

# Contactors – General Purpose and Definite Purpose

A rugged and comprehensive range of contactors from 5 to 900 HP



Sprecher+Schuh IEC contactors are designed and manufactured in plants that are quality certified to international standard ISO 9001

Sprecher + Schuh's broad line of general purpose contactors combine performance and reliability in space saving designs that are well proven and used the world over. Sprecher + Schuh's IEC design is dimensionally among the smallest devices in the industry. A range of definite purpose contactors is also available, providing reliable and economic performance in commercial applications.

## Economy and selection

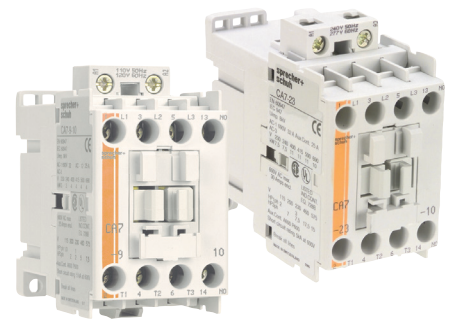
Four different contactor families provide a wide variety of contactor sizes, one for practically every horsepower increment! The ability to select intermediate sizes assures a closer match for your motor and provides economy not found with traditionally sized devices. Definite purpose contactors are available in one, two, three and four pole, up to 90A.

## Precisely match the contactor to the application

Unique to IEC-style contactors is the ability to select the exact device required for a specific application. By identifying the conditions under which the contactor will be used, i.e., resistive loads, reversing, inching and plugging, etc., published "life-curve" data predicts contact life in millions of operations. This information enables you to select the precise contactor for your application... without buying too much or too little.

## Designed for long life

Destructive electrical arcs are common when opening or "breaking" the contacts of larger contactors. Sprecher + Schuh general purpose contactors are designed to dramatically reduce electrical arcing by quickly guiding the arc off of the contacts and into specially designed "arc chutes." This special design divides and eliminates the electrical arcs quickly, significantly increasing contact life and assuring reliable operation.



## Limitless choices

A comprehensive selection of modular accessories is available for all contactor families, which allows infinite contactor and starter combinations, both open and enclosed.

## Safety in mind...

Virtually all Sprecher + Schuh contactors are designed to be safe from accidental contact with the finger or back-of-hand. On the smaller contactors, terminals and set screws are recessed, while larger devices (up to Series CA9) accept terminal covers that provide protection according to VDE 0106, Part 100.

## Manufactured to rigorous quality standards

Sprecher + Schuh contactors are designed and manufactured in plants that maintain quality certification to the rigorous international standards, ISO 9001. Sprecher + Schuh manufacturing facilities renew ISO certification every three years by passing an exacting quality assurance audit.

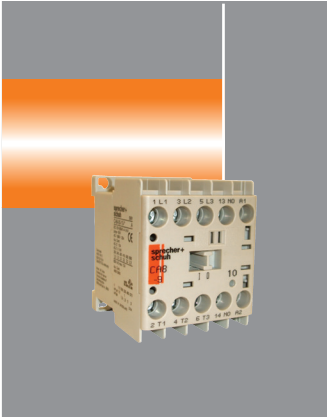
## International standards and approvals

All Sprecher+Schuh IEC contactors are cULus CSA Approved, along with several other certifications. They also carry the CE Mark and meet IEC 60947-1 requirements. They are approved in virtually every international market.

7.5HP 50HP

75HP

900HP



### CA8 Series Contactor

- Provides commercial-grade performance for motors up to 7.5 HP
- Features low-profile design and 45mm width
- Maintains narrow width with modular, snap-on accessories
- Performs up to 700,000 electrical and 15,000,000 mechanical operations



### CA7 Series Contactor

- Covers up to 75HP industrial applications
- Features small dimensions, as little as 45mm wide
- Uses interchangeable accessories for all contactor sizes
- Provides flexibility with reversible coils for group installation
- Has dual-cage clamp lugs on CA7-30 and larger units
- Designed and tested with respect to Type 1 and 2 Coordination



### CA9 Series Contactor

- Covers up to 900HP industrial applications
- Provides a dimensional advantage with a smaller size and footprint
- Features a universal electronic AC/DC coil
- Has various application selections, with IEC solutions up to 2650A
- Includes expanded certifications
- Provides extended life with arc quenching technology



### CDP2 Definite Purpose Contactors

- Covers commercial applications up to 90A / 50HP
- Available in one, two, three and four pole
- Meet or exceed electrical and mechanical requirements defined by definite purpose contactor standards
- Three convenient wire connection methods

Horsepower	AC Induction Motors						
	Single Phase		Three Phase				
	115 Volt	230 Volt	200 Volt	230 Volt	380-415 Volt	460 Volt	575 Volt
	@ 60 HZ	@ 60 HZ	@ 60 HZ	@ 60 HZ	@ 50 HZ	@ 60 HZ	@ 60 HZ
1/6	4.4	2.2	~	~		~	~
1/4	5.8	2.9	~	~		~	~
1/3	7.2	3.6	~	~		~	~
1/2	9.8	4.9	2.5	2.2	1.3	1.1	0.9
3/4	13.8	6.9	3.7	3.2	1.8	1.6	1.3
1	16.0	8.0	4.8	4.2	2.3	2.1	1.7
1 1/2	20.0	10.0	6.9	6.0	3.3	3.0	2.4
2	24.0	12.0	7.8	6.8	4.3	3.4	2.7
3	34.0	17.0	11.0	9.6	6.1	4.8	3.9
5	56.0	28.0	17.5	15.2	9.7	7.6	6.1
7 1/2	80.0	40.0	25.3	22.0	14.0	11.0	9.0
10	100	50.0	32.2	28.0	18.0	14.0	11.0
15	135	68.0	48.3	42.0	27.0	21.0	17.0
20	~	88.0	62.1	54.0	34.0	27.0	22.0
25	~	110	78.2	68.0	44.0	34.0	27.0
30	~	136	92.0	80.0	51.0	40.0	32.0
40	~	176	120	104	66.0	52.0	41.0
50	~	216	150	130	83.0	65.0	52.0
60	~	~	177	154	103	77.0	62.0
75	~	~	221	192	128	96.0	77.0
100	~	~	285	248	165	124	99.0
125	~	~	359	312	208	156	125
150	~	~	414	360	240	180	144
175	~	~	475	413	275	207	168
200	~	~	552	480	320	240	192
250	~	~	692	604	403	302	242
300	~	~	~	722	482	361	289
350	~	~	~	828	560	414	336
400	~	~	~	954	636	477	382
450	~	~	~	1030	711	515	412
500	~	~	~	1180	786	590	472

The information in this chart was derived from Table 50.1 of UL standard 508A. The voltages listed are rated motor voltages. The currents listed shall be permitted for system voltage ranges of 110-120, 220-240, 380-415, 440-480 and 550-600 volts.

The full-load current values are for motors running at usual speeds and motors with normal torque characteristics. Motors built for especially low speeds or high torques may have higher full-load currents, and

multi-speed motors will have full-load currents varying with speed. In these cases, the nameplate current ratings shall be used.

Caution: The actual motor amps may be higher or lower than the average values listed above. For more reliable motor protection, use the actual motor current as listed on the motor nameplate. Use this table as a guide only.

**UL / CSA Maximum HP Rating Selection ①**

Sprecher + Schuh Contactor Series	Maximum Horsepower					
	Single Phase		Three Phase			
	115 Volt	230 Volt	200 Volt	230 Volt	460 Volt	575 Volt
CA7-9	1/2	1 1/2	2	2	5	7-1/2
CA7-12	1/2	2	3	3	7-1/2	10
CA7-16	1	3	5	5	10	15
CA7-23	2	3	5	7-1/2	15	15
CA7-30	2	5	7-1/2	10	20	25
CA7-37	3	5	10	10	25	30
CA7-43	3	7-1/2	10	15	30	30
CA7-55	5	10	15	20	40	40
CA7-60	5	10	15	20	40	50
CA7-72	5	15	20	25	50	60
CA7-85	7-1/2	15	25	30	60	60
CA7-97	10	20	30	30	75	75
CA9-116(-EI)	~	~	30	40	75	100
CA9-146(-EI)	~	~	40	50	100	125
CA9-190(-EI)	~	~	50	60	105	150
CA9-205(-EI)	~	~	60	75	150	200
CA9-265(-EI)	~	~	75	100	200	250
CA9-305(-EI)	~	~	100	125	250	300
CA9-370(-EI)	~	~	125	150	300	350
CA9-400-EI	~	~	125	150	300	400
CA9-460-EI	~	~	150	200	400	500
CA9-580-EI	~	~	200	250	500	600
CA9-750-EI	~	~	~	300	600	700
CA9-860-EI	~	~	~	400	800	1000
CA9-1060-EI	~	~	~	450	900	1150

**NEMA Size Labeled Selection**

NEMA Size	Sprecher + Schuh Contactor Series	Maximum Horsepower					
		Single Phase		Three Phase			
		115V	230V	200V	230V	460V	575V
00	CAN7-12	1/3	1	1-1/2	1-1/2	2	2
0	CAN7-16	1	2	3	3	5	5
1	CAN7-37	2	3	7-1/2	7-1/2	10	10
2	CAN7-43	3	7-1/2	10	15	25	25
3	CAN7-85	7-1/2	15	25	30	50	50

① "EI" designation indicates coil has electronic interface capability with a PLC.

**DC Motor Ratings**

Table 50.2  
Full-load motor-running currents in amperes corresponding to various DC horsepower ratings  
Table 50.2 effective April 25, 2003

Horsepower	90 Volts	110-120 Volts	180 Volts	220-240 Volts	500 Volts	550-600 Volts
1/10	~	2.0	~	1.0	~	~
1/8	~	2.2	~	1.1	~	~
1/6	~	2.4	~	1.2	~	~
1/4	4.0	3.1	2.0	1.6	~	~
1/3	5.2	4.1	2.6	2.0	~	~
1/2	6.8	5.4	3.4	2.7	~	~
3/4	9.6	7.6	4.8	3.8	~	1.6
1	12.2	9.5	6.1	4.7	~	2.0
1-1/2	~	13.2	8.3	6.6	~	2.7
2	~	17	10.8	8.5	~	3.6
3	~	25	16	12.2	~	5.2
5	~	40	27	20	~	8.3
7-1/2	~	58	~	29	13.6	12.2
10	~	76	~	38	18	16
15	~	110	~	55	27	24
20	~	148	~	72	34	31

**Table 139.1 – Rating Codes for AC Control-Circuit Contacts at 50 and 60 Hz ④**

Contact Rating Code Designation ①	Thermal continuous test current Amperes	Maximum current, amperes ②								Maximum volt-Amperes	
		120 Volt		240 Volt		480 Volt		600 Volt			
		Make	Break	Make	Break	Make	Break	Make	Break	Make	Break
A150	10	60	6.00	~	~	~	~	~	~	7200	720
A300	10	60	6.00	30	3.00	~	~	~	~	7200	720
A600	10	60	6.00	30	3.00	15	1.50	12	1.20	7200	720
B150	5	30	3.00	~	~	~	~	~	~	3600	360
B300	5	30	3.00	15	1.50	~	~	~	~	3600	360
B600	5	30	3.00	15	1.50	7.50	0.75	6	0.60	3600	360
C150	2.5	15	1.5	~	~	~	~	~	~	1800	180
C300	2.5	15	1.5	7.5	0.75	~	~	~	~	1800	180
C600	2.5	15	1.5	7.5	0.75	3.75	0.375	3.00	0.30	1800	180
D150	1.0	3.60	0.60	~	~	~	~	~	~	432	72
D300	1.0	3.60	0.60	1.80	0.30	~	~	~	~	432	72
E150	0.5	1.80	0.30	~	~	~	~	~	~	216	36

**Table 139.2 – Rating Codes for DC Control-Circuit Contacts ④**

Contact Rating Code Designation ①	Thermal continuous test current Amperes	Maximum make or break current, Amperes ③			Maximum make or break volt-Amperes at 300 volts or less
		125 Volt	250 Volt	301 to 600 Volt	
N150	10	2.2	~	~	275
N300	10	2.2	1.1	~	275
N600	10	2.2	1.1	0.40	275
P150	5.0	1.1	~	~	138
P300	5.0	1.1	0.55	~	138
P600	5.0	1.1	0.55	0.20	138
Q150	2.5	0.55	~	~	69
Q300	2.5	0.55	0.27	~	69
Q600	2.5	0.55	0.27	0.10	69
R150	1.0	0.22	~	~	28
R300	1.0	0.22	0.11	~	28

- ① The numerical suffix designates the maximum voltage design values, which are to be 600, 300, and 150 volts for suffixes 600, 300, and 150 respectively. Test voltage shall be 600, 250, or 125 volts.
- ② For maximum ratings at voltages between the maximum design value and 120 volts, the maximum make and break ratings are to be obtained by dividing the volt-amperes rating by the application voltage. For voltages below 120 volts, the maximum make current is to be the same as for 120 volts, and the maximum break current is to be obtained by dividing the break volt-amperes by the application voltage, but these currents are not to exceed the thermal continuous test current.
- ③ For maximum ratings at 300 volts or less, the maximum make and break ratings are to be obtained by dividing the volt-ampere rating by the application voltage, but the current values are not to exceed the thermal continuous test current.
- ④ Data tables extracted from UL508 Standards for Industrial Control Equipment.

**Predicting Electrical Life**

Sprecher + Schuh contactors are designed for superior performance in a wide variety of applications, by giving consideration to the specific load, utilization category and required electrical life, you can purchase exactly the type and size of

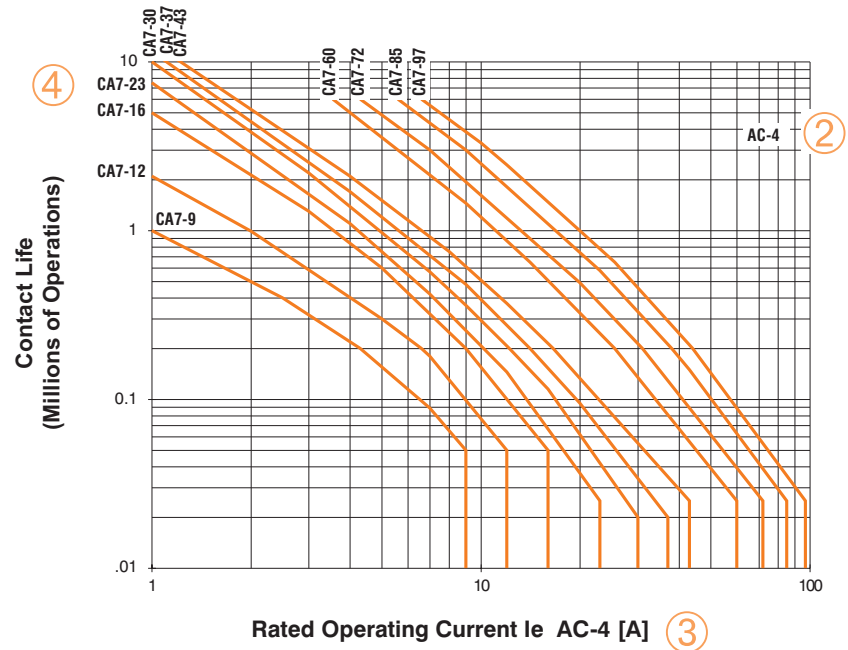
contactor required. This assures reliable operation and high value the ability to very closely match the contactor to the application.

- ① Identify the appropriate utilization category. For this example, we will determine CA7 contact life for inching and plugging squirrel-cage motors. ❶

Utilization Category	Definition	
AC-1	Resistance Furnaces	Non inductive or slightly inductive loads, Resistive Furnaces
AC-2	Slip-ring motors	Starting and stopping of running motors
AC-3	Squirrel-cage motors	Starting and stopping of running motors
AC-4	Squirrel-cage motors	Starting, plugging, and inching (Plugging is understood as stopping or reversing the motor rapidly by reversing the motor primary connections while the motor is running. Inching [or jogging] is understood as energizing a motor once or repeatedly for short periods to obtain small movements of the driven mechanism.)
AC-15	Electromagnets	Electromagnets for contactors, valves, solenoid actuators

Squirrel-cage motors: starting, plugging, inching Ue = 230...460 VAC

- ② Choose the graph for the utilization category selected. (a graph pertaining to most Utilization Categories can be found in each contactor section.)
- ③ Locate the Rated Operational Current (Ie) along the bottom of the chart and follow the graph lines up to the intersection of the appropriate contactor's life-load curve.
- ④ Read the estimated contact life along the vertical axis. ❷



- ❶ A comprehensive list of Utilization Categories can be found in each contactor section, however, these are the primary categories used in most industrial motor applications.
- ❷ The life-load curves shown here are based on Sprecher+Schuh tests according to the requirements defined in IEC 60947-4-1. Since contact life in a given application is dependent on environmental conditions and duty cycle, actual application contact life may vary from that indicated by the curves shown here.

**Determining Contact Life**

To determine the contactor's estimated electrical life, follow these guidelines:

1. Identify the appropriate Utilization Category from Table A.
2. In the technical pages for each contactor size, choose the graph for the Utilization Category selected.
3. Locate the Rated Operational Current ( $I_e$ ) along the bottom of the chart and follow the graph lines up to the intersection of the appropriate contactor's life-load curve.
4. Read the estimated contact life along the vertical axis.

**Table A – IEC Special Utilization Categories, AC Ratings ①**

	Cat-egory	Typical Applications	Conditions for testing electrical life						Ops.	Conditions for testing making and breaking capacity						Ops.							
			Make			Break				Make			Break										
			I/le	U/ue	cos	Ic/Ie	Ur/Ue	cos		I/le	U/ue	cos	Ic/Ie	U/ue	cos								
<b>CONTACTORS</b>	<b>AC-1</b>	Non-inductive or slightly inductive loads; resistance furnaces	All values			1	1	0.95	1	1	0.95	6000	1.5	1.05	0.8	1.5	1.05	0.8	50				
	<b>AC-2</b>	Slip-ring motors: Starting, plugging	All values			2	1.05	0.65	2	1.05	0.65	6000	4	1.05	0.65	4	1.05	0.65	50				
	<b>AC-3</b>	Slip-ring motors: Starting, switching off motors during running	Ie 17Amp 17Amp < Ie 100Amp Ie > 100Amp	6	1	0.65	6	1	0.35	1	0.17	0.65	1	0.17	0.35	6000	10	1.1	0.65	8	1.1	0.35	50
	<b>AC-4</b>	Squirrel-cage motors: Starting, plugging, inching ⑤	Ie 17Amp 17Amp < Ie 100Amp Ie > 100Amp	6	1	0.65	6	1	0.35	6	1	0.65	6	1	0.35	6000	12	1.1	0.65	10	1.1	0.35	50
	<b>AC-5a</b>	Switching of electric discharge lamp control		2	1.05	0.45	2	1.05	0.45	2	1.05	0.45	6000	3	1.05	0.45	3	1.05	0.45	50			
	<b>AC-5b</b>	Switching of incandescent lamps		1	1.05		1	1.05		1	1.05		6000	1.5	1.05		1.5	1.05		50			
	<b>AC-6a</b>	Switching of transformers												Rating derived from AC-3 rating (x 0.45)									
	<b>AC-6b</b>	Switching of capacity banks												Depends on circuit conditions of application									
	<b>AC-12</b>	Control of resistive loads and solid state loads with isolation by opto couplers	All values	1	1	0.9	1	1	0.9	1	1	0.9	6050										
	<b>CONTROL DEVICES</b>	<b>AC-13</b>	Control of solid state loads with transformer isolation		2	1	0.65	1	1	0.65	1	1	0.65	6050	10	1.1	0.65	1.1	1.1	0.65	10		
<b>AC-14</b>		Control of small electromagnetic loads	72 VA	6	1	0.3	1	1	0.3	1	1	0.3	6050	6	1.1	0.7	6	1.1	0.7	10			
<b>AC-15</b>		Control of electromagnetic loads	72 VA	10	1	0.3	1	1	0.3	1	1	0.3	6050	10	1.1	0.3	10	1.1	0.3	10			
<b>AC-20</b>		Connecting and disconnecting under no load conditions		No testing required																			
<b>AC-21</b>		Switching or resistive loads, including moderate overloads	All values	1	1	0.95	1	1	0.95	1	1	0.95	10000	1.5	1.05	0.95	1.5	1.05	0.95	5			
<b>SWITCHES</b>	<b>AC-22</b>	Switching of mixed resistive & inductive loads, including moderate overloads	All values	1	1	0.8	1	1	0.8	1	1	0.8	10000	3	1.05	0.65	3	1.05	0.65	5			
	<b>AC-23</b>	Switching of motor loads or other highly inductive loads	All values	1	1	0.65	1	1	0.65	1	1	0.65	10000	10	1.05	0.45	8	1.05	0.45	5			

<b>Legend</b>	
<b>Ue</b>	Rated operational voltage
<b>U</b>	Voltage before make
<b>Ur</b>	Recovery voltage
<b>Ie</b>	Rated operational current
<b>I</b>	Making current
<b>Ic</b>	Breaking current
<b>L</b>	Inductance of test circuit
<b>R</b>	Resistance of test circuit

- ① Utilization categories and test conditions for AC & DC. For contactors according to IEC 158-1, starters according to IEC 292-1 ... 4 and control switches according to IEC 337-1 and IEC 337-1A.
- ② With a minimum value of 1000A for I or Ic.
- ③ With a minimum value of 800A for Ic.
- ④ With a minimum value of 1200A for I.
- ⑤ Plugging is understood as stopping or reversing the motor rapidly by reversing the motor primary connections while the motor is running. Inching [or jogging] is understood as energizing a motor once or repeatedly for short periods to obtain small movements of the driven mechanism.



**Determining Contact Life**

To determine the contactor's estimated electrical life, follow these guidelines:

1. Identify the appropriate Utilization Category from Table A.
2. In the technical pages for each contactor size, choose the graph for the Utilization Category selected.
3. Locate the Rated Operational Current ( $I_e$ ) along the bottom of the chart and follow the graph lines up to the intersection of the appropriate contactor's life-load curve.
4. Read the estimated contact life along the vertical axis.

**Table A – IEC Special Utilization Categories, DC Ratings ①**

Category	Typical Applications	Rated Current	Conditions for testing electrical life						Ops.	Conditions for testing making and breaking capacity						Ops.
			Make			Break				Make			Break			
			I/le	U/ue	cos	Ic/le	Ur/ue	cos		I/le	U/ue	cos	Ic/le	U/ue	cos	
<b>DC-1</b>	Non-inductive or slightly inductive loads, resistance furnaces	All Values	1	1	1	1	1	1		1.5 ②	1.1 ②	1 ②	1.5 ②	1.1 ②	1 ②	
<b>DC-2</b>	Shunt-motors: Starting, switching off motors during running	All Values	2.5	1	2	1	0.1	7.5		4	1.1	2.5	4	1.1	2.5	
<b>DC-3</b>	Shunt motors: Starting, plugging, inching	All Values	2.5	1	2	2.5	1	2		4	1.1	2.5	4	1.1	2.5	
<b>DC-4</b>	Series-motors: Starting, switching off motors during running	All Values	2.5	1	7.5	1	0.3	10		4	1.1	15	4	1.1	15	
<b>DC-5</b>	Series-motors: Starting, plugging, inching	All Values	2.5	1	7.5	2.5	1	7.5		4	1.1	15	4	1.1	15	
<b>DC-15</b>	Electromagnets for contactors, valves, solenoid actuators	All Values	1	1	6 x P ③	1	1	6 x P ③		1.1	1.1	6 x P ③	1.1	1.1	6 x P ③	

**CA7 Contactors for Elevator Duty Minimum Operational Life**

Contactor	Cycles
CA7-9	500,000 ④⑤
CA7-12	
CA7-16	
CA7-23	
CA7-30	
CA7-37	
CA7-43	
CA7-55	
CA7-60	
CA7-72	
CA7-85	
CA7-97	

**CNX Special Purpose Contactor Minimum Operational Life in Resistive Applications**

Contactor	Cycles
CNX-205	250,000 ④
CNX-205	
CNX-206	
CNX-207	
CNX-208	
CNX-209	100,000 ④
CNX-212	
CNX-218	

Legend	
<b>Ue</b>	Rated operational voltage
<b>U</b>	Voltage before make
<b>Ur</b>	Recovery voltage
<b>Ie</b>	Rated operational current
<b>I</b>	Making current
<b>Ic</b>	Breaking current
<b>L</b>	Inductance of test circuit
<b>R</b>	Resistance of test circuit

① Utilization categories and test conditions for AC & DC. For contactors according to IEC 158-1, starters according to IEC 292-1 ... 4 and control switches according to IEC 337-1 and IEC 337-1A.

② Only according to VDE.

③ P = Ue x Ie rated power [W]. The value "6 x P" has been derived from an empiric relationship which covers most magnetic loads for DC up to an upper limit of P = 50W.

④ Life data shown are the minimum test requirements per UL/CSA. Actual life in application may exceed these values.

⑤ Value pending on 55A and 97A contactors at time of this printing.

**Contactors Catalog Numbers**

Sprecher+Schuh employs a catalog number coding system for contactors (and many other devices) that follows a logical pattern, where every digit signifies a specific device attribute. Where indicated, the use of dashes (–) serves to separate device characteristics and should always be used when ordering.

The following example illustrates all of the possible combina-

tions when specifying contactors and reversing contactors (open type only). See Section C for an explanation of the catalog number coding system for enclosed contactors and starters.



Configuration	
CA	Contactors
CAU	Reversing Contactors
CAN	NEMA Labeled Contactors
CA(V)L	Lighting Contactors
CNX	Special Purpose Contactors
CA_Y2	Elevator Wye-Delta

Contactors Series	
<u>Series CA8</u>	<u>Series CA9</u> ②
8-09(C)	9-116(-EI)
8-12(C)	9-146(-EI)
	9-190(-EI)
<u>Series CA7</u> ①	9-205(-EI)
7-9(E)	9-265(-EI)
7-12(E)	9-305(-EI)
7-16(E)	9-365(-EI)
7-23(E)	9-400-EI
7-30(E)	9-460-EI
7-37(E)	9-580-EI
7-40(E)	9-750-EI
7-43(E)	9-860-EI
7-55(E)	9-1060-EI
7-60(D)	9-1260-EI
7-72(D)	9-2050-EI
7-85(D)	9-2650-EI
7-90(D)	
7-97(D)	

Auxiliary Contacts	
-10	N.O. Auxiliary
-01	N.C. Auxiliary
-11	N.O. & N.C. Auxiliary
-02	2 N.C. Auxiliaries
-22	2 N.O. & 2 N.C. Aux.
-00	No Auxiliaries
<b>4-pole CA7 &amp; CA8 Contactors</b> ③	
-M40	4 N.O. Power Poles
-M31	3 N.O. Power Poles/ 1 N.C. Power Pole
-M22	2 N.O. Power Poles/ 2 N.C. Power Poles

Coil Code	
<u>AC</u>	<u>DC</u>
24Z	12E
120	24E, 24DD
220W	24W
277	36E
415	48E
480	110E, 110DD
600	220E
	<u>AC/DC</u>
	24W
	48W
	120W
	480W

**This illustration is for reference only.  
Turn to the appropriate page to determine  
specific catalog number.**

① (D) and (E) suffix designates DC contactors.  
 ② (-EI) suffix indicates electronic coil. Optional on CA9-116...365, standard on CA9-400...2650.  
 ③ On four pole contactors, this number designates main power pole configuration.

**A**

**Notes**

**Contactors**

Lined area for notes.