CONTACTORS


220V 50/60Hz
K5
A1
A2
1 L1
3 L2
5 L3
21 NC
FC
32D01
01
FEDERAL
22 NC
2 T1
4 T2
6 T3

Power Contactors

FC06M
FC09M

FC09D
FC12D
FC18D

FC25D
FC32D

FC40D
FC50D
FC65D

FC80D
FC95D

FC115D
FC150D

FC220D
FC260D
FC300D

FC400D
FC475D
FC580D
FC650D
FC750D

Contactors for Capacitor Switching

FC12DK
5 kVAr

FC18DK
10 kVAr

FC25DK
15 kVAr

FC32DK
20 kVAr

FC65DK
30 kVAr

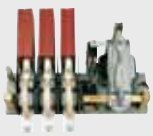
FC95DK
50 kVAr

FC150DK
70 kVAr

Thyristor Switching Contactors

FCT15K - FCT30K - FCT50K

High Current Contactors



EC300 ... EC2500

CONTENT

TS EN 60947-4-1
IEC 60947-4-1
EN 60947-4-1
CE

Assembly position : Front face downwards
Altitude : 2000 m (max)
Relative Humidity : 50% (40°C) , 90% (20°C)
Ambient Temperature : between -5°C and +40°C
Pollution Degree : III

Contactors allow remote-control of electrical facilities such as compensation, heating etc. and in particular, electrical motors via a cable. When they are used with thermal relays, they protect devices and facilities against overload currents. Federal contactors are manufactured in accordance with international IEC 60947-4-1, TS EN60947-4-1 standards and CE. Coil and auxiliary contact blocks can be easily mounted and demounted with primary and auxiliary contacts. FC-type contacts have three-end coil. In this way, connection flexibility is provided. Coils of the contactors can be controlled safety between 0.8 and 1.1 times more of rated coil voltage. They operate with full efficiency between ambient temperatures of -5°C and +55°C. Contactors' capability of being assembled on rail provides great ease during installation. They can resist 1000V voltage in terms of their material composition.

Major features of the contactor:
1- The contactor should bear high current values without being subject to any corruption or boiling. This depends on quality of contactors (contact surface technology and resource technology). Contactor selection is very important especially in AC-3 class and capacitor control.
2- While the contractor is closed, the current flowing over the contacts causes heating. This heating is limited in standards. According to IEC 60947-4-1, when continuous thermal current (Ith) passes through primary contacts for 8 hours, maximum heat increase in contactor terminals should not exceed 65K.
3- When the contactor breaks the current, it forms an electrical arc between separating contacts. The arc is the electron and ion current detaching from the contact material as a result of thermal impact. Arc temperature reaches thousands of degrees and this is higher than the temperature born by metals and conductors used in manufacture of breaking cells and contacts. Therefore, arc should be terminated as soon as possible. For this purpose, separators are used in contactors.

Acceptable continuous thermal current Ith:
Acceptable thermal current is the highest value of the test current to be used in heat increase test to be carried out in accordance with IEC 60947-4-1. This test is based on applying current to contact terminals through PVC-insulated copper conductors for 8 hours. In this case, heat change in contactor terminals should not exceed (ΔQ) 65 K.

Closing capacity:
The closing capacity is the current value, which the contactor can successfully close without any damage in contacts. Power factor and frequency of closing are factors affecting the closing capacity. In IEC60947-4-1, for AC3 utilization class; if Ie is the maximum motor operating current; the closing capacity should be 10 x Ie.

Breaking capacity:
The breaking capacity is the current value, which the contactor can successfully break without any damage in contacts and arc extinction cells. As the voltage value increases, the breaking capacity decreases. In IEC60947-4-1, for AC3 utilization class; if Ie is the maximum motor operating current; the closing capacity should be 8 x Ie.

Mechanical life:
Maximum number of openings + closings, which can be performed without any maintenance operation by supplying the coil only without passing any current through main poles of the contactor, determines mechanical resistance of the contactor.

Electrical life:
Electrical resistance is the maximum number of openings + closings without any maintenance operation while load current passes through poles of the contactor. Electrical resistance is determined as a result of tests carried out on typical currents specified for various utilization classes.

AC1: Ohmic loss,
Closing current=breaking current=Ie

AC3: Squirrel cage asynchronous motors,
Closing current = 6 Ie (drive)
Breaking current = Ie (Ie=In)

AC4: Discrete operation of squirrel cage or ring asynchronous motor and current breaking applications,
Closing current=breaking current=6 Ie.

Contactor Selection According to Utilization Classes
One of the most important points in contactor selection is to understand the load well and to determine instant load characteristic sizes well.
Important selection parameters:
Operating voltage (Ue), operating current (Ie), Coil voltage, current to be broken (Ic), utilization class, operating type and contact life.

Contactor selection for motors:
Important selection parameters in contactor selection for motors;
- Operating voltage (Ue),
- Breaking current while motor is operating = Operating current (Ie),
- Motor start-up current (Ic=m x Ie),
- Start-up frequency (K),
- Operation number.

a. Cage asynchronous motors:
Motor rated power (kW), operating voltage and motor operating type (continuous, discrete, short-term etc.) are taken into consideration. While contactor is selected for motors operated at low power due to reasons such as high environmental temperature or increased safety, danger zone etc., motor operating current should be taken into consideration.

b. Ring asynchronous motors:
Separate selections are made for stator and rotor circuits. Selection of stator contactor is made according to Ith thermal current. Important criteria for selection in rotor circuit are operating status (start-up, adjustment), insulation (there is grounding or not), application type (intermediate contactor or final contactor).

c. Contactor selection in driving AC motors:
In direct driving; selection is made in AC3 utilization category according to motor nominal power. In unloaded star-triangle drives, since 1/3 of the motor nominal current shall pass through star contactor, the star contactor is selected at 1/3 of the nominal motor power according to AC3 utilization category. Since energy and triangle contactor is serially connected to motor coils, motor coil current passes through these contactors during operation. Therefore, these contactors are selected at 0.58 times more that is 1/o of the motor nominal power according to AC3 category. All the contactors are selected at 0.58 times more that is 1/o of the motor nominal power according to AC3 category in star-triangle drive of motors under load.

d. Contactor selection for DC current:
Extinction of arc in direct current is more difficult than alternative current. In this selection, time constant L/R of the load is a size as important as load voltage and current. Load constant (L/R) is approximately 1 ms in non-inductive loads, 7.5 ms in shunt motors, 10 ms in serial motors and 300 ms in electromagnets. Important parameters in inductive DC load switching are voltage, load type (Ohmic or inductive) and switching frequency.

e. Ohmic loads:
Ohmic loads are the most problem-free loads for enablement and disablement; because only rated current passes through the contactor. Closing current is equal to breaking current. It should be considered that the heat to be produced shall be higher as the switching

Contactor selection in driving cage asynchronous motors	
Direct drive	Primary contactor current = Ie
Normal star-delta drive	Primary contactor : 0,58 Ie Delta contactor : 0,58 Ie Star contactor : 0,58 Ie Transition contactor : 0,30 Ie
Impedance drive	Primary contactor : Ie Start-up contactor : 0,7 Ie
Auto transformer drive	Primary contactor : Ie Transformer contactor : Ie Star contactor : 0,5 Ie

Contactor selection in direct driving squirrel cage asynchronous motors:

Threephase 380/400V		Thermal relay adjustment area (A)	Suitable FEDERAL Contactor
kW	In (A)		
0,37	1,03	1 - 1,6	FC09D
0,55	1,6	1,25 - 2	FC09D
0,75	2	1,6 - 2,5	FC09D
1,1	2,6	2,5 -4	FC09D
1,5	3,5	2,8 - 4	FC09D
2,2	5	4,5 - 6,3	FC09D
3	6,6	5,5 - 8	FC09D
4	8,5	7 - 10	FC09D
5,5	11,5	9 - 12,5	FC12D
7,5	15,5	14 - 20	FC18D
9	18,5	17 - 22	FC25D
11	22	20 - 25	FC25D
15	30	23 - 32	FC32D
18,5	37	30 - 40	FC40D
22	44	37 - 50	FC50D
30	60	55 - 70	FC65D
37	72	63 - 80	FC80D
45	85	75 - 105	FC95D
55	105	95 - 125	FC115D
75	138	100 - 160	FC150D
90	170	125 - 200	FC220D
110	205	200 - 315	FC260D
132	245	200 - 315	FC260D
160	300	250 - 400	FC300D

Contactor selection in star-triangle driving squirrel cage asynchronous motors:

380/400V		Thermal relay adjustment area (A)	Suitable FEDERAL Contactor		
kW	In (A)		Line	Star	Delta
7,5	15,5	7-10	FC12D	FC12D	FC09D
9	18,5	9-12,5	FC12D	FC12D	FC09D
11	22	11-16	FC12D	FC12D	FC09D
15	30	14-20	FC18D	FC18D	FC09D
18,5	37	20-25	FC18D	FC18D	FC09D
22	44	23-32	FC32D	FC32D	FC18D
30	60	30-40	FC50D	FC40D	FC25D
37	72	38-50	FC50D	FC50D	FC32D
45	85	48-57	FC50D	FC50D	FC32D
55	105	57-66	FC65D	FC65D	FC50D
75	138	63-80	FC80D	FC80D	FC50D
90	170	75-105	FC150D	FC150D	FC80D
110	205	100-160	FC150D	FC150D	FC80D
132	245	100-160	FC220D	FC220D	FC150D
160	300	125-200	FC220D	FC220D	FC150D
200	370	200-315	FC260D	FC260D	FC220D
220	408	200-315	FC260D	FC260D	FC220D

frequency increases and calculation should be made by assuming lower rated current of the contactors selected according to AC1. 2 or 3 poles of 3-phase contactors, which are used for supplying heating circuits that are usually mono-phased, are connected serially. If two poles are serial, rated operating current should be calculated as 1,6xIe; if three poles are serial, it should be calculated as 2xIe.

f. Compensation applications:
Capacitors cause high frequency (1…5kHz) and high value temporary currents in the circuits they are connected to during start up. Switching of a single capacitor or a capacitor within a group of capacitors has different characteristics. Gradual start-up in group of capacitors is more difficult for the contactor. Because, while the capacitors in group of capacitors start up gradually, a circulating current is formed between parallel capacitor, in addition to drawing current of the battery and it forces the contactor. Therefore, special contactors and combinations have been developed for compensation applications. Where required, shock coil is used to limit the current. Contactors developed for controlling tri-phase capacitors have been developed with limit resistant transition contact blocks limiting the current value at start-up.

g. Illumination facility applications:
Impact voltages and currents, which occur in illumination applications from time to time, may force the contactor. It has been classified in terms of type behavior and closing-breaking operation for selection. While contactor is selected for illumination circuits, important factors are bulb type, connection, whether there is compensation or not, start-up and operating current and power factor. While the contactor is loaded up to 15 times of the lamp rated current during closing in filament lamps, breaking current is equal to rated current. Compensation is very important in discharge and florescent lamps. In high pressure mercury vapor lamps, a current occurs at two times of the operating current during pre-heating period (approximately 5 minutes). This regime period is about 10 minutes in halogen lamps and sodium vapor lamps.

Utilization classes of contactor:

Accurate determination of the utilization class and selection in accordance with this class is the most important point for healthy operation of the contactor. The reason of many failures encountered in application is the failure to make the right selection according to utilization class of contactors.

AC1 class:
It covers the alternative current loads with a power factor at least 0,95. The most common example of this is heating applications.

AC3 class:
This is the most common application class. It covers cage asynchronous motors disabled while in operation after driving. At closing, motor start-up current, which is 5…7 times more than rated current of the motor, passes through the contactor contacts. At start-up, the contactor shall break the rated current drawn by the motor. At that time, the voltage between contactor poles is about 20% of the nominal voltage. This is an easy breaking situation. Examples of this class are stator and stator control of all standard squirrel cage motors and ring asynchronous motors, elevators, escalators, conveyors, pumps, ventilators, mixers, air-conditioning devices, coolers and valves.

AC4 class:
This is related to discrete operation and reverse-current braking applications of cage or ring motors. Contactor opens and closes at driving current, which is 5…7 times more than rated current of the motor. Breaking is difficult at low speeds. Sample applications are pressing machines, wire and cable machines, discrete operating machine tools, metallurgy, lifting, electro valves, couplers etc.

a.Contactor utilization classes according to IEC 60947-4-1:

Current type	Utilization category	Area of utilization
Alternative current	AC - 1	Non-inductive or low-inductive loads, resistance furnaces
	AC - 3	Squirrel cage motors, driving, motor stop in operation
	AC - 4	Squirrel cage motors, driving, reversing operation, stepping operation
	AC - 5a	Electrical discharge lamp control mechanism switching
	AC - 6b	Switching of capacitor groups

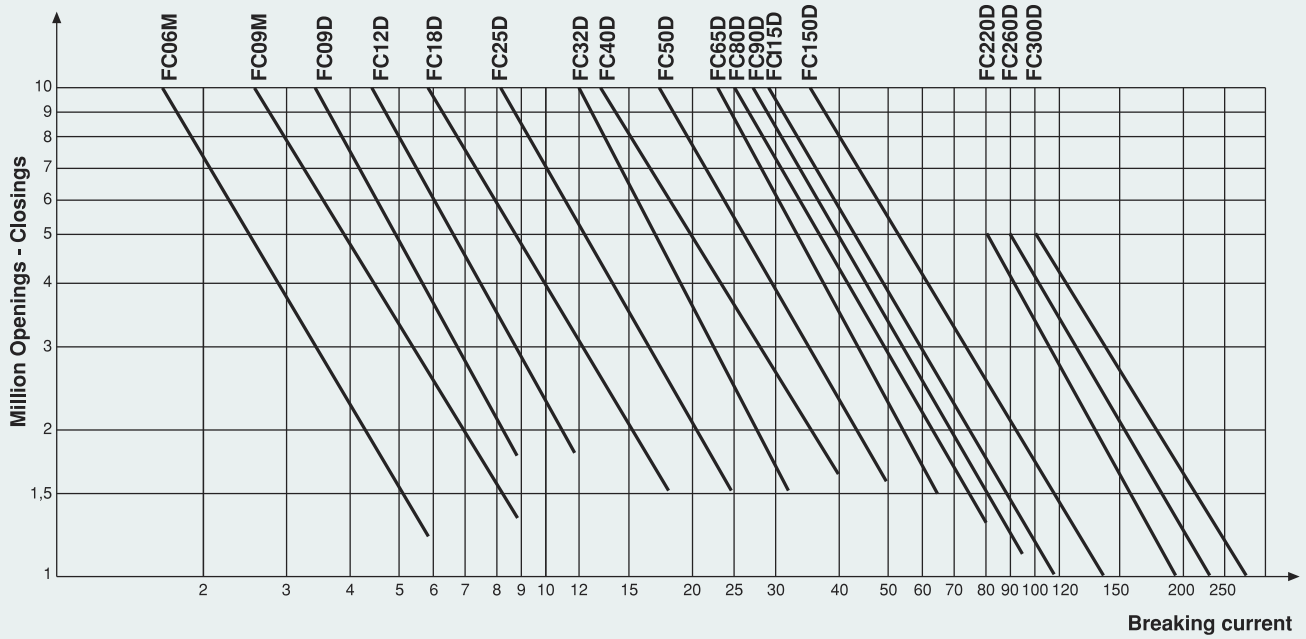


Fig-1 Contactor selection according to electrical life (Ue≤440 V for AC - 3 class) powers according to 50 Hz' operating voltage (kW)

Contactor failures and impacts:
If the contactors are not used in accordance with the technical data present in the catalogues or if there are failures in the supply network, failures may occur.

Possible disablement reasons of contactors:
In general, contactors are actually devices which are not subject to failures quite easily. If selection has been made correct and if operating conditions are accurate, a contactor may perform millions of safe openings - closings. Below are the failures frequently encountered in contactors and reasons and solutions of these failures.
- Too long control (coil) circuit cables may cause some problems. Whereas significant voltage decrease throughout long cables makes closing difficult, too big section cable capacitance hinders opening. If control cable is longer than the recommended value, it is recommended to utilize a lower coil voltage or to connect a parallel resistance or inductive impedance to the coil.
- Existence of dust or foreign objects in the contactor, sever atmosphere conditions and corrosion may hinder closing of the contactor especially with remote-control. When such a fault is encountered, the contactor should be cleaned with a strong clean air flow against dust and dirt, housing should be made more closed and protected, the circuit should be checked and any factor corrupting conductivity should be eliminated.
- The contactor coil may burn due to low or high voltage. Voltage regulator should be used in cases where network voltage fluctuates too much. Moreover, dust and foreign objects in air gap facilitate it. When coil is burnt, first voltage and frequency should be checked and a stable control voltage should be ensured.
- Another incident hindering opening other than the capacitive impact is adherence of the contacts. Reason of this adherence might be switching in high current, short circuit or fault in star-delta transition. If there is a short circuit, first of all reason of the short circuit should be found out.
- Incidents causing noisy operation of the contactor are presence of foreign objects such as dust etc. in the air gap, failure of nucleus surface due to long-time operation and inappropriate voltage and frequency. In order to avoid them, nucleus surface should be kept clean and coil should be replaced according to voltage and frequency if required.

Coil replacement:
Screws on both sides of the contactor are removed, top parts are separated, coil in the bottom is pulled out of its slot and new coil is mounted. Top part is placed and contactor is closed. However, attention should be paid to secure the spring during assembly.

Contact life depending on opening current:
Contact melting loss at a particular switch device generally depends on opening current and contact lives are given in diagrams.
The most common area of utilization of the contactors is operation of motors. Different operating types of the motors are classified in IEC 60947-4-1.

Connection sections:

Min. and max. connection sections (mm^2)	Primary contact / Auxiliary contact	mm^2	mm^2	mm^2	mm^2	mm
FC 09D		1...4	1...4 + 1...4	1...6	1...6 + 1...6	8
FC12D		1...4	1...4 + 1...4	1...6	1...6 + 1...6	8
FC18D		1...2,5	1...2,5 + 1...2,5	1...2,5	1...2,5 + 1...2,5	8
		2...6	1,5...6 + 1,5...6	1,5...6	1,5...6 + 1,5...6	10
FC25D		2...10	1,5...6 + 1,5...6	1,5...6	1,5...6 + 1,5...6	10
FC32D		1...2,5	1...2,5 + 1...2,5	1...2,5	1...2,5 + 1...2,5	8
		2...10	4...10 + 4...10	1,5...10	2,5...10 + 2,5...10	12
FC40D FC50D FC65D		1...2,5	1...2,5 + 1...2,5	1...2,5	1...2,5 + 1...2,5	8
		2,5...25	2,5...16 + 2,5...16	2,5...25	4...16 + 4...16	—
FC80D		1...2,5	1...2,5 + 1...2,5	1...2,5	1...2,5 + 1...2,5	8
FC95D		4...50	4...35 + 4...35	4...50	16...35 + 16...35	—
FC115D FC150D	—	4...95	4...50 + 4...50	4...95	16...50 + 16...50	—
FC220D FC260D FC300D	—	4...185	4...95 + 4...95	4...185	4...95 + 4...95	32

			FC06M	FC09M	FC09D	FC12D	FC18D	FC25D	FC32D	FC40D	FC50D
Utilization class : AC3 **Ie max** **Ue< 440 V**		A	6	9	9	12	18	25	32	40	50
Utilization class : AC1 **Ie max**	40 °C	A	16	16	25	25	32	40	50	60	80
	55 °C		12	12	20	20	26	32	44	55	70
Rated insulation voltage-Ui (a.c.) 50-60 Hz		V	690	690	1000	1000	1000	1000	1000	1000	1000
Rated impulse withstad voltage - Uimp		kV	8	8	8	8	8	8	8	8	8
Motor control 3 ~ AC3 Driving Stopping	220 / 230 V	kW	1,5	2,2	2,2	3	4	5,5	7,5	11	15
	380 / 400 V	kW	2,2	4	4	5,5	7,5	11	15	18,5	22
	415 V	kW	2,2	4	4	5,5	9	11	15	22	25
	500 V	kW	3	4	5,5	7,5	10	15	18,5	22	30
	660 / 690 V	kW	3	4	5,5	7,5	10	15	18,5	30	33
Rated current AC 5A		A	9	12	12	16	25	35	45	55	70
Weight		gr.	0,16	0,16	0,33	0,33	0,345	0,52	0,55	1,14	1,14
Number of auxiliary contacts			1 NO or 1 NC	1 NO or 1 NC	1 NO or 1 NC	1 NO or 1 NC	1 NO or 1 NC	1 NO or 1 NC	1 NO or 1 NC	1 NO + 1 NC	1 NO + 1 NC
Coil power consumption (at holding)		W	2	2	2	2	2	2,7	2,7	8	8
Power loss per pole		W	0,16	0,30	0,25	0,45	1,00	1,00	1,30	2,00	4,50
Max. - min. tightening torque		Nm	1-1,5	1-1,5	1-1,5	1-1,5	1-1,5	1,2-2	1,2-2	3,5-4,5	3,5-4,5


FCC-D0


FCC-D2


FCC-D4


FCAB-F11
FCAB-F20
FCAB-F02


FCB-F20
FCB-F02
FCB-F11


FCB-F40
FCB-F31
FCB-F22
FCB-F13
FCB-F04

Note: Auxiliary contact blocks are assembled on front face of the contactor

NO : Normally open contact

											
FC65D	**FC80D**	**FC95D**	**FC115D**	**FC150D**	**FC220D**	**FC260D**	**FC300D**	**FC400D**	**FC475D**	**FC580D**	**FC650D**	**FC750D**
65	80	95	115	150	220	260	300	400	475	580	650	750
80	125	125	200	200	300	300	350	600	650	750	950	1000
70	100	100	180	180	260	260	300	500	600	850	850	800
1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
8	8	8	8	8	8	8	8	8	8	8	8	8
18,5	22	25	30	40	60	80	90	110	140	180	200	220
30	37	45	55	75	110	140	160	200	250	315	355	400
37	45	45	59	80	116	140	160	200	250	315	355	400
37	55	55	75	90	132	180	200	230	290	360	410	470
37	45	45	80	100	160	200	250	300	375	470	530	650
80	100	115	140	180	-	-	-	-	-	-	-	-
1,14	1,38	1,38	2,4	2,4	7,4	7,4	7,4	16	22	22	22	22
1 NO + 1 NC	1 NO + 1 NC	1 NO + 1 NC	-	-	-	-	-	-	-	-	-	-
8	5,5	5,5	4,5	4,5	20	20	20	20	24	24	24	24
6,50	8,00	11,50	7,00	11,50	15,00	21,00	27,00	27,00	27,00	27,00	27,00	27,00
3,5-4,5	6-10	6-10	6-10	6-10	10-14	10-14	10-14	10-14	10-14	10-14	10-14	10-14


FCC-D6


FCC-D8


FCC-D10


FCC-D12

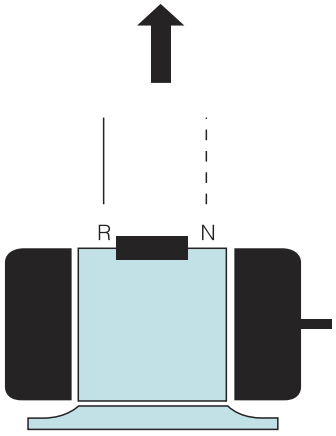

FCAB-F11
FCAB-F20
FCAB-F02


FCB-F20
FCB-F02
FCB-F11

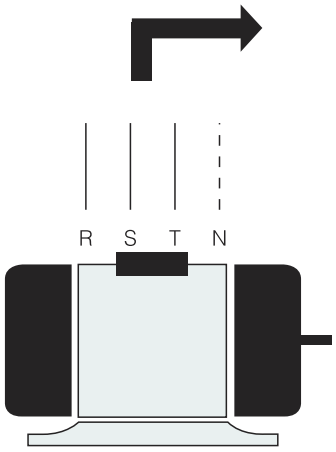

FCB-F40
FCB-F31
FCB-F22
FCB-F13
FCB-F04

12

Mono-phase motors				Threephase motors								
kW	HP	220 V A	240 V A	kW	HP	220-240 V A	380 V A	415 V A	440 V A	500 V A	660 V A	1000 V A
0,37	0,5	3,9	3,6	0,37	0,5	1,8	1,03	—	0,99	1	0,6	0,4
0,55	0,75	5,2	4,8	0,55	0,75	2,75	1,6	—	1,36	1,21	0,9	0,6
0,75	1	6,6	6,1	0,75	1	3,5	2	2	1,68	1,5	1,1	0,75
1,1	1,5	9,6	8,8	1,1	1,5	4,4	2,6	2,5	2,37	2	1,5	1
1,5	2	12,7	11,7	1,5	2	6,1	3,5	3,5	3,06	2,6	2	1,3
1,8	2,5	15,7	14,4	2,2	3	8,7	5	5	4,42	3,8	2,8	1,9
2,2	3	18,6	17,1	3	4	11,5	6,6	6,5	5,77	5	3,8	2,5
3	4	24,3	22,2	3,7	5	13,5	7,7	7,5	7,1	5,9	4,4	3
4	5	29,6	27,1	4	5,5	14,5	8,5	8,4	7,9	6,5	4,9	3,3
4,4	6	34,7	31,8	5,5	7,5	20	11,5	11	10,4	9	6,6	4,5
5,2	7	39,8	36,5	7,5	10	27	15,5	14	13,7	12	8,9	6
5,5	7,5	42,2	38,7	9	12	32	18,5	17	16,9	13,9	10,6	7
6	8	44,5	40,8	10	13,5	35	20	—	—	15	11,5	7,5
7	9	49,5	45,4	11	15	39	22	21	20,1	18,4	14	9
7,5	10	54,4	50	15	20	52	30	28	26,5	23	17,3	12
				18,5	25	64	37	35	32,8	28,5	21,3	14,5
				22	30	75	44	40	39	33	25,4	17
				25	35	85	52	47	45,3	39,4	30,3	20
				30	40	103	60	55	51,5	45	34,6	23
				33	45	113	68	60	58	50	39	25
				37	50	126	72	66	64	55	42	28
				40	54	134	79	71	67	60	44	30
				45	60	150	85	80	76	65	49	33
				51	70	170	98	90	83	75	57	38
				55	75	182	105	100	90	80	61	40
				59	80	195	112	105	97	85	66	43
				63	85	203	117	115	109	89	69	45
				75	100	240	138	135	125	105	82	53
				80	110	260	147	138	131	112	86	57
				90	125	295	170	165	146	129	98	65
				100	136	325	188	182	162	143	107	71
				110	150	356	205	200	178	156	118	78
				129	175	420	242	230	209	184	135	85
				132	180	425	245	240	215	187	140	90
				140	190	450	260	250	227	200	145	95
				147	200	472	273	260	236	207	152	100
				150	205	483	280	270	246	210	159	102
				160	220	520	300	280	256	220	170	115
				180	245	578	333	320	289	254	190	135
				185	250	595	342	325	295	263	200	138
				200	270	626	370	340	321	281	215	150
				220	300	700	408	385	353	310	235	160
				250	340	800	460	425	401	360	274	200
				257	350	826	475	450	412	365	280	203
				280	380	900	510	475	450	400	305	220
				295	400	948	546	500	473	416	320	227
				300	410	980	565	510	481	420	325	230
				315	430	990	584	535	505	445	337	239
				335	450	1100	620	550	518	472	355	250
				355	480	1150	636	580	549	500	370	262
				375	500	1180	670	610	575	527	395	273
				400	545	1250	710	650	611	540	410	288
				425	580	—	760	690	650	574	445	302
				445	600	—	790	730	680	595	455	317
				450	610	—	800	740	690	608	460	320
				175	645	—	850	780	730	645	485	335
				500	680	—	900	820	780	680	515	350

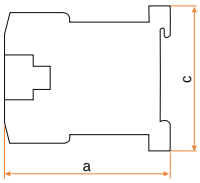


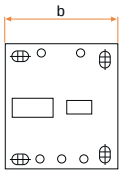
Monophase motors



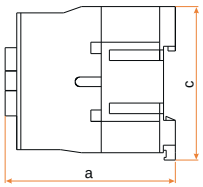
Threephase motors

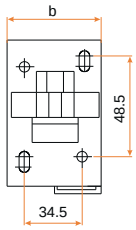
Type	a	b	c
FC06M	57	45.5	58
FC09M	57	45.5	58



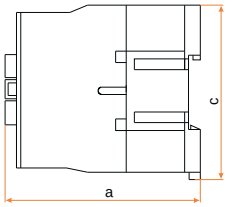


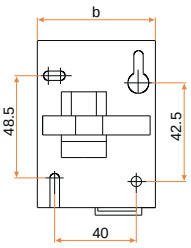
Type	a	b	c
FC 09D	80	46	74.5
FC12D	80	46	74.5
FC18D	86	46	74.5



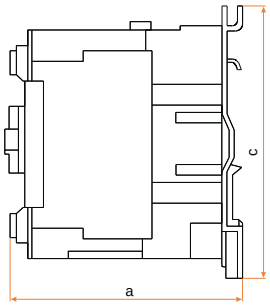


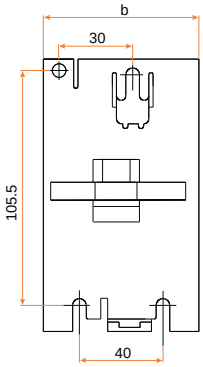
Type	a	b	c
FC25D	94	57	84
FC32D	99	57	84



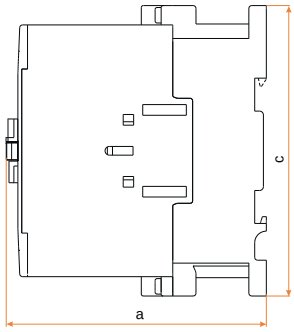


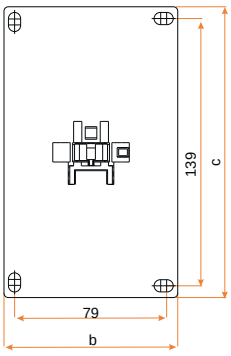
Type	a	b	c
FC40D	115	75	128
FC50D	115	75	128
FC65D	115	75	128
FC80D	127	75	128
FC95D	127	75	128



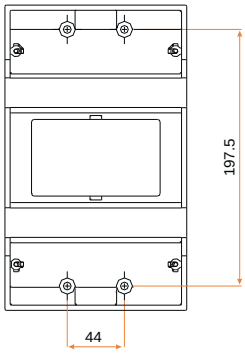


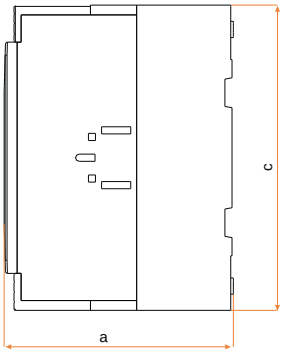
Type	a	b	c
FC115D	134,5	90	150
FC150D	134,5	90	150

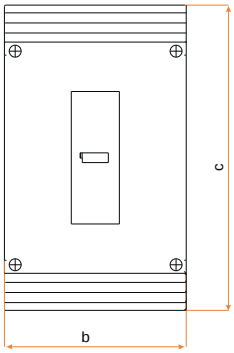




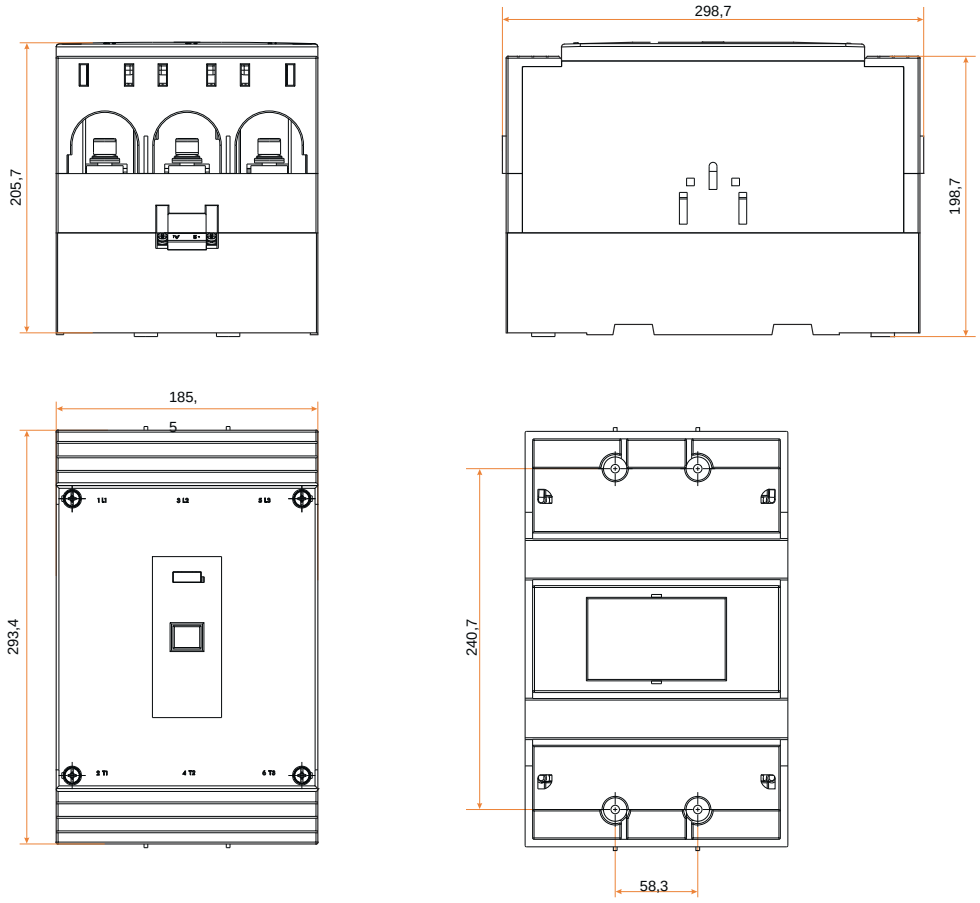
Type	a	b	c
FC220D	177	140	235
FC260D	177	140	235
FC300D	177	140	235





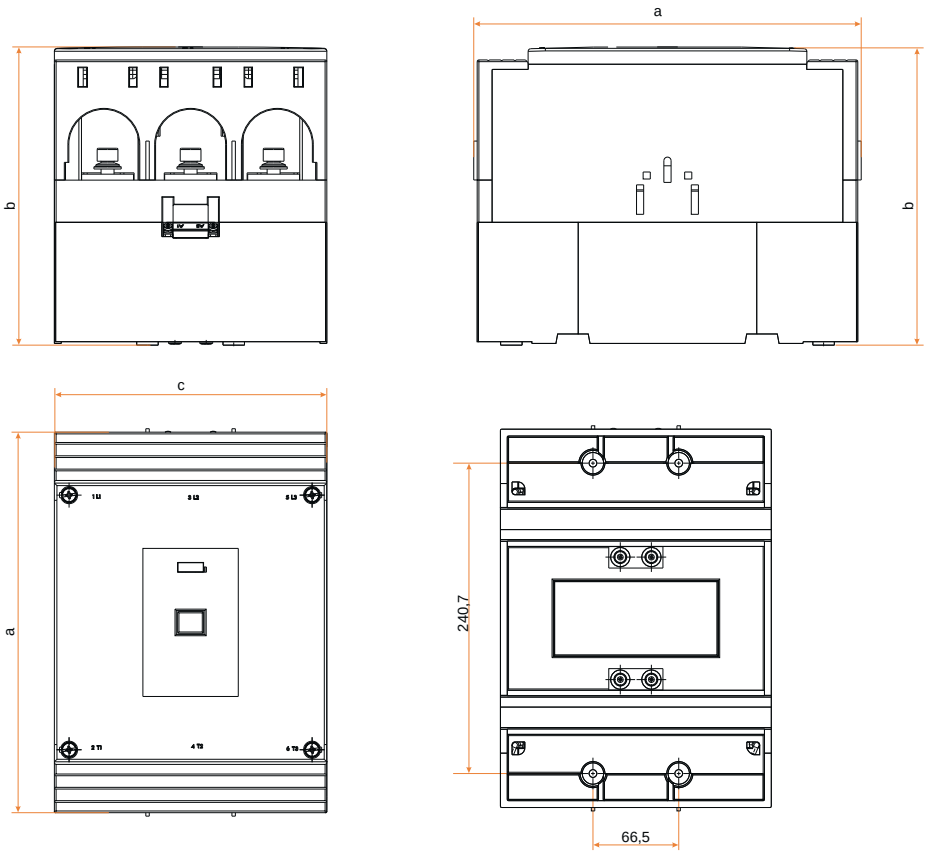


FC400D

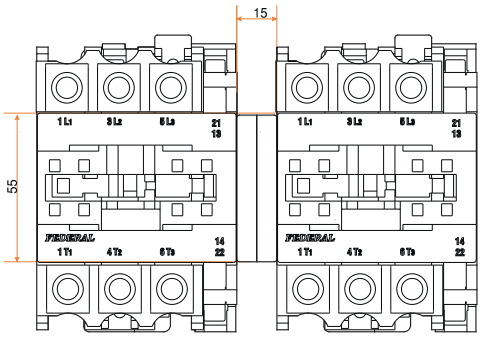


Type	a	b	c
FC475D	298	229	210
FC580D	298	229	210
FC650D	298	229	210
FC750D	298	229	210

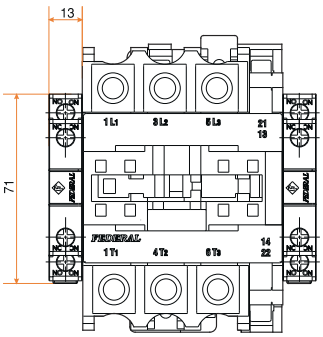
FC750D



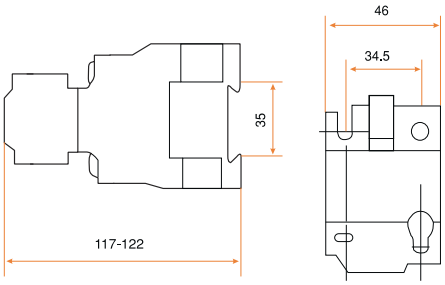
Mechanical lock



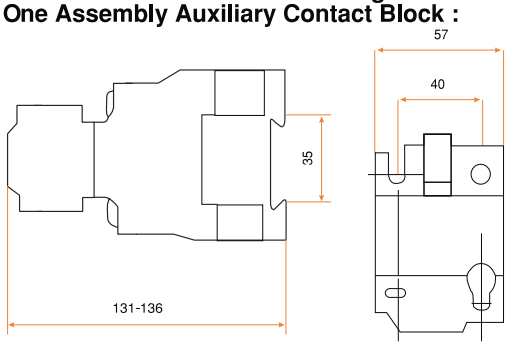
Side assembled contact block



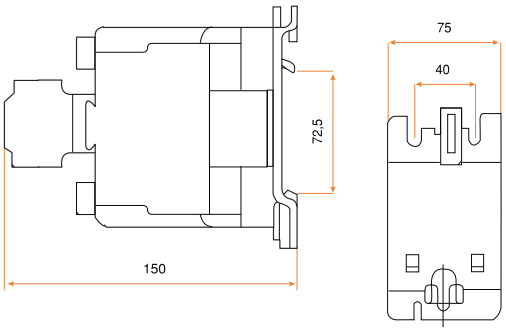
FC12D / FC18D Front Assembling
One Assembly Auxiliary Contact Block :



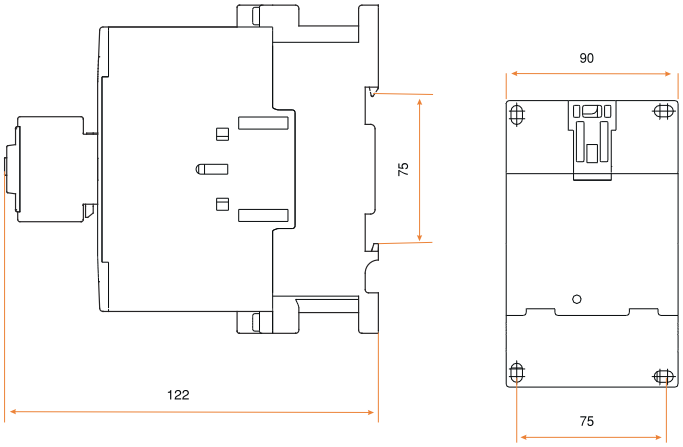
FC25D / FC32D Front Assembling
One Assembly Auxiliary Contact Block :



FC40D / FC65D / FC95D Front Assembling
One Assembly Auxiliary Contact Block :



FC150D Front Assembling
One Assembly Auxiliary Contact Block :



Order codes of auxiliary contact blocks

Top Assembly Type	Order code
FCB-F20	8DD-A0020-0000
FCB-F11	8DD-A0011-0000
FCB-F02	8DD-A0002-0000
FCB-F40	8DD-A0040-0000
FCB-F31	8DD-A0031-0000
FCB-F22	8DD-A0022-0000
FCB-F13	8DD-A0013-0000
FCB-F04	8DD-A0004-0000

Side Assembly Type	Order code
FCAB-F11	8DD-B0011-0000
FCAB-F20	8DD-B0020-0000
FCAB-F02	8DD-B0002-0000

Order codes of spare coils:

Type	Order code
FCC-D2	8DD -C□□20-0000
FCC-D4	8DD -C□□30-0000
FCC-D6	8DD -C□□40-0000
FCC-D8	8DD -C□□50-0000
FCC-D10	8DD -C□□60-0000
FCC-D12	8DD -C□□70-0000

□□ Indicates coil operating voltage

Order codes of spare primary contact sets:

Type	Order code
FC09 D	8DD-0000-0009
FC12 D	8DD-0000-0012
FC18 D	8DD-0000-0018
FC25 D	8DD-0000-0025
FC32 D	8DD-0000-0032
FC40 D	8DD-0000-0040
FC50 D	8DD-0000-0050
FC65 D	8DD-0000-0065
FC80 D	8DD-0000-0080
FC95 D	8DD-0000-0095
FC115 D	8DD-0000-0115
FC150 D	8DD-0000-0150
FC200 D	8DD-0000-0200
FC260 D	8DD-0000-0260
FC300 D	8DD-0000-0300
FC400 D	8DD-0000-0400
FC475 D	8DD-0000-0475
FC580 D	8DD-0000-0580
FC650 D	8DD-0000-0650
FC750 D	8DD-0000-0750

Descriptions of contactor type codes:

FC- 50 D 11 K5 (Sample contactor type)

- K5 → Coil voltage value
- 11 → Number of auxiliary contacts (1)
- D → Contactor type (2)
- 50 → Rated current (AC-3)
- FC → Federal contactor

(1) First figure indicates number of normally open (NO) contacts and second figure indicates number of normally closed (NC) contacts.

Sample
11=1NO + 1NC

(2) M : Mini contactor
D : Standard contactor
DK: Compensation contactor

Order codes of contactors :

Type	AC-3 Ie (A)	kW 400 V	Standard auxiliary contact	Order code
FC06M22*	6	2.2	2 NO + 2 NC	9DM -K3 223-0006
FC06M	6	2.2	1 NO 1 NC	9DM -□□ 103-0006 9DM -□□ 013-0006
FC09M	9	4	1 NO 1 NC	9DM -□□ 103-0009 9DM -□□ 013-0009
FC09D	9	4	1 NO 1 NC	9DD -□□ 103-0009 9DD -□□ 013-0009
FC12D	12	5,5	1 NO 1 NC	9DD -□□ 103-0012 9DD -□□ 013-0012
FC18D	18	7,5	1 NO 1 NC	9DD -□□ 103-0018 9DD -□□ 013-0018
FC25D	25	11	1 NO 1 NC	9DD -□□ 103-0025 9DD -□□ 013-0025
FC32D	32	15	1 NO 1 NC	9DD -□□ 103-0032 9DD -□□ 013-0032
FC40D	40	18,5	1 NO + 1 NC	9DD -□□ 113-0040
FC50D	50	22	1 NO + 1 NC	9DD -□□ 113-0050
FC65D	65	30	1 NO + 1 NC	9DD -□□ 113-0065
FC80D	80	37	1 NO + 1 NC	9DD -□□ 113-0080
FC95D	95	45	1 NO + 1 NC	9DD -□□ 113-0095
FC115D	115	55	-	9DD -□□ 003-0115
FC150D	150	75	-	9DD -□□ 003-0150
FC220D	220	110	-	9DD -□□ 003-0220
FC260D	260	140	-	9DD -□□ 003-0260
FC300D	300	160	-	9DD -□□ 003-0300
FC400D	400	200	-	9DD -□□ 003-0400
FC475D	475	250	-	9DD -□□ 003-0475
FC580D	580	315	-	9DD -□□ 003-0580
FC650D	650	355	-	9DD -□□ 003-0650
FC750D	750	400	-	9DD -□□ 003-0750

□□ Indicates coil operating voltage. *Auxiliary contactor.

Order codes of mechanical locks :

Type	Order code
FC09D...FC32D	8DD-MK000-0001
FC40D...FC95D	8DD-MK000-0002

Coil voltages :

Give coil voltages of the contactors in accordance with the table below.

□□	24V	42V	48V	110V	220V	230V	240V	380V	415V	440V	500V
AC	A5	D5	E5	H5	K5	N5	R5	S5	T5	U5	V5
DC	A6		E6	H6	K6					U6	

Sample1: For 220 V, 50/60 Hz coil voltage; K5.

Sample2: For AC3 class 32 A, normally closed, coil voltage 48 V 50/60 Hz contactor: FC - 32DO1 E5.

Sample3: For AC3 class 95 A, normally 3 closed and 1 open auxiliary contacts, coil voltage 220 V 50/60 Hz contactor

FC - 95D11K5 + FCB-F02 (Contactor and 1 FCB - F02 contact block shall be adequate.)

FC115 ... FC750 Contactor Coil (with electronic control unit)

100-250V AC

Coils according to IEC standards
Coil can close contactors at 85% of coil voltage
Coil can open contactors between 30% - 70% of coil voltage.

While selecting coil voltage, voltage drops at working time and voltage rises at night should be taken into consideration.

Contactor for capacitor switching:
Contactor for capacitor switching have been designed to switch capacitors and can be safely utilized in compensation circuits thanks to their special design. Contactors limit start-up currents of the capacitors thanks to limiting contact blocks. In this way, life of either capacitors or circuit protective devices is extended. The only difference of FEDERAL contactor for capacitor switching from normal contactors is the transition block with current limiting resistances connected parallel to primary contacts on the contactor.

Reasons for use of compensation contactor:
As it is known, capacitors cause high frequencies between 1 and 15 kHz and very short-time high currents that can be ten times more than the rated current during initial start-up. Inductance (shock coil) may be added to each three phases which the capacitor is connected to. However, as this transaction is difficult in practice, contactor for capacitor switching designed only for this purpose are utilized. In this way, life of the contactor shall extend by 100% when compared to normal contactors. To given an example, if electrical life of normal contactors at maximum load is 100.000, life of contactor for capacitor switching is 200.000.

Principles of operation:
Contactor for capacitor switching' principle of operation is as follows. When contactor coil receives energy, first contacts of the transition block are closed. Approximately 3,5 ms after first start-up current of the capacitor passes through these contactors, contacts of the transition block are opened and nominal current of the capacitors are carried by primary contacts.

Circuit diagram:

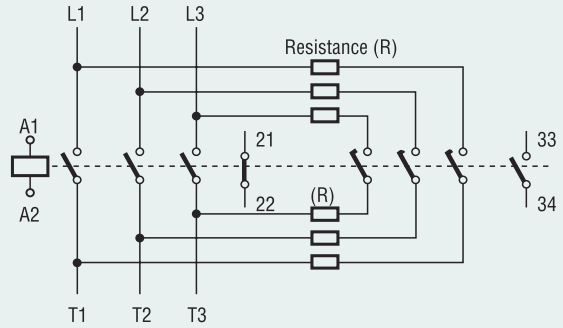


Fig-2 FC-12DK; FC-18DK; FC-25DK; FC-32DK

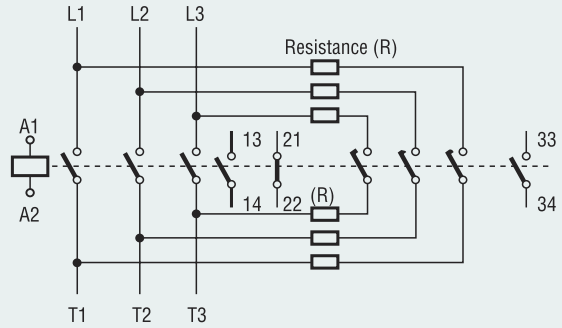
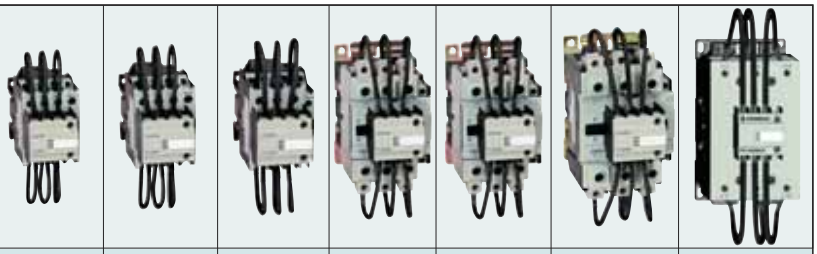


Fig-3 FC-65DK; FC-95DK



Contactor type			FC12DK	FC18DK	FC25DK	FC32DK	FC65DK	FC95DK	FC150DK
Utilization class AC-6b Iemax Ue ≤ 415 V		A	8	15	23	29	43	72	101
Rated thermal current (Ith)		A	25	32	40	50	80	125	200
Rated insulation voltage (kVAr) Q ≤ 40°C	220/240 V		3	6	7	10	15	30	40
	380/415 V		5	10	15	20	30	50	70
Rated insulation voltage		V	690	690	690	690	690	690	690
Rated impulse withstad voltage		kV	8	8	8	8	8	8	8
Electrical life (opening - closing)			200.000	200.000	200.000	200.000	200.000	200.000	200.000
Number of auxiliary contacts			1NO + 1NC	1NO + 1NC	1NO + 1NC	1NO + 1NC	2NO + 1NC	2NO + 1NC	1NO or 1NC
Weight		kg	0,39	0,40	0,58	0,60	1,36	1,58	2,65
Coil power consumption		W	2	2	2,7	2,7	8	5,5	4,5
Power loss per pole		W	0,45	1,00	1,00	1,30	6,50	11,50	11,50
Max. - min. tightening torque		Nm	1-1,5	1-1,5	1,2-2	1,2-2	3,5-4,5	6-10	6-10

Order codes of contactor for capacitor switching

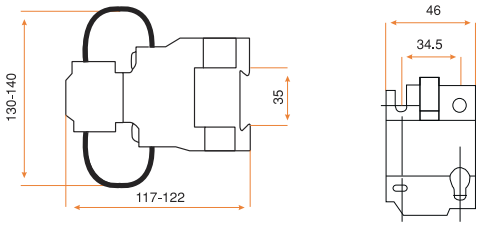
Type	AC-6b Ie (A)	kVAr 400 V	Standard auxiliary contact	Order code
FC12DK	8	5	1 NO + 1 NC	9DK-□□ 113-0012
FC18DK	15	10	1 NO + 1 NC	9DK-□□ 113-0018
FC25DK	23	15	1 NO + 1 NC	9DK-□□ 113-0025
FC32DK	29	20	1 NO + 1 NC	9DK-□□ 113-0032
FC65DK	49	30	2 NO + 1 NC	9DK-□□ 213-0065
FC95DK	72	50	2 NO + 1 NC	9DK-□□ 213-0095
FC-150DK	101	70	1 NO 1 NC	9DK-□□ 103-0150 9DK-□□ 013-0150

Order codes of contactor for capacitor switching accessories :

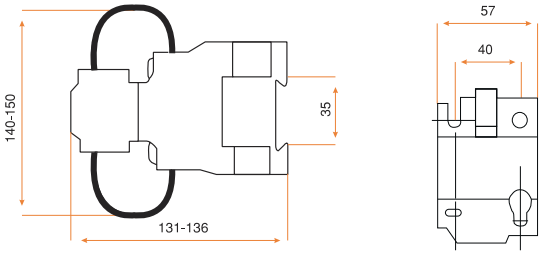
Type	Order code
Compensation resistance block	8DK-D21-0□□□
Compensation block	8DK-D21-1□□□

□□□ Contactor type

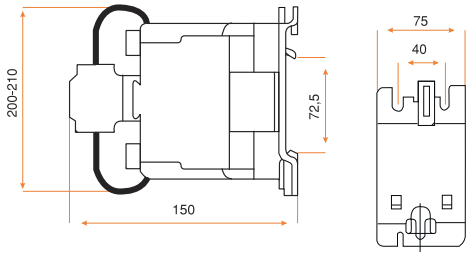
FC12DK / FC18DK



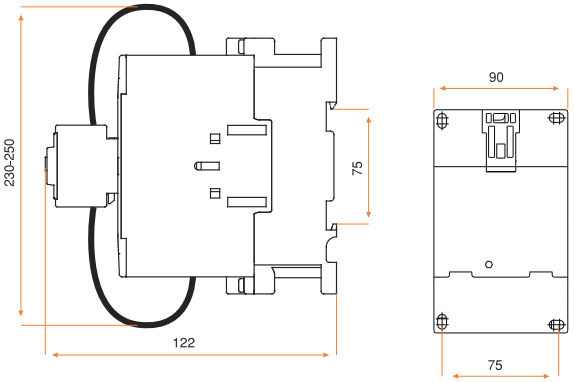
FC25DK / FC32DK



FC65DK / FC95DK



FC150DK



Utilization of power electronic components in enablement and disablement of electrical loads, instead of mechanical contactors, is becoming more general with improvement of technology. Rapid opening and closing can be made with thyristor switched contactor for capacitor switching. In this way, step is enabled and disabled within a period. Rapid compensation can be made in big, powerful loads enabled and disabled very quickly such as spot welding machine, port crane, welding machines, elevator, drill, electrical arc furnaces, pulsed loads, induction furnaces used in automotive, paper, package, food, textile, glass and cement industries. With the improving technology, current and voltage capacities of power electronic switching components increase and their prices decrease. As it is mentioned below, switching made with semi-conductors have significant superiorities on mechanical switching.

Advantages of semi-conductive switching:

·No moving parts.
·No arc during switching
·No wearing
·No inductance at control side
·Silent
·No electromagnetic interference
·High switching speed
·High reliability
·Long-life
·Resistance to shock and vibration
·Switching possible while phase angle is zero
·High input - output insulation
· No arc like other contactor systems as steps are enabled at zero transition of voltage
·No temporary impact, instant peak, corruption, interference during switching in electronic devices supplied by the same system

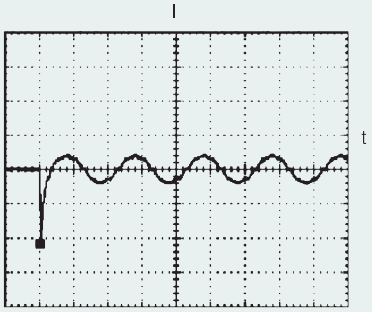


Fig-4: Compensation capacitor and a contactor for capacitor switching enabled at the same time

As it can be seen in Figure-4, peak value of the over current drawn by the capacitor during enablement is about 5 times more than the peak value of nominal current.

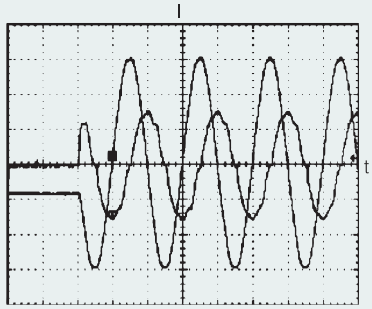


Fig-5 : Voltage and current wave forms on capacitor during enablement of same capacitor with semi-conductive contactor

In switching made with semi-conductive contactors, there is no over current as seen in Figure-5.

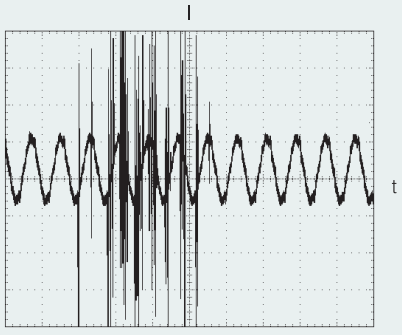


Fig-6 : Currents passing through a compensation capacitor switched with contactor for capacitor switching.

Current impacts seen in Figure-6 are the interferences caused by enablement of another capacitor. As harmonic current drawn by another capacitor during enablement shall also be drawn from the capacitors on parallel circuit, such interferences are inevitable. During enablement of the capacitors switched with the semi-conductive contactor in the compensation system, no over current shall pass through it and there shall be no interference on other parallel capacitors as seen in Figure 6.

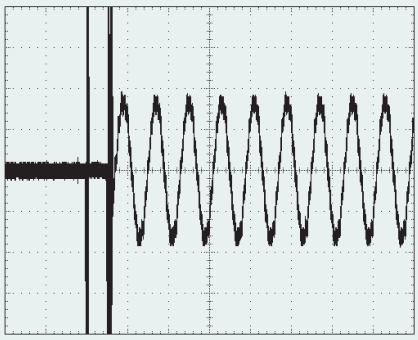


Fig-7

Current wave form drawn by a capacitor while enabled with a contactor for capacitor switching is seen in Figure 7. Here, repetition of current impacts to cause successive interferences is a result of mechanical vibrations during adherence of contactor contacts. It can be seen in the figure that current impacts are 10 times more than nominal current.

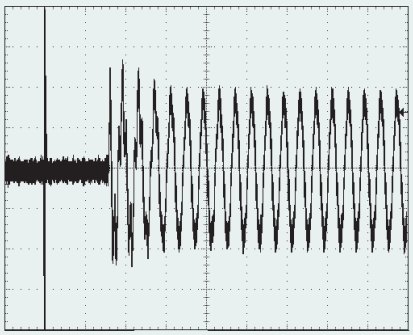


Fig-8

Current wave forms recorded at enablement of a capacitor switched with thyristor switched contactor for capacitor switching are given-in Figure-8. As it is seen, there is no over current during enablement. Fluctuation in the current, which lasts for about 3 periods, is a temporary situation arising from the harmonic filter connected to the circuit. No over current passes through a capacitor enabled in this way and there is no interference on capacitors parallel to it.

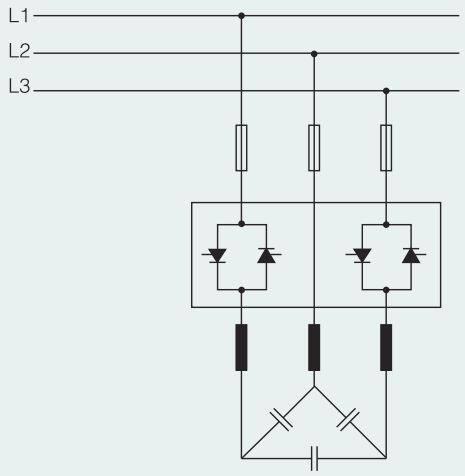
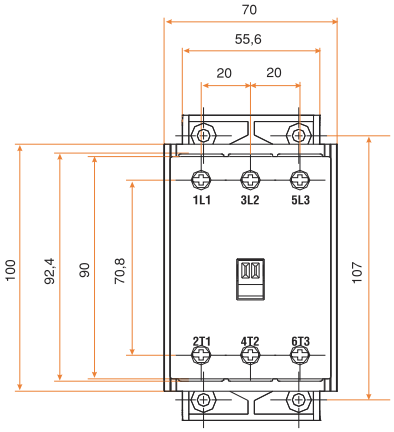


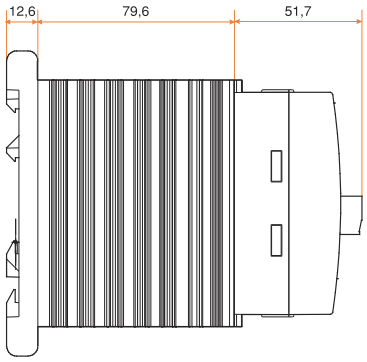
Fig-9 Connection diagram of a step in thyristor switched compensation system

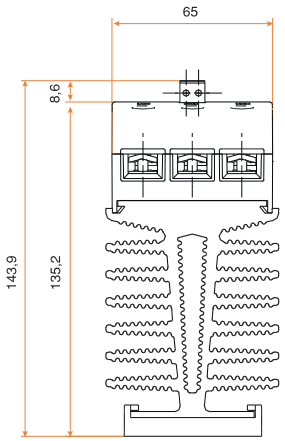
Note: Utilization of harmonic filter or current limiting reactor in non-filter compensation system and utilization of super flink NH fuse for protection is mandatory.

		FCT15K 	FCT30K 	FCT50K 
Operating voltage Un	V	400	400	400
Peak voltage	V	1200	1200	1200
Rated current	A	15	30	50
Peak current (t=10 msn)	A	320	450	450
Operating temperature	°C	-5 ... + 55	-5 ... + 55	-5 ... + 55
Storage temperature	°C	-40 ...+100	-40 ...+100	-40 ...+100
Reaction time max	ms	10	10	10
Control voltage		220 V AC, 12- 24 V DC-AC	220 V AC, 12- 24 V DC-AC	220 V AC, 12- 24 V DC-AC
Control current	mA	22	22	22
Rated capacitor power	kVAr	10	20	30
Order code		9DE-K3003-0015	9DE-K3003-0030	9DE-K3003-0050

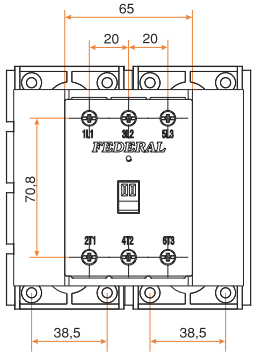
FCT15K

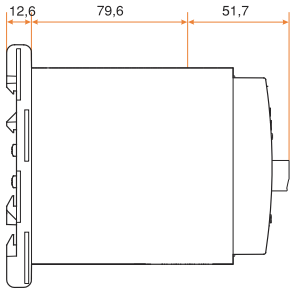


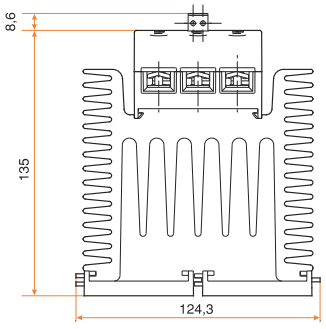




FCT30K-FCT50K







Federal High Current Contactors:
They are used safely in Ohmic, inductive and capacitive, AC and DC circuits, network-transformer inverter systems. Contactors comply with EN 60947-4-1 standard. Contactors, which have 3 poles normally, are manufactured with 1, 2 and 4 poles upon order. Federal contactors are designed to break DC current. Since arc extinction is more difficult in DC than AC, Federal contactors can be utilized in AC circuits safely for a long time. Selection of contactors for various utilization classes and voltages is shown in the technical values table.

Advantages:
- As there are arc contacts, primary contacts are not damaged in starting and breaking currents.
- Large arc separators can be safely used in severe conditions, to which compact contactors cannot resist, thanks to magnetic blow and special contact system.
- Heating of coil nucleus is avoided at high frequencies. Thanks to this feature, it is suitable for utilization in induction furnaces.
- There is no noise while contactor is in operation.
- Power consumption is very low.
- It is now affected from voltage fluctuations.
- There is adequate number of auxiliary contacts. (Number of auxiliary contacts may be increased if required.)
- There is no spare part problem.
- There is mechanical lock option as well as electrical lock.
- As well as these advantages, economic characteristic provides another advantage.
- It has long electrical life as they have double contacts..

Coil circuit:
AC control supply voltage is converted into DC via a bridge diode and applied to contactor coil. As it can be seen in the connection diagram, starting button is placed on AC circuit; stopping button and thermal relay opening contact is placed on DC circuit. Contactor is not opened due to voltage fluctuations. For example, voltage should go below 55V (0.25xUs) for the contactor to open in a network with control supply voltage as (Us) 220V. When contactor is enabled initially, it draws a maximum current of 4A and while it is in operation, it draws maximum 180mA. As it can be understood here, power consumption of Federal contactors is very low. There is no noise problem in the contactor due to dirt or rust on nucleus plates in coil circuit.

Contact system:
There are arc and primary contacts in main circuit of the contactor. First of all, arc contacts close the circuit in case of closing and instant driving currents on the nominal current are taken over by this contact. After that, primary contacts are closed to provide full contact. Thanks to this closing mechanism, damage of primary contacts due to crash and wearing due to arcs is avoided. In case of opening, first primary contacts and then arc contacts are opened with spring force as soon as after coil voltage is broken. In this way, primary contacts are not damaged due to arc.

Auxiliary contacts:
There are 4 open and 4 closed auxiliary contacts on the contactor. 2 open and 2 closed contacts of them have been used in coil circuit. Other 4 contacts (2 open and 2 closed) are kept as spares. 2 open and 2 closed contacts can be added to them if required.

Arc separators:
The arc formed during opening with the electromagnetic blow in the contactor is pushed into the arc separators and arc separators in the separator separate the arc and extinct it. Therefore, contactors should not be opened and closed under voltage without assembling arc separators.

Connection types in AC and DC circuits:
Connection type of contactors for AC and various DC voltages is given in Figure-10. However, opening spring size and distance is different in AC and DC contactors. This fact should be taken into consideration in orders. In order to let electromagnetic blow push the arc into separators, energy to the contactor should be supplied through top terminals, where separators are present.

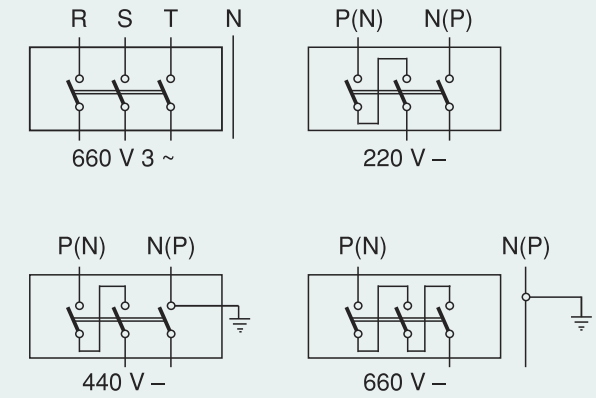
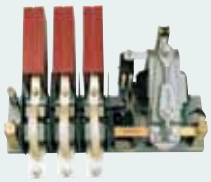
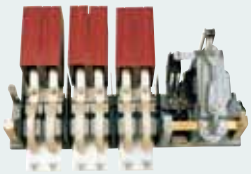
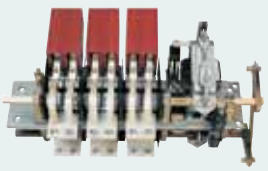


Fig-10

									
Type			**EC 300**	**EC 400**	**EC 630**	**EC 800**	**EC 1250**	**EC 1600**	**EC 2000**	**EC 2500**
Utilization class (Ith) le max	AC1 ≤ 40°C	A	300	400	630	800	1250	1600	2000	2500
Number of poles *		Ad.	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3	1,2,3	1,2,3	1,2,3
Rated impulse withstand voltage		kV	8	8	8	8	8	8	8	8
For motor control (Squirrel cage motors) 3 ~ AC3	220 / 230 V	kW	75	110	160	200	370	470	580	730
	380 / 400 V	kW	132	200	280	335	630	790	980	1230
	500 V	kW	180	257	355	450	740	960	1190	1490
In compensation circuits	380 / 400 V	kVAr	150	200	250	300	450	525	655	820
Rated insulation voltage	Ui	~ V	690	690	690	690	690	690	690	690
Coil voltage	Us (AC)	~ V	24, 48, 110, 220, 240, 380, 415							
	Us (DC)	– V	24, 48, 110, 220, 240, 380, 415							
Coil voltage operating interval	xUs	~ V	0,72 - 1,1							
Auxiliary contacts	NA (10A)	Ad	2	2	2	2	2	2	4	4
	NK (10A)	Ad	2	2	2	2	2	2	4	4
Coil power consumption	pulling	W	800	800	800	800	880	880	1760	1760
	holding	W	26	26	26	26	35	35	70	70
Mechanical life		Operation	50000	50000	50000	50000	50000	50000	50000	50000
Dimensions	depth	mm	245	245	245	245	245	245	500	500
	wideness	mm	462	462	462	462	577	577	710	710
	height	mm	370	370	370	370	370	370	370	370
Weight		kg	28,6	29,2	29,8	30,4	44,2	44,8	88,4	89,6
Power loss per pole		W	6	11	26	42	52	85	80	125

Us: Control supply voltage.

* High Current Contactors are manufactured with 3 poles as a standard.

Connection diagram :

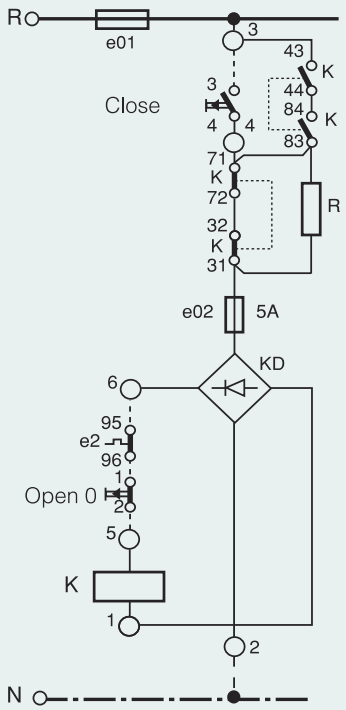
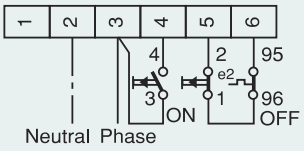
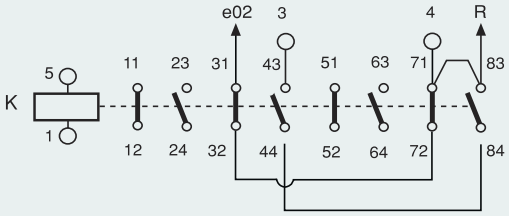


Fig-11



Connector connection diagram



Auxiliary contact block connection diagram

e01 : 6A fuse
e02 : 5A fuse
e2 Thermal relay contact (Depends on user request)
---- : Connections to be made by user (Stop mechanism)
R : Voltage separator resistance (2200 Ω - 75 W)
KD : Bridge diode
K : Coil

- ○ : Sequence connectors - V RN=220 V for R1=(2200±%5)Ω-75W
- Place stop button in DC circuit as shown in the diagram, otherwise there shall be a delay in opening.
- Connectors no 5 and 6 are subject to short circuit for test. User should pay attention to this fact and make the connection according to the diagram.

Mechanical lock connection diagram:

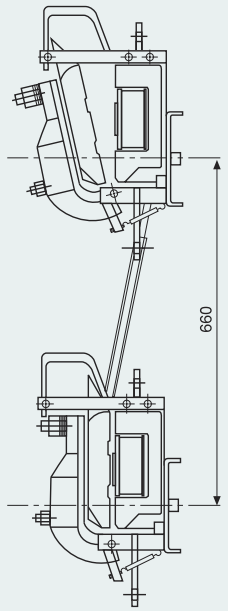


Fig-12

Order codes of contactors :

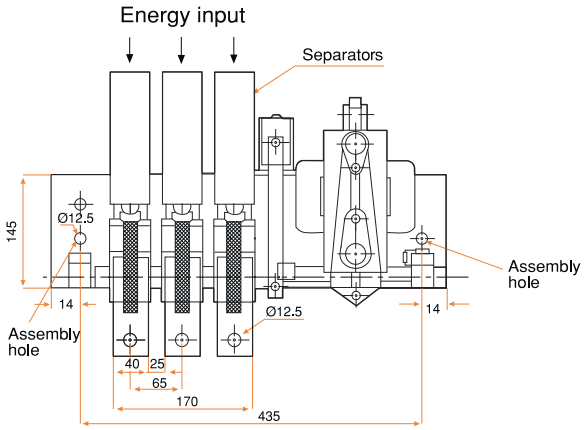
Type	AC-3 Ie (A)	kW 400 V	Standard Auxilary Contact	Order code
EC 300	300	132	4 NO + 4 NC	9DY-□□ 22 Δ-0300
EC 400	400	200	4 NO + 4 NC	9DY-□□ 22 Δ-0400
EC 630	630	280	4 NO + 4 NC	9DY-□□ 22 Δ-0630
EC 800	800	325	4 NO + 4 NC	9DY-□□ 22 Δ-0800
EC 1250	1250	630	4 NO + 4 NC	9DY-□□ 22 Δ-1250
EC 1600	1600	790	4 NO + 4 NC	9DY-□□ 22 Δ-1600
EC 2000	2000	980	4 NO + 4 NC	9DY-□□ 22 Δ-2000
EC 2500	2500	1230	4 NO + 4 NC	9DY-□□ 22 Δ-2500

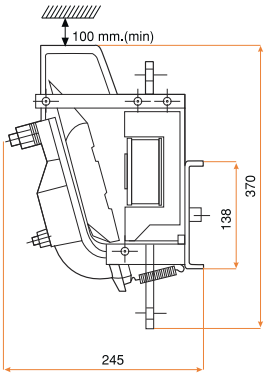
Coil voltages :

□□	24 V	48 V	110 V	220 V	240 V	380 V	415 V
50/60 Hz	A5	E5	H5	K5	R5	S5	T5
DC	A6	E6	H6	K6	R6	S6	T6

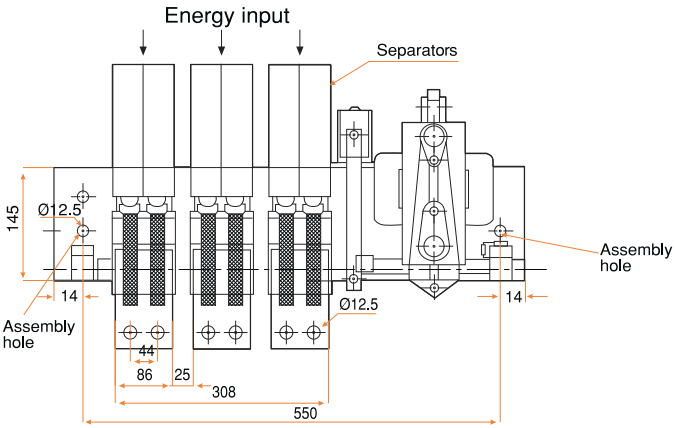
□□ : Coil operating voltages Δ : Number of poles ((1, 2, 3, 4)

EC300-EC400-EC630-EC800:





EC1250 - EC1600:



EC2000 - EC2500: