†5250000	165
170M6021	170M6071	170M6121	170M6171	170M6221	170M6271		‡2000	1150000	‡6350000	175

†Rated voltage (IEC) 600V.
‡Rated voltage (IEC) 550V.
• Watts loss provided at rated current.
• Microswitch indicator ordered separately. See accessories on pages 212-213.
• For fuse curves see pages 158 and 159.