

Eaton

Control power transformers



Application guide

Control power transformers

In North America, the control voltage is created by a control power transformer or a power supply. We offer a wide range of control power transformers for the North American market, with UL and CSA approval.

The most common secondary voltage is 120 VAC, but also 24 VAC are used. In addition to control signals, it is not uncommon for the transformer to feed smaller 120 VAC loads, such as a receptacle for computers, lighting in the cabinet and other smaller consumers.

Insulation system, temperature classes

NEMA ST-1/UL 5085 define insulation system according to below

Ambient temperature, °C	Temperature rise		Temperature class, °C
	winding °C	Hot spot °C	
40	55	10	105
40	80	30	150
25	135	20	180
40	115	30	185
40	150	30	220

Windings

A control power transformer may have multiple windings on primary and secondary side. Series/multiple windings consist of two similar coils in each winding that can be connected in series or parallel. Transformers with multiple windings are designated with an "r" or "x" between the voltage ratings, for example 120/240 or 120x240. If multiple windings are designated "x" the windings can be connected only in series or parallel. With the "r" designation, a mid-point also becomes available, see wiring diagrams for additional information.

Sizing

Control power transformers are identified by their nominal, steady-state VA capacity. Some loads, such as contactor coils, require a temporary spike in power once power is applied. Then after the contacts have been pulled in, very little power is needed to hold the contacts closed. Other devices, such as pilot lights, consume the same amount of energy when power is first applied through to continued operation. Each control power transformer has a maximum inrush power rating, stated in the ordering tables. The transformer size should be calculated so that the secondary voltage will not dip below 90% of the rated voltage during inrush.

This inrush VA can be determined using the following formula:

$$\text{Inrush VA} = \sqrt{(\text{total inrush, VA})^2 + (\text{total sealed, VA})^2}$$

"Total inrush" is the total sum of all the inrush power of the loads applied, and "Sealed inrush" is the total sum of all the sealed power of the loads applied to the transformer. Once the Inrush power requirement has been determined, the control power transformer is sized from the information in the ordering tables, either for 85%, 90%, or 95% secondary voltage drop.

Recommended overcurrent protection

The transformer is normally protected by two primary fuses and one secondary fuse. Smaller transformers have a very high inrush current, 25-40 times of the full load current. It is recommended that the primary fuses can

withstand 40 times of the full load current during 0,01 s. For full load currents below 9 A, the secondary fuse is sized to max 167% of the full load current. For full load currents, 9 A and above, the secondary fuse is sized to max 125% of the full load current or to closest larger standard rating.

Control power transformers that are part of a motor control circuit, the transformer is connected at the load side motor circuit short circuit protective device, can be sized according to NEC 430.72(C). Main difference compared to NEC 450.3(B) is that the primary fuses that protect the transformers with full load current less than 2 A can be sized up to 500% of full load current. NEC 430.72(C) allows Supplementary Protection under certain conditions. We always recommend that fuses approved for Branch Circuit Protection are used. If the transformer is connected at the load side of the main switch, fuses should be approved for Branch Circuit Protection, such as time delay class CC, and sized in accordance with NEC 450.3(B). The secondary fuse can however in most cases be of Supplementary Protection type. If the control power transformer is feeding a circuit external of the equipment, for example a receptacle, the secondary fuse must be approved for Branch Circuit Protection.

Calculation example

A control panel contains of 2 pcs 4 kW contactors, 2 pcs 7,5 kW contactors, 4 relays and 6 indication lights. Supply voltage 480 VAC, control voltage 120 VAC. Max allowed voltage drop in the secondary side, 90% of rated voltage

Product	Qty	Inrush power, VA	Sealed power VA	Total inrush power, VA	Total sealed power VA
4 kW contactor	2	25	3,3	50	6,6
7,5 kW contactor	2	58	6,5	116	13
Relay	4	29	3,3	58	6,6
Indicating lights	6	7	7	42	42
<i>Total</i>				<i>266</i>	<i>68,2</i>

$$\text{Inrush VA} = \sqrt{(266)^2 + (68,2)^2} = 275 \text{ VA}$$

Requested control power transformer: Type MTE with fuse holders, 240x480 V primary, 120 V secondary

Data from the ordering table on page 4

Catalogue number	Power VA	Inrush capacity, VA, max voltage drop, secondary side % of rated voltage		
		95%	90%	85%
C0050E2AFB	50	170	200	240
C0075E2AFB	75	310	410	540
C0100E2AFB	100	370	540	730

Select C0075E2AFB, sealed continuous power 75 VA (require 68,2 VA), inrush capacity 410 VA (require 275 VA).

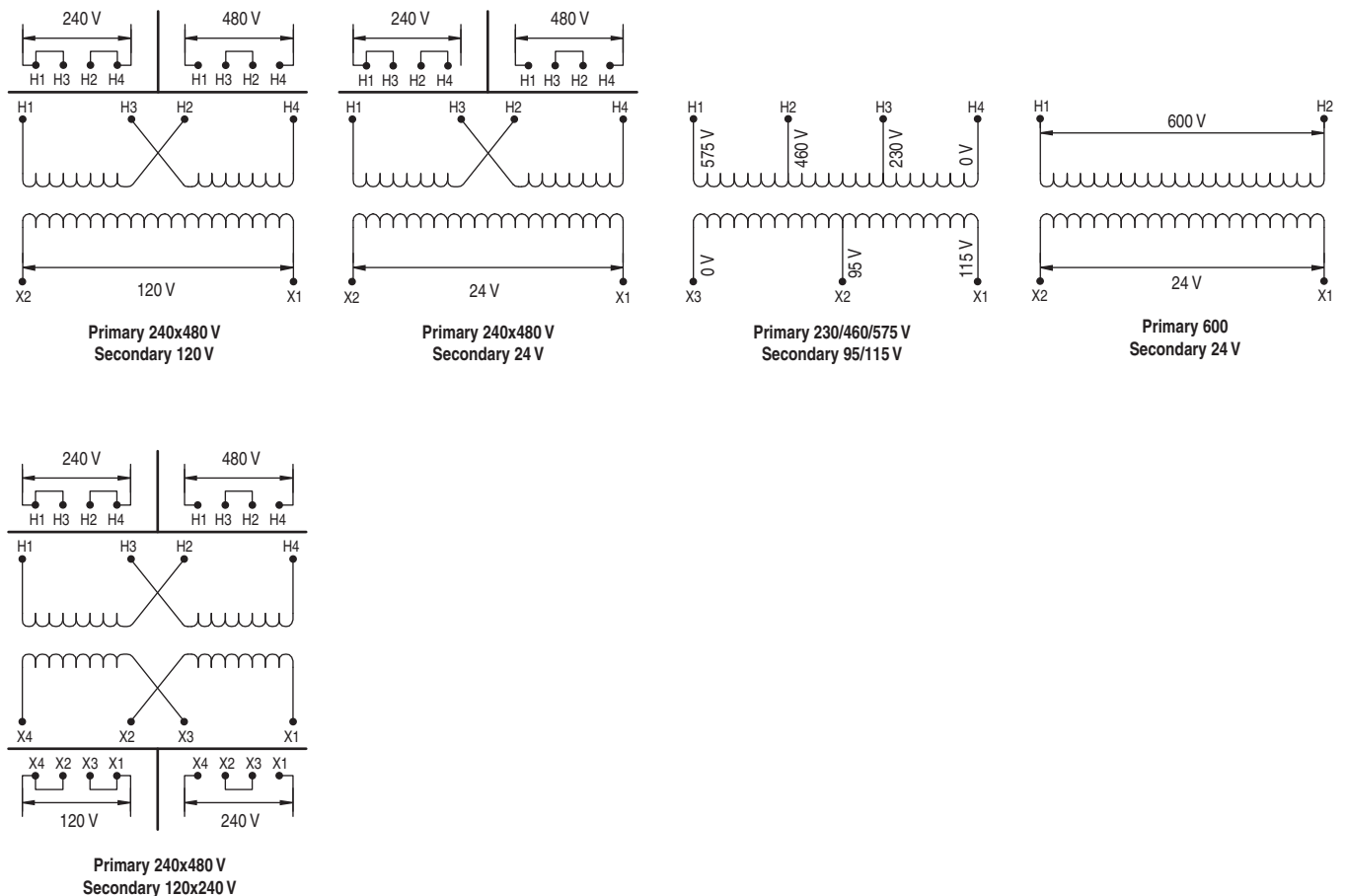
Recommended overcurrent protection

Eaton Bussmann Series fuses

Power VA	Primary fuse according to NEC 250.3(B) - time delay class CC ¹⁾			Secondary fuse, Midget, time delay ¹⁾		
	240 V	480 V	600 V	24 V	120 V	240 V
50	CBFNQ-R-4-10	CBFNQ-R-1-4	CBFNQ-R-1-4	CBFNM-3-2-10	CBFNM-6-10	CBFNM-3-10
75	CBFNQ-R-4-10	CBFNQ-R-3-10	CBFNQ-R-1-4	CBFNM-5	CBFNM-1	CBFNM-1-2
100	CBFNQ-R-6-10	CBFNQ-R-4-10	CBFNQ-R-3-10	CBFNM-6-1-4	CBFNM-1-1-4	CBFNM-3-4
150	CBFNQ-R-1	CBFNQ-R-1-2	CBFNQ-R-1-2	CBFNM-10	CBFNM-1-6-10	CBFNM-1
200	CBFNQ-R-1-1/-2	CBFNQ-R-6-10	CBFNQ-R-1-2	CBFNM-12	CBFNM-2-1-2	CBFNM-1-1-4
250	CBFNQ-R-2	CBFNQ-R-8-10	CBFNQ-R-6-10	CBFNM-15	CBFNM-3-2-10	CBFNM-1-6-10
300	CBFNQ-R-2-1-2	CBFNQ-R-1-1-2	CBFNQ-R-1	CBFNM-20	CBFNM-4	CBFNM-1-6-10
350	CBFNQ-R-3	CBFNQ-R-1-1-2	CBFNQ-R-1-1-4	CBFNM-20	CBFNM-4-1-2	CBFNM-2-1-4
500	CBFNQ-R-4	CBFNQ-R-1-6-10	CBFNQ-R-1-1-2	CBFNM-30	CBFNM-6-1-4	CBFNM-3-2-10
750	CBFNQ-R-7	CBFNQ-R-3	CBFNQ-R-2-1-2	CBLPJ40 ¹⁾	CBFNM-10	CBFNM-5
1000	CBFNQ-R-10	CBFNQ-R-4	CBFNQ-R-3		CBFNM-12	CBFNM-6
1500	CBFNQ-R-15	CBFNQ-R-7	CBFNQ-R-5		CBFNM-20	CBFNM-10
2000	CBFNQ-R-20	CBFNQ-R-10	CBFNQ-R-8		CBFNM-25	CBFNM-12
3000	CBFNQ-R-30	CBFNQ-R-15	CBFNQ-R-12		CBLPJ-35 ²⁾	CBFNM-20
5000	CBLPJ-50 ²⁾	CBFNQ-R-25	CBFNQ-R-20		CBLPJ-60 ²⁾	CBFNM-30

1) See page 8 for fuse disconnectors
2) Class J fuse

Wiring diagram



Control power transformers

Type MTE

Technical data



Design	Epoxy encapsulated windings
Frequency	50/60 Hz
Insulation system	130° (80°C temperature rise), 50-100 VA: 105° (55°C temperature rise)
Fuse holders	Primary class CC (some versions) secondary clips for Midget fuse, can be bypassed
Terminals	Screw with pressue plate
Ingress prot., IEC 60529	IP 00/IP 20 with terminal covers, accessory
Standards	ANSI/NEMA ST1, UL 5085
Approval	cUL listed guide XPTQ, file E10156
Certificate	RoHS

Transformer with clips for secondary fuse, 240x480 V primary, 120 V secondary, IP 00

Rated power VA	Inrush capacity, VA at 20% cos-φ max voltage drop on secondary side % of rated voltage			Catalogue numbers		Weight kg/each ¹⁾	Packing size
	95%	80%	85%	Transformer without fuse holder, primary side	Transformer with fuse holder, primary side		
50	170	200	240	C0050E2A	C0050E2AFB	1,2	1
75	310	410	450	C0075E2A	C0075E2AFB	1,6	1
100	370	540	730	C0100E2A	C0100E2AFB	1,9	1
150	780	930	1150	C0150E2A	C0150E2AFB	3	1
200	810	1150	1450	C0200E2A	C0200E2AFB	3,9	1
250	1400	1900	2300	C0250E2A	C0250E2AFB	4,5	1
300	1900	2700	3850	C0300E2A	C0300E2AFB	5,1	1
350	3100	3650	4800	C0350E2A	C0350E2AFB	6,2	1
500	4000	5300	7000	C0500E2A	C0500E2AFB	8,7	1
750	8300	11000	14000	C0750E2A	C0750E2AFB	12,8	1
1000	9000	13000	18500	C1000E2A	C1000E2AFB	13,4	1
1500	10500	15000	20500	C1500E2A	C1500E2AFB	18,1	1

Transformer with clips for secondary fuse, 240x480 V primary, 24 V secondary, IP 00

50	170	200	240	C0050E2B	C0050E2BFB	1,2	1
75	310	410	450	C0075E2B	C0075E2BFB	1,6	1
100	370	540	730	C0100E2B	C0100E2BFB	1,9	1
150	780	930	1150	C0150E2B	C0150E2BFB	3	1
200	810	1150	1450	C0200E2B	C0200E2BFB	3,9	1
250	1400	1900	2300	C0250E2B	C0250E2BFB	4,5	1
300	1900	2700	3850	C0300E2B	C0300E2BFB	5,1	1
350	3100	3650	4800	C0350E2B	C0350E2BFB	6,2	1
500	4000	5300	7000	C0500E2B	C0500E2BFB	8,7	1
750	8300	11000	14000	C0750E2B	C0750E2BFB	12,8	1

1) Transformers with fuse holders on primary side, the weight increase with 0,1 kg

Transformer 240x480 V primary, 120x240 V secondary, IP 00

Rated power VA	Inrush capacity, VA at 20% cos-φ max voltage drop on secondary side % of rated voltage			Catalogue numbers		Weight kg/each ¹⁾	Packing size
	95%	80%	85%	Transformer without fuse holder, primary side	Transformer with fuse holder, primary side		
50	170	200	240	C0050E2CXX		1,2	1
75	310	410	450	C0075E2CXX		1,6	1
100	370	540	730	C0100E2CXX		1,9	1
150	780	930	1150	C0150E2CXX		3,1	1
200	810	1150	1450	C0200E2CXX		3,9	1
250	1400	1900	2300	C0250E2CXX		4,6	1
300	1900	2700	3850	C0300E2CXX		5,4	1
350	3100	3650	4800	C0350E2CXX		6,2	1
500	4000	5300	7000	C0500E2CXX		8	1
750	8300	11000	14000	C0750E2CXX		12	1

Transformer with clips for secondary fuse, 230/460/575 V primary, 95/115 V secondary, IP 00

Rated power VA	Inrush capacity, VA at 20% cos-φ max voltage drop on secondary side % of rated voltage			Catalogue numbers		Weight kg/each ¹⁾	Packing size
	95%	80%	85%	Transformer without fuse holder, primary side	Transformer with fuse holder, primary side		
50	170	200	240	C0050E3C	C0050E3CFB	1,6	1
75	310	410	450	C0075E3C	C0075E3CFB	2	1
100	370	540	730	C0100E3C	C0100E3CFB	2,7	1
150	780	930	1150	C0150E3C	C0150E3CFB	3,5	1
200	810	1150	1450	C0200E3C	C0200E3CFB	4,1	1
250	1400	1900	2300	C0250E3C	C0250E3CFB	4,4	1
300	1900	2700	3850	C0300E3C	C0300E3CFB	5,3	1
350	3100	3650	4800	C0350E3C	C0350E3CFB	7,5	1
500	4000	5300	7000	C0500E3C	C0500E3CFB	9,8	1
750	8300	11000	14000	C0750E3C	C0750E3CFB	12,7	1

Transformer with clips for secondary fuse, 600 V primary, 24 V secondary, IP 00

Rated power VA	Inrush capacity, VA at 20% cos-φ max voltage drop on secondary side % of rated voltage			Catalogue numbers		Weight kg/each ¹⁾	Packing size
	95%	80%	85%	Transformer without fuse holder, primary side	Transformer with fuse holder, primary side		
50	170	200	240	C0050E4W	C0050E4WFB	1,1	1
75	310	410	450	C0075E4W	C0075E4WFB	1,6	1
100	370	540	730	C0100E4W	C0100E4WFB	1,8	1
150	780	930	1150	C0150E4W	C0150E4WFB	3	1
200	810	1150	1450	C0200E4W	C0200E4WFB	3,7	1
250	1400	1900	2300	C0250E4W	C0250E4WFB	4,5	1
300	1900	2700	3850	C0300E4W		5	1
350	3100	3650	4800	C0350E4W		6,2	1
500	4000	5300	7000	C0500E4W		8	1
750	8300	11000	14000	C0750E4WXX ²⁾		12,7	1

Terminal covers for MTE transformers

Description	Catalogue number	Weight kg/each	Packing size
Terminal covers, primary and secondary side, 50-350V A, IP 20	FSK4	0,05	1
Terminal covers, primary and secondary side, 500-1500 VA, IP 20	FSK6	0,07	1
Covers for primary fuses, transformers with fuse holders on primary side ³⁾	CBSAMI-7N	0,015	1

1) Transformers with fuse holders on primary side, the weight increase with 0,1 kg

2) Clips for secondary fuse not included

3) Order 2 pcs for each transformer, the cover is fixed onto the fuse. UR guide JDVS file E58836, CSA class 6225-01 file LR47235

Control power transformers

Type MTK

Technical data



Design	Epoxy encapsulated windings
Frequency	50/60 Hz
Insulation system	180° (135°C temperature rise)
Terminals, primary	Screw with pressure plate
Terminals, secondary	≤2000 VA: screw with pressure plate, others: with cable lug
Ingress protection, IEC 60529	IP 00
Standards	ANSI/NEMA ST1, UL 5085
Approval	cUL listed guide XPTQ, file E10156
Certificate	RoHS

Transformer 240x480 V primary, 120 V secondary, IP 00

Rated power VA	Inrush capacity, VA at 20% cos-φ max voltage drop on secondary side % of rated voltage			Beställningsnummer	Vikt/st kg	Förp. storlek
	95%	80%	85%			
1000	9000	13000	18500	C1000K2A	13,6	1
1500	10500	15000	20500	C1500K2A	13,8	1
2000	17000	25500	34000	C2000K2A	17,3	1
3000	24000	36000	47500	C3000K2A	24,1	1
5000	55000	92500	115000	C5000K2A	40,5	1

Transformer 240x480 V primary, 120x240 V secondary, IP 00

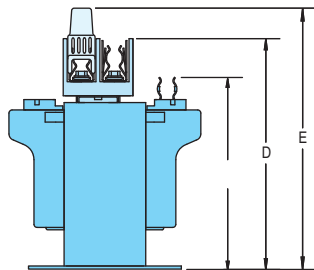
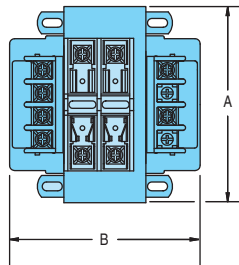
1000	9000	13000	18500	C1000K2CXX	12	1
1500	10500	15000	20500	C1500K2CXX	14,1	1
2000	17000	25500	34000	C2000K2CXX	18,2	1
3000	24000	36000	47500	C3000K2CXX	25,5	1
5000	55000	92500	115000	C5000K2CXX	42	1

Transformer 230/460/575 V primary, 95/115 V secondary, IP 00

1000	9000	13000	18500	C1000K3C	13,3	1
1500	10500	15000	20500	C1500K3C	15,2	1
2000	17000	25500	34000	C2000K3C	19,3	1
3000	24000	36000	47500	C3000K3C	29	1
5000	55000	92500	115000	C5000K3C	46,4	1

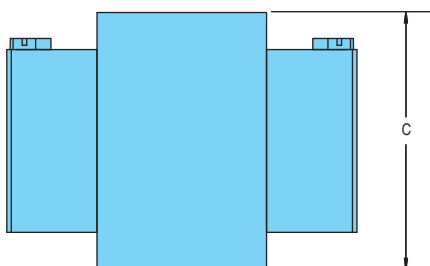
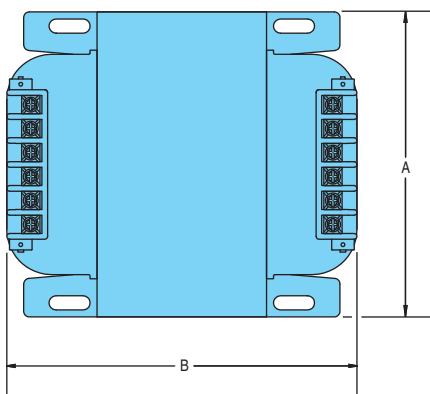
Dimensions Type MTE and MTK

Dimensions, type MTE



Rated power, VA	Dimensions, mm									
	A ¹⁾	B	C	D	E ²⁾	A ¹⁾	B	C	D	E ²⁾
240x480 to 120 V and 240x480 to 24 V						240x480 to 120x240 V				
50	76/98	96	79	102	125	76	96	69		
75	76/98	102	80	102	125	76	102	69		
100	86/98	102	88	111	134	86	102	73		
150	95/98	102	96	118	141	95	102	85		
200	114	111	112	134	157	114	111	101		
250	114	111	112	134	157	114	111	101		
300	114	121	112	134	157	114	121	101		
350	114	121	112	134	157	114	121	101		
500	133	155	131	151	134	133	155	118		
750	133	193	131	148	171	133	193	118		
1000	171	155	160	183	206					
1500	191	191	160	196	199					
230/460/575 to 95/115 V						600 to 24 V				
50	76/98	82	79	102	125	76/98	86	65	100	123
75	86/98	88	87	111	134	76/98	92	73	98	121
100	86/98	101	87	110	133	86/98	86	80	110	133
150	95/98	116	92	118	141	95/98	102	89	114	137
200	114	111	104	130	153	114	102	105	134	157
250	114	111	105	134	157	114	111	106	134	157
300	114	131	108	134	157	114	121	106		
350	133	126	114	151	174	114	133	105		
500	133	149	125	150	173	133	137	116		
750	133	184	122							

Dimensions, type MTK



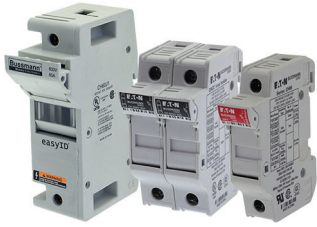
240x480 to 120 V			240x480 to 120x240 V		
1000	200	133	114	200	133
1500	172	173	146	172	173
2000	171	197	146	171	197
3000	229	210	194	229	210
5000	229	229	191	229	229
230/460/575 to 95/115 V					
1000	162	178	138		
1500	171	197	146		
2000	229	182	191		
3000	229	219	194		
5000	229	278	191		

1) Second digit is valid for MTE transformer with cover type CBSAMI-7N installed
2) MTE transformer with cover type CBSAMI-7N installed

Eaton Bussmann Series fuse disconnectors

For use with control power transformers without built-in fuse holders

Technical data

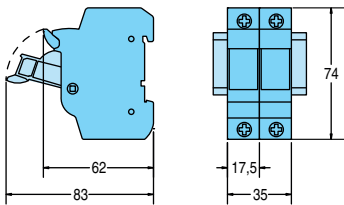


Rated voltage	600 V
Short circuit current, SCCR	Class CC/J: 200 kA, Midget 10 kA with fuse type CBFNM installed
Indicator tripped fuse	Lamp indicator, neon lamp 90-600 VAC
Ingress prot. IEC 60529	IP 20
Standards	UL 4248/4248-4/ UL4848-8, CSA 22.2 No 248
Approvals	Class CC/J: UL listed guide IZLT file E14853, CSA class 6225-01 file 47235 Midget: cUR gude IZLT2 file E14853
Certificate	CE, RoHS

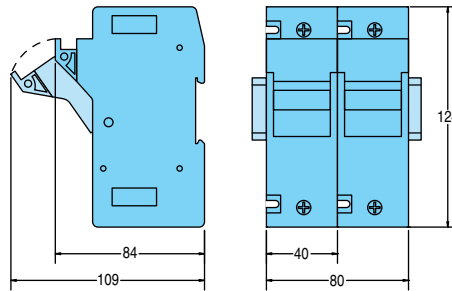
Fuse disconnectors

Fuse type	No. of poles	Rated current, A	Catalogue number - fuse disconnecter		Weight g/pole	Packing size
			without lamp indicator	with lamp indicator		
Class CC	1 pole	30	CBCHCC1DU	CBCHCC1DIU	53	1
Class CC	2 pole	30	CBCHCC2DU	CBCHCC2DIU	106	1
Midget	1 pole	30	CBCHM1DU	CBCHM1DIU	53	1
Midget	2 pole	30	CBCHM2DU	CBCHM2DIU	106	1
Class J	1 pole	60	CBCH60J1	CBCH60J1I	257	1
Class J	2 pole	60	CBCH60J2	CBCH60J2I	514	1

Dimensions, mm



Class CC/Midget, 30 A



Class J. 60 A

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