Solidvar

Solid State Contactor

SOLIDVAR MANUAL Version 5.0

varixx

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Descriprion

Os Solid State Contactors Varixx Solidvar series, are contactors thyristor circuits that replace directly the conventional induction motor starter three-phase or any other application instead of contactors electromechanical

Varixx SSC and Static Switches represent the current state of the art in this area, being able to work including on ring motor rotor, where the frequency is variable.

Solidvar series contactors are designed to directly replace accountants conventional, presenting similar mechanical construction, not needing food additional. The tension itself contactor coil drive conventional can command the Solid-State Contactor. The tension command can be in the range of 20 to 240 VAC/VDC in various options, with a consumption of 15mA which allows acting directly by the CP or CLP..

The VARIXX SSC operate on the system “Zero Switch Control”, that is, they turn on at voltage zero and turn off at zero current, not generating noise electromagnetic and over voltages, besides smoothing the “Inrush Current”. Complete isolation between control, power and contacts assistants provided by optical couplings; being so, the user need not worry about differences in phases or polarity.

There are single-phase models, biphasic and triphasic, the three-phase model can be “Normal” (N) or “High Current” (HC), being that it also features two other versions namely: “Reversal” (HCR) and “Light” (HCL). Types HC, HCR and HCL are specially indicated for engine drive (operations in AC3 and AC4) and type N for operating with resistive loads (AC1)

In general, they are called contactors. Solid State or SSC models three-phase and two-phase loads inductive or resistive and Switches Static the single-phase models, normally applicable in resistive loads

All VARIXX models, even the smallest, do not use Triacs, being the truth prepared for inductive loads, Due to its advanced system of triggering of thyristors or alternators, with optical isolation and transient filters, which allows safe application on systems with phase reversal, without danger of blowing of fuses by triggering a half-cycle, by transients in the network or load.

The Light line was specially developed with a view to saving space for applications that do not require high average current, that is, have a low working cycle even with high current spikes, as for example in engines wound rotor (with rings) or any other with low “Working Cycle”, even if at high maneuver frequencies

Application

Solid State Contactors are an evolution of the old Static Keys. While those are used basically for resistive loads, the SSC are designed to support loads highly inductive motors, such as AC induction, cage type or others starting direct or not. It has the advantage of not cause transients and still withstand high maneuver frequencies. Additionally provide substantial savings by avoiding downtime for maintenance and loss of production, especially in systems with high frequencies of maneuvers and in difficult environments.

Main Advantagens

› Operates in harsh or dirty environments.

› High number of maneuvers per hour.

› Very high durability.

› It does not require periodic maintenance.

› Does not wear out.

› Does not generate noise for PLC, CNC or CP (Zero Switch Control).

› Silent operation.

› High immunity against vibrations and impacts.

› Does not cause vibrations to other components.

› Turns on when voltage passes to zero (Zero Switch Control).

› Turns off when current passes to zero.

› Low consumption, compatible with CLP (approximately 15 mA).

› It does not generate surges on shutdown.

› Features, Selections and Sizing

Eletrical Features

› Nominal currents: 20 to 2000 A.

› Types: Normal (1, 2 and 3 phases), Light (3 Phases), High Current (3 Phases), Reversal (3 Phases).

› Maximum switching voltages: 600 VAC (Others on request).

› Control voltages: 20 to 50VAC/VDC, 100 to 240VAC/VDC, 110VAC and 220VAC, Consumption = 15mA.

› Poles: Single-phase, Two-phase and Three-phase.

› Operating Speed: 20000 maneuvers per hour (maximum).

› Auxiliary contacts: 2 NO, 2 NC, 1NO/1NC, 4 NO, 4NC, 2 NO/2NC, 3NO/ 1NC, 1NO/3NC, Maximum Voltage = 250 VAC/VDC, Capacity = 1Amp (Continuous), VF = 2V, Imax (1 sec)= 7Amps.

› Ambient temperature: 0 to 40°C (up to 75°C with derating).

› Isolation between command and power: 2500V.

› Isolation between power/mass: 1500 V.

› Immunity to electromagnetic noise in the controller: Very high for models with AC controller power supply. High for models with AC/DC command power.

› Life cycle: Greater than 20 years or 200 million operations.

› TON (On delay): 20 mSec to simulate electromechanical contactor or 8 mSec (on request) for PWM controls.

› TOFF (Total shutdown time): 20 mSec in the normal version or 8 mSec in the PWM control version (upon request). TYPE SELECTION: To select a suitable model for your application, just follow a few simple rules:

Type Selection

To select a suitable model for your application, just follow a few simple rules:

› If your application is resistive loads or distribution, choose “N” model contactors, see pages 8 to 10.

› If your application is for direct starting of engines, with starting current of up to 7 times the rated(nominal) engine, without reversing the direction of rotation, choose the “HC” model, see pages 11 and 12.

› If your application is for direct motor/ engine starting, with a starting current of up to 7 times the motor nominal, with rotation direction reversal, choose the “HCR” model, see page 13.

› For application on any type of load with low service cycles or on the rotor of wound motors, choose models from the “HCL” line, see page 14

› For application in wound rotor (ring) motors, in the stator, the switching voltage must be the same as that of the mains and for the rotor, the switching voltage must be twice the nominal of the rotor, if the motor operates with reversing of rotation direction, and equal to nominal if the motor does not operate with rotation direction reversal.

› Select the table for your type of application as described above, and in the power columns, for your voltage, the number of HPs of your motor or your load in KW and locate the type indicated in the first column, on the left.

› Remember that this table is valid for ambient temperatures of up to 40°C. For higher temperatures it is necessary to consider the reduction of the working current according to the rule established later. See page 7.

› To correctly select the contactor, the three columns of the table must be considered: Maximum current (eg motor starting current), Average current (Thermal) taking into account the working cycle according to the formula or graph on the page 6.

Sizing

Direct method (Approximate)
It can always be used with resistive loads, or in the case of motors if the number of starts/hour is not too high. Locate in the table the nominal voltage and power in KW or in HP depending on the case and in the column on the left the contactor model.

Method of selection by average and maximum currents
This is the most correct selection method, as it takes into account the two limitations that must be considered, which are the maximum currents and the average (thermal) current that must be considered to avoid overheating the heatsink. To calculate the average current, it is necessary to know the working cycle for resistive loads and motors and the starting time, in the case of the motor. You can use the formula below or the graph on page 6.

By the Formula

$$I_{AVG} = \frac{((Ip \times Tp) + (In \times Tn))}{(Tp + Tn + Td)}$$

Ip = Inrush current

Tp = Start time (= 0 for resistance)

In = Current in nominal state

Tn = Time in nominal state

From the graph

In the graph on page 6, enter the working cycle on the horizontal axis.

$$CT\% = \frac{100 \times Ton}{(Ton + Toff)}$$

CT= working cicle

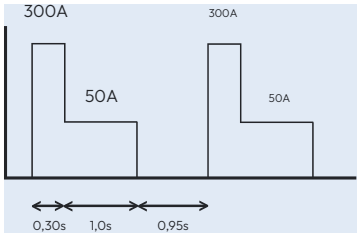
Ton = Tp + Tn = Start time + nominal.

Toff = off time.

Choose the curve corresponding to the **number of maneuvers/hour and departure time**. On the vertical axis is the multiplier that must be considered to find the average current. Multiply the number found by the rated load current at steady state to obtain the average load current. **Tmean = Tnominal x Factor.**

Example

Motor with direct start with 1600 starts/hour



Tp + Tn + Td = 2.25 sec.

Tp (300A) = 0.3 sec.

Tn (50A) = 1.0 sec.

Td (0 A) = 0.95 sec.

In = 50A.

Ip= 300A.

Average current by the formula:

I m = (0.3 x 300 + 1.0 x 50 + .95 x 0) / 2.25

Im = 62.22 A

Average current per graph:

Ct%= 100 x (0.3+1)/2.25 = 57.7%

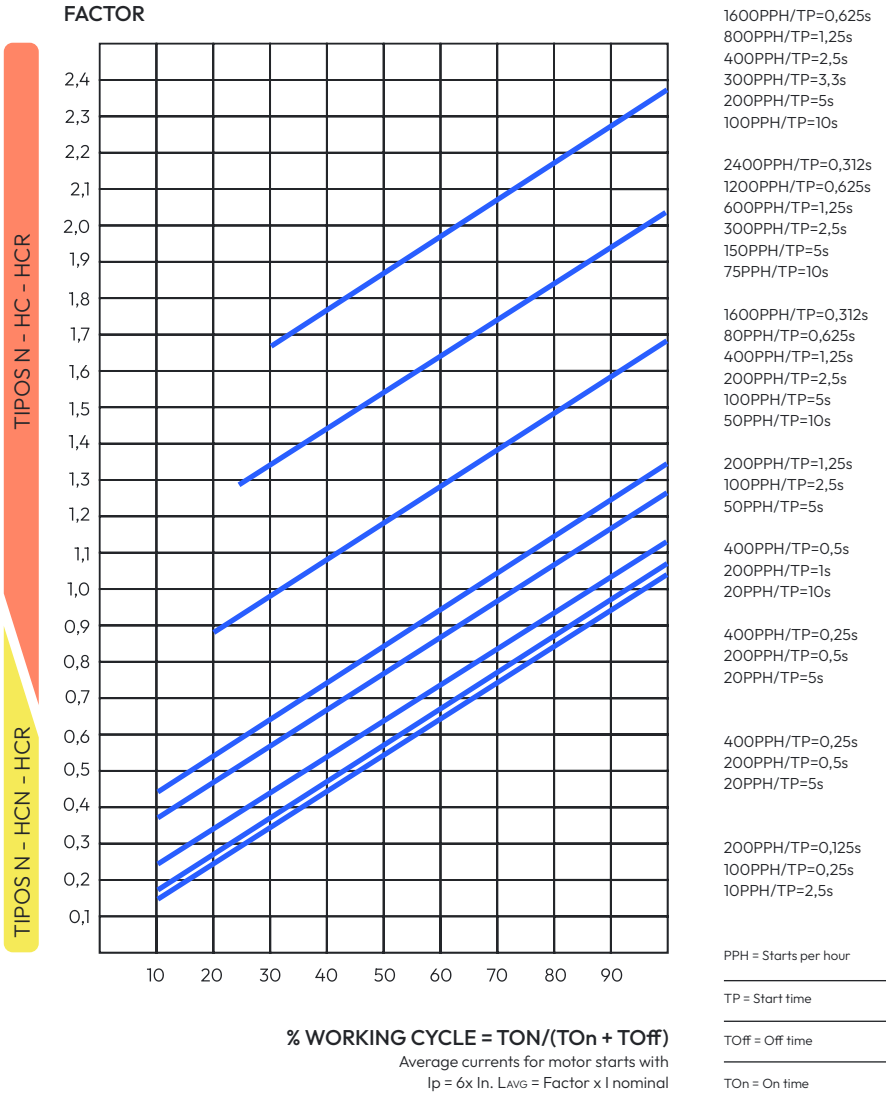
MH=3600/2.25 = 1600 Maneuvers/Hour.

Entering at 58% and for the 1600 MH curve and 0.325 sec starting time we would have Factor = 1.25 and Im= 1.25 xIn = 1.25 x 50

Im = 62.5 A

Chart to determine the average process current.

Multiply the factor found on the vertical axis by the load's rated current to get the average current.



We have to choose a contactor that has the maximum current equal to or greater than 300 Amperes and the same or greater average current than 62.5 Amps.

In this case, we can choose a contactor HC type, which has a maximum current well higher than average, being suitable for engine start.

The closest type would be the VCT75HC the which has a maximum current of 455 A and 68A average current

The dissipated power can be estimated multiplying the average current by 4.5 in three-phase systems, by 3 in two-phase and by 1.5 in single phase. In this case, the power dissipated is equal to 300W and the load is approximately (for 440 V Three phase): 50 x 440 x 1.73 x 0.9 = 34254 W.

It can be seen that the loss is approximately: 300 Watts against 34,000 Watts controlled for the load, being then equal to 0.8%, therefore being very little. However, provision should be made for ventilation in the panel where it is installed. In the case of many contactors in the same panel, it is necessary to foresee the replacement of the indoor air with fans. Graph for determining the average current of the process. Multiply the factor found on the vertical axis by the current rated load to obtain the average current.

Rule for determining Maximum Average Currents for ambient temperatures different from 40°c.

Obviously, thyristor equipment, dissipate a small amount of heat during operation, due to the drop in voltage upon the thyristors (Approximately 0.7% of the potency controlled). This heat needs to be transferred to the environment through sinks, which also serve as a base for thyristors. In this way, if the air surrounding is very warm this transfer loses efficiency and the temperature of the heatsinks can reach the switch-off point of 85°C.

Therefore, for hot environments above 40°C, it is necessary to oversize the SSC to improve heat transfer.

Thus, depending on the temperature environment, it can result that even a contactor normal type (not HC) can be used for starting motors, this if when analyzing the average and maximum contactor currents resulting after derating, the same are within the expected range for the engine in question.

Graph for determining the reduction (derating) or increase in average contactor current as a function of surrounding air temperature. Multiply the factor found on the vertical axis by the average current from the contactor table to obtain the new current maximum average at the temperature of use.

› The average current specified in the table is referred to 40°C. For every 1°C above 40°C and up to a maximum of 75°C, you must consider a decrease in current average of 2.8%.

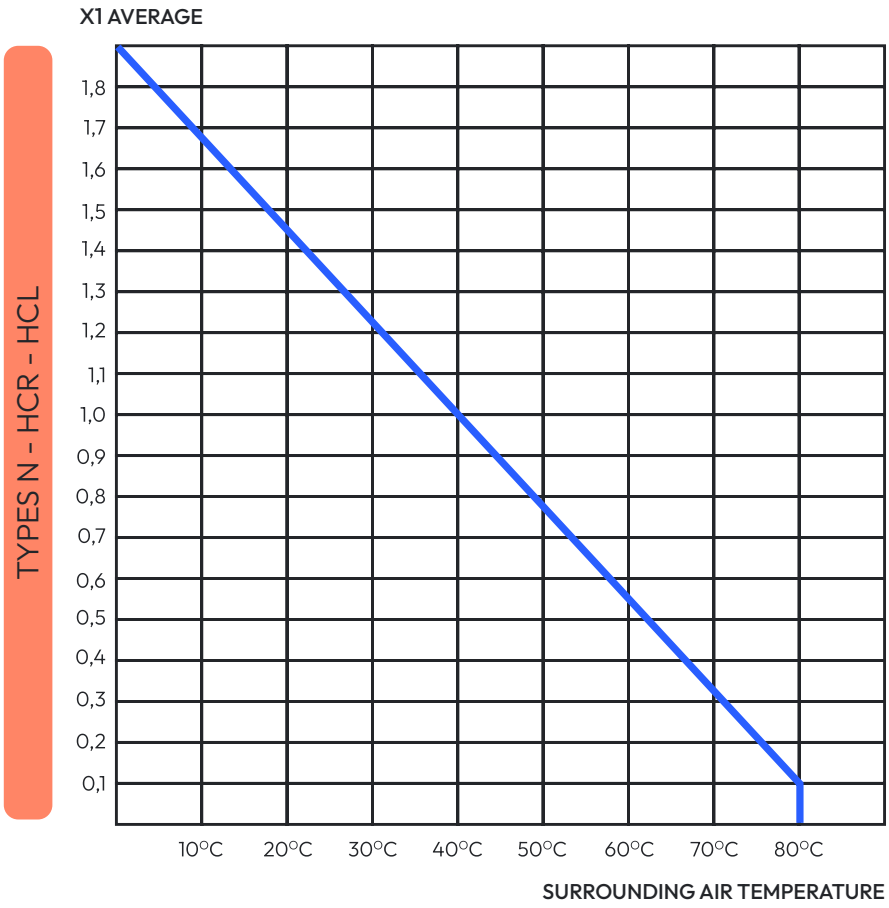
› The opposite is also valid and for lower temperatures can be consider an increase in the average current bearable by the contactor.

› To make it easier, see the curve on the side. The factor found must be multiplied by average current from the table to find the average current at actual temperature.

› Example: For the contactor found on the example above (VCT-75-HC) with air around 50°C we would find the factor of 0.8 The maximum average current would then be: Im(50°C) = Im x 0.8 = 68Ax 0.8 = 54A.

› If the surrounding air temperature were 20°C, we would have: Im(20°C) = Im x 1.4 = 68Ax 1.4 = 95.2A.

Then for the same contactor:
Im(20°C)= Im x 1.4 = 68A x 1.4 = 95A
Im(40°C)= Im x 1.0 = 68A x 1.0 = 68A
Im(50°C)= Im x 0.8 = 68A x 0.8 = 54A.



On the following pages along with the characteristic's tables can be found dimension tables.

It is important to note that the module control is Plug-in, being fitted in the upper part of the SSC, being easy to access and replacement, being the same, for the chosen version, is unique for the whole range of currents up to 2000 Amps, with just one control module in stock, to cover all SSC of the same type. the modules of thyristors are also easily replaceable.

TThe trigger modules are encapsulated, one for each phase, with optical isolation, which provides high reliability and high isolation between command and power and between phases. These modules also include protection against built-in dv/dt (snubber).

The drawings are not to scale, and you should observe the dimensions and tables to obtain the dimensions thereof.

› Single-phase Contactors Type N for resistive loads and distribution.

Type N (normal) contactors are suitable for resistive loads activation or distribution. Your selection is simple:

› Use the table on the side. Select on power column, for your voltage, the number of KWs of your load and obtain the model in the first column, completing the code with table information bottom.

› Remember that these tables apply to ambient temperatures up to 40°C. For higher temperatures is needed oversize the SSC according to the rule set out on page 7.

› Unlike HC models it is not need to worry about the number starts/hour, as resistive loads do not generate current peaks at startup

Note: On single-phase contactors up to 100A auxiliary contact combinations possible are only M00, M11, M20 and M02.

Single-phase Contactors N-Type (Normal)

Contactors for resistive load activation (AC1)

Complete with: (check out tabel) B* - Command Tension M** - Auxiliary Contacts D* - Fan Tension	Nominal Current (A)	Average Current (thermal) (A)	Maximum Current (5 sec) (A)	Maximum Power AC1 (kW)		
				220V	380V	440V
VCM-40-N-B*-M**-D0	40	32	87	8,8	15	17
VCM-50-N-B*-M**-D0	50	36	140	11	19	22
VCM-75-N-B*-M**-D0	75	50	227	16	28	32
VCM-100-N-B*-M**-D*	100	68	318	22	38	44
VCM-125-N-B*-M**-D*	125	105	318	27	47	54
VCM-150-N-B*-M**-D*	150	145	455	33	57	66
VCM-200-N-B*-M**-D*	200	170	455	44	76	88

Contactors higher than 200A and Direct Current Contactor on request.

Maximum voltage = 600VAC *Higher voltages available on request.

ADDITIONAL INFORMATION:

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Auxiliary contacts - Page 20
Selection Examples - Page 25
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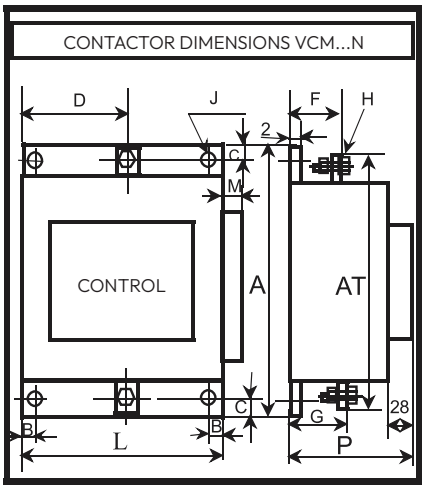
COMPLETE THE MODEL OF THE CONTACTOR ACCORDING TO THE INFORMATIONS BELOW:

Auxiliary contacts

M00 = 0NO/NC
M02 = 2NC
M04 = 4NC
M11 = 1NO + 1NC
M13 = 1NO + 3NC
M20 = 2NO
M22 = 2NO + 2NC
M31 = 3NO + 1NC
M40 = 4NO

Command Tensions:
B2 = 20 a 50 VAC/VDC
B3 = 100 a 240 VAC/VDC

Fan Tensions:
D1 = 110VAC
D2 = 220VAC



Contactor dimensions VCM Models – N-Type – Normal Single-phase

VCM Models...	Forced / Natural Ventilation	Length (L) mm	Height (A) mm	Depth (P) mm	Height (AT) mm	B mm	C mm	D mm	F mm	G mm	H mm	J mm	M mm
40N	N	100	145	166	177	10	5	50	103	103	M5	5	-
50N	N	100	145	166	177	10	5	50	103	103	M5	5	-
75N	N	100	200	250	200	10	7	50	186	186	M8	7	-
100N	F	100	200	250	200	10	7	50	186	186	M8	7	-
125N	F	100	200	250	200	10	7	50	186	186	M8	7	-
150N	F	150	200	250	200	10	7	75	190	190	M10	7	-
200N	F	150	200	250	200	10	7	75	190	190	M10	7	45

Single-phase contactors above 200A - On request

› N-Type Biphasic Contactors for resistive loads and distribution.

N-type (normal) two-phase contactors are suitable for load handling resistive or distribution. Your selection is simple:

› Use the table on the side. Select on power column, for your voltage, the number of KWs of your load and obtain the model in the first column, completing the code with table information bottom.

› Remember that these tables apply to ambient temperatures up to 40°C. For higher temperatures are needed on scale the SSC according to the rule established on page 7.

› Unlike HC models it is not need to worry about the number starts/hour, as resistive loads do not generate current peaks at startup.

Notes:

1 - In biphasic contactors of 20A, 25A and 30A, the auxiliary contact combinations possible are only M00, M11, M20 and M02.

2 - The 20A, 25A and 30A contactors are fully encapsulated.

Biphasic Contactors N-Type (Normal)

Contactors for resistive load activation: (AC1). Currents from 20A to 2000A

Complete with: (check out tabel) B* - Command Tension M** - Auxiliary Contacts D* - Fan Tension	Nominal Current (A)	Average Current (thermal) (A)	Maximum Current (5 sec) (A)	Maximum Power AC1 (kW)		
				220V	380V	440V
VCB-20-N-B*-M**-D0	20	12	65	8	13	16
VCB-25-N-B*-M**-D0	25	15	65	10	16	20
VCB-30-N-B*-M**-D0	30	22	65	12	20	24
VCB-40-N-B*-M**-D0	40	30	87	15	26	30
VCB-50-N-B*-M**-D0	50	40	140	19	33	38
VCB-75-N-B*-M**-D0	75	55	227	29	49	58
VCB-100-N-B*-M**-D*	100	100	318	38	65	75
VCB-125-N-B*-M**-D*	125	120	318	48	82	96
VCB-150-N-B*-M**-D*	150	140	455	58	98	115
VCB-200-N-B*-M**-D*	200	188	455	75	130	150
VCB-250-N-B*-M**-D*	250	250	560	95	160	190
VCB-300-N-B*-M**-D*	300	300	735	115	200	230
VCB-400-N-B*-M**-D*	400	345	735	150	260	300
VCB-500-N-B*-M**-D*	500	415	875	190	330	380
VCB-650-N-B*-M**-D*	650	485	1480	250	430	500

VCB-1000-N-B*-M**-D*	750	555	1480	285	490	570
VCB-1000-N-B*-M**-D*	1000	1000	2100	380	660	760
VCB-1250-N-B*-M**-D*	1250	1500	2660	475	820	950
VCB-1500-N-B*-M**-D*	1500	1700	3500	570	990	1140
VCB-1750-N-B*-M**-D*	1750	2000	3500	645	1120	1290
VCB-2000-N-B*-M**-D*	2000	2200	4200	760	1315	1520

Maximum voltage = 600VAC *Higher voltages available on request.

ADDITIONAL INFORMATION:

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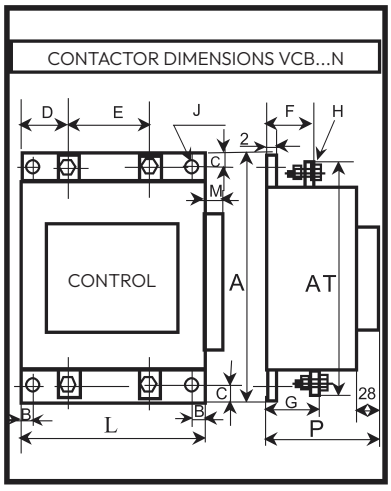
COMPLETE THE MODEL OF THE CONTACTOR ACCORDING TO THE INFORMATIONS BELOW:

Auxiliary contacts

M00 = 0NO/NC
M02 = 2NC
M04 = 4NC
M11 = 1NO + 1NC
M13 = 1NO + 3NC
M20 = 2NO
M22 = 2NO + 2NC
M31 = 3NO + 1NC
M40 = 4NO

Command Tensions:
B2 = 20 a 50 VAC/VDC
B3 = 100 a 240 VAC/VDC

Fan Tensions:
D1 = 110VAC
D2 = 220VAC



Contactor dimensions Modelos VCB – Tipo N – Bifásicos Normais

VCB Models...	Forced / Natural Ventilation	Length (L) mm	Height (A) mm	Profund. (P) mm	Height (AT) mm	B mm	C mm	D mm	E mm	F mm	G mm	H mm	J mm	M mm
20N	N	105	150	100	130	10	5	15	44	58	58	M5	5	-
25N	N	100	145	120	142	20	5	15	44	68	68	M5	5	-
30N	N	100	145	120	142	20	5	15	44	68	68	M5	5	-
40N	N	150	145	166	177	20	5	47	56	103	103	M5	6	-
50N	N	150	145	166	177	10	5	47	56	103	103	M5	6	-
75N	N	150	170	250	200	10	7	40	70	186	186	M8	7	-
100N	F	150	170	250	200	10	7	40	70	186	186	M8	7	45
125N	F	200	170	250	200	10	7	50	100	186	186	M8	7	45
150N	F	200	170	250	200	10	7	50	100	190	190	M10	7	45
200N	F	250	170	250	200	10	7	60	130	190	190	M10	7	45

250N	F	250	170	250	200	20	20	60	130	190	190	M10	7	45
300N	F	251	280	275	264	20	20	62	127	194	220	M10	9	-
400N	F	251	280	275	264	20	20	62	127	194	220	M10	9	-
500N	F	251	330	275	313	20	20	62	127	194	220	M10	9	-
650N	F	251	430	275	420	20	20	62	127	214	214	M12	9	-
750N	F	251	480	275	470	20	20	62	127	214	214	M12	9	-
1000N	F	370	700	300	710	12	12	92	178	89	226	M14	11	-
1250N	F	550	700	350	720	12	12	136	278	121	278	M16	11	-
1500N	F	550	800	350	820	12	12	136	278	121	278	M16	11	-
1750N	F	550	850	350	870	12	12	136	278	121	278	2xM14	11	-
2000N	F	550	950	350	970	12	12	136	278	121	278	2xM14	11	-

SIZING

› N-Type Three-Phase Contactors for resistive loads and distribution.

Type N (normal) three-phase contactors are suitable for load handling resistive or distribution. Your selection is simple:

› Use the table on the side. Select on power column, for your voltage, the number of KWs of your load and obtain the model in the first column, completing the code with table information bottom

› Remember that these tables apply to ambient temperatures up to 40°C. For Higher temperatures are needed on scale the SSC according to the rule set out on page 7.

› Unlike HC models it is not need to worry about the number starts/hour, as resistive loads do not generate current peaks at startup.

Note: On three-phase contactors of 20A, 25A and 30A auxiliary contact combinations possible are only M00, M11, M20 and M02.

Three-Phase Contactors N-Type (Normal)						
Contactors for resistive load activation: (AC1). Currents from 20A to 2000A						
Complete with: (check out tabel) B* - Command Tension M** - Auxiliary Contacts D* - Fan Tension	Nominal Current (A)	Average Current (thermal) (A)	Maximum Current (5 sec) (A)	Maximum Power AC1 (kW)		
				220V	380V	440V
VCT-20-N-B*-M**-D0	20	12	65	8	13	16

VCT-25-N-B*-M**-D0	25	15	65	10	16	20
VCT-30-N-B*-M**-D0	30	22	65	12	20	24
VCT-40-N-B*-M**-D0	40	30	87	15	26	30
VCT-50-N-B*-M**-D0	50	40	140	19	33	38
VCT-75-N-B*-M**-D0	75	55	227	29	49	58
VCT-100-N-B*-M**-D*	100	100	318	38	65	75
VCT-125-N-B*-M**-D*	125	120	318	48	82	96
VCT-150-N-B*-M**-D*	150	140	455	58	98	115
VCT-200-N-B*-M**-D*	200	188	455	75	130	150
VCT-250-N-B*-M**-D*	250	250	560	95	160	190
VCT-300-N-B*-M**-D*	300	300	735	115	200	230
VCT-400-N-B*-M**-D*	400	345	735	150	260	300
VCT-500-N-B*-M**-D*	500	415	875	190	330	380
VCT-650-N-B*-M**-D*	650	485	1480	250	430	500
VCT-750-N-B*-M**-D*	750	555	1480	285	490	570
VCT-1000-N-B*-M**-D*	1000	1000	2100	380	660	760
VCT-1250-N-B*-M**-D*	1250	1500	2660	475	820	950
VCT-1500-N-B*-M**-D*	1500	1700	3500	570	990	1140
VCT-1750-N-B*-M**-D*	1750	2000	3500	645	1120	1290
VCT-2000-N-B*-M**-D*	2000	2200	4200	760	1315	1520

Maximum voltage = 600VAC *Higher voltages available on request.

ADDITIONAL INFORMATION:

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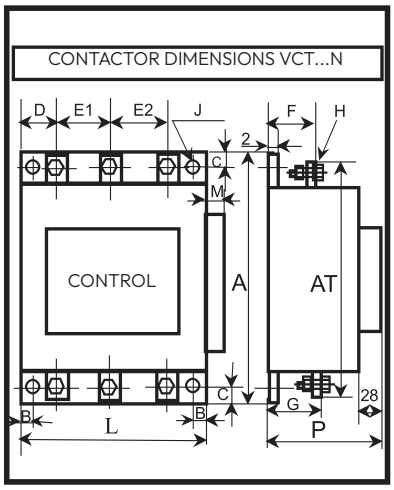
COMPLETE THE MODEL OF THE CONTACTOR ACCORDING TO THE INFORMATIONS BELOW:

Auxiliary contacts

M00 = 0NO/NC
M02 = 2NC
M04 = 4NC
M11 = 1NO + 1NC
M13 = 1NO + 3NC
M20 = 2NO
M22 = 2NO + 2NC
M31 = 3NO + 1NC
M40 = 4NO

Command Tensions:
B2 = 20 a 50 VAC/VDC
B3 = 100 a 240 VAC/VDC

Fan Tensions:
D1 = 110VAC
D2 = 220VAC



Contactor dimensions VCT Models – Tipo N – Trifásicos Normais															
VCM Models...	Forced / Natural Ventilation	Length (L) mm	Height (A) mm	Depth (P) mm	Height (AT) mm	B mm	C mm	D mm	E1 mm	E2 mm	F mm	G mm	H mm	J mm	M mm
20N	N	105	150	100	130	10	5	15	22	22	58	58	M5	5	-
25N	N	100	145	120	142	20	5	15	22	22	68	68	M5	5	-
30N	N	100	145	120	142	20	5	15	22	22	68	68	M5	5	-
40N	N	150	145	166	177	20	5	35	46	46	103	103	M5	6	-
50N	N	150	170	250	200	10	7	37	47	47	186	186	M5	7	-
75N	N	200	170	250	200	10	7	40	60	60	186	186	M8	7	-
100N	F	150	170	250	200	10	7	37	47	47	186	186	M8	7	45
125N	F	200	170	250	200	10	7	40	60	60	186	186	M8	7	45
150N	F	200	170	250	200	10	7	45	80	80	190	190	M10	7	45
200N	F	250	170	250	200	10	7	45	80	80	190	190	M10	7	45
250N	F	240	291	260	305	20	7	42	61	61	190	190	M10	7	-
300N	F	251	280	275	264	20	20	62	85	85	194	220	M10	9	-
400N	F	377	280	275	264	20	20	62	126	126	194	220	M10	9	-
500N	F	377	330	275	313	20	20	62	126	126	194	220	M10	9	-
650N	F	377	430	275	420	20	20	62	126	126	214	214	M12	9	-
750N	F	377	480	275	470	20	20	98	126	126	214	214	M12	9	-
1000N	F	540	700	300	710	12	12	130	172	172	89	226	M12	11	-
1250N	F	800	700	350	720	12	12	130	278	261	121	278	M14	11	-
1500N	F	800	800	350	820	12	12	130	278	261	121	278	M16	11	-
1750N	F	800	850	350	870	12	12	130	278	261	121	278	2XM14	11	-
2000N	F	800	950	350	970	12	12	130	278	261	121	278	2XM14	11	-

SIZING

> HC Type Biphasic Contactors (High Current) for engines.

The HC type two-phase contactors are suitable for starting motors in categories AC3/AC4 with one of the phases connected directly to the network. Your selection may be done directly by the table, taking into account the maximum and average currents as already described. The table also indicates, approximately, the model, from the motor power and voltage, for general applications

› Find in the power column, for your voltage, the number of HPs (1 HP = 0.746 KW) of your engine and obtain the model from first column on the left completing the code with table information below.

› If the average current in the present application, calculated as explained previously, is greater than the table prescribes, you must select a larger model, which supports it.

› This table is valid for temperatures environments up to 40°C. for higher temperatures it is necessary to oversize the SSC according to the rule established on the page 7.

› This table is valid for direct starting of motors, with starting current up to 7 times the motor rating.

HC Type Biphasic Contactors (High Current)

Contactors for motors activation AC3/AC4. Currents from 20A to 1250A

Complete with (check out table): B* - Command tension M** - Auxiliary contacts D* - Fan tension	Nominal Current (A)	Average Current (Thermal) (A)	Maximum Current (5sec) (A)	Maximum Power AC3/AC4 (HP)		
				220V	380V	440V
VCB-20-HC-B*-M**-D0	20	30	87	6	10	12
VCB-30-HC-B*-M**-D0	30	30	140	10	17	20
VCB-40-HC-B*-M**-D0	40	30	227	15	25	30
VCB-50-HC-B*-M**-D0	50	45	318	20	35	40
VCB-75-HC-B*-M**-D0	75	68	455	25	40	50
VCB-100-HC-B*-M**-D*	100	120	455	30	50	60
VCB-125-HC-B*-M**-D*	125	125	560	35	60	70
VCB-150-HC-B*-M**-D*	150	135	735	45	75	90
VCB-200-HC-B*-M**-D*	200	150	735	50	85	100
VCB-250-HC-B*-M**-D*	250	250	875	55	100	115
VCB-300-HC-B*-M**-D*	300	300	875	65	110	130
VCB-400-HC-B*-M**-D*	400	345	1480	100	170	200
VCB-500-HC-B*-M**-D*	500	415	1750	125	215	250
VCB-650-HC-B*-M**-D*	650	485	2660	175	300	350
VCB-750-HC-B*-M**-D*	750	840	3500	225	390	450
VCB-1000-HC-B*-M**-D*	1000	950	4200	275	470	550
VCB-1250-HC-B*-M**-D*	1250	1180	4900	325	560	650

Maximum voltage = 600VAC *Higher voltages available on request.

ADDITIONAL INFORMATION:

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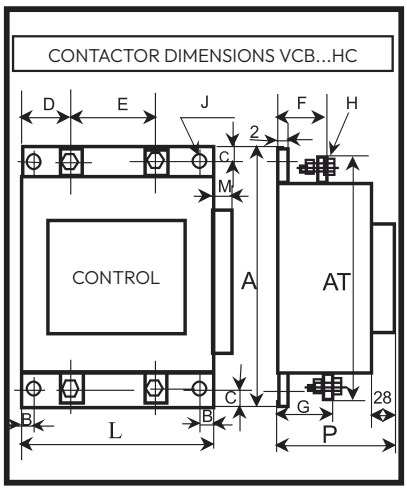
COMPLETE THE MODEL OF THE CONTACTOR ACCORDING TO THE INFORMATIONS BELOW:

Auxiliary contacts

M00 = 0NO/NC
M02 = 2NC
M04 = 4NC
M11 = 1NO + 1NC
M13 = 1NO + 3NC
M20 = 2NO
M22 = 2NO + 2NC
M31 = 3NO + 1NC
M40 = 4NO

Command Tensions:
B2 = 20 a 50 VAC/VDC
B3 = 100 a 240 VAC/VDC

Fan Tensions:
D1 = 110VAC
D2 = 220VAC



Contactor dimensions Modelos VCB – HC Type – Bifásicos Alta Corrente

VCB Models...	Forced / Natural Ventilation	Length (L) mm	Height (A) mm	Depth (P) mm	Height (AT) mm	B mm	C mm	D mm	E mm	F mm	G mm	H mm	J mm	M mm
20HC	N	150	145	166	177	20	5	47	56	103	103	M5	6	-
30HC	N	150	145	166	177	20	5	47	56	103	103	M5	6	-
40HC	N	150	145	166	177	20	5	47	56	103	103	M5	6	-
50HC	N	150	145	166	177	10	5	47	56	103	103	M5	6	-
75HC	N	150	170	250	200	10	7	40	70	190	190	M8	7	-
100HC	F	200	170	250	200	10	7	40	70	190	190	M8	7	-
125HC	F	200	170	250	200	10	7	50	100	190	190	M8	7	45
150HC	F	250	170	250	208	10	7	50	100	192	209	M10	7	45
200HC	F	250	170	260	208	20	10	60	130	192	209	M10	9	45
250HC	F	251	170	260	264	20	10	60	130	192	209	M10	9	45
300HC	F	251	280	275	264	20	10	62	127	194	220	M10	9	-
400HC	F	251	330	290	313	20	10	62	127	214	214	M12	9	-
500HC	F	251	380	290	374	20	10	62	127	214	214	M12	9	-
650HC	F	251	430	290	420	20	10	62	127	214	214	M12	9	-
750HC	F	370	500	280	510	12	12	92	178	89	226	M12	11	-
1000HC	F	370	550	280	560	12	12	92	178	89	226	M14	11	-
1250HC	F	370	650	280	660	12	12	192	171	89	226	M16	11	-

› Three-Phase Contactors Type HCR (High Current w/ Reversal) for motors

Three-phase HCR contactors are suitable for starting motors with reversal of the direction of rotation, in AC3/AC4 categories. Your selection can be made directly by the table taking into account counts the maximum and average currents as already described. The table also indicates approximately the model, based on engine power and voltage for common applications.

› Find in the power column, for your voltage, the number of HPs (1 HP = 0.746 KW) of your engine and obtain the model from first column on the left completing the code with table information below

› This table is valid for temperatures environments up to 40°C. for higher temperatures it is necessary to oversize the SSC according to the rule established on the page 7.

› Likewise, if the average current in the present application, calculated according to previously explained, is greater than the table prescribes, you must select a larger model that supports it

› This table is valid for direct starting of motors, with starting current up to 7 times the motor rating.

Three-Phase Contactors Type HCR (High Current w/ Reversal)

Contactors for motors activation AC3/AC4. Currents from 20A to 1250A

Complete with: (check out table) B* - Command Tension M** - Auxiliary Contacts D* - Fan Tension	Nominal Current (A)	Average Current (thermal) (A)	Maximum Current (5 sec) (A)	Maximum Power AC1 (kW)		
				220V	380V	440V
VCT-20-HCR-B*-M**-D0	20	30	87	6	10	12
VCT-30-HCR-B*-M**-D0	30	30	140	10	17	20
VCT-40-HCR-B*-M**-D0	40	30	227	15	25	30
VCT-50-HCR-B*-M**-D0	50	45	318	20	35	40
VCT-75-HCR-B*-M**-D0	75	68	455	25	40	50
VCT-100-HCR-B*-M**-D*	100	120	455	30	50	60
VCT-125-HCR-B*-M**-D*	125	125	560	35	60	70
VCT-150-HCR-B*-M**-D*	150	135	735	45	75	90
VCT-200-HCR-B*-M**-D*	200	150	735	50	85	100
VCT-250-HCR-B*-M**-D*	250	250	875	55	100	115
VCT-300-HCR-B*-M**-D*	300	300	875	65	110	130
VCT-400-HCR-B*-M**-D*	400	345	1480	100	170	200
VCT-500-HCR-B*-M**-D*	500	415	1750	125	215	250
VCT-650-HCR-B*-M**-D*	650	485	2660	175	300	350

VCT-750-HCR-B*-M**-D*	750	840	3500	225	390	450
VCT-1000-HCR-B*-M**-D*	1000	950	4200	275	470	550
VCT-1250-HCR-B*-M**-D*	1250	1180	4900	325	560	650

Maximum voltage = 600VAC *Higher voltages available on request.

ADDITIONAL INFORMATION:

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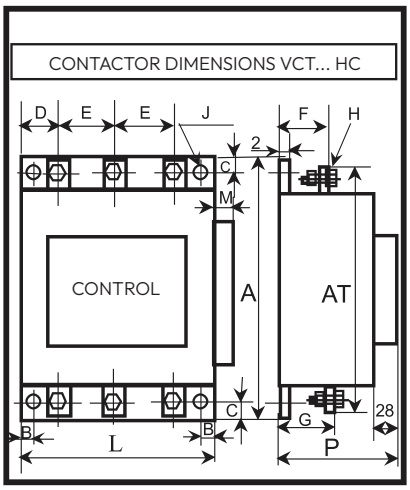
COMPLETE THE MODEL OF THE CONTACTOR ACCORDING TO THE INFORMATIONS BELOW:

Auxiliary contacts

M00 = 0NO/NC
M02 = 2NC
M04 = 4NC
M11 = 1NO + 1NC
M13 = 1NO + 3NC
M20 = 2NO
M22 = 2NO + 2NC
M31 = 3NO + 1NC
M40 = 4NO

Command Tensions:
B2 = 20 a 50 VAC/VDC
B3 = 100 a 240 VAC/VDC

Fan Tensions:
D1 = 110VAC
D2 = 220VAC



Contactor dimensions VCT Models – HC Type – Three-Phase Hight Current

VCT Models...	Forced / Natural Ventilation	Length (L) mm	Height (A) mm	Depth (P) mm	Height (AT) mm	B mm	C mm	D mm	E mm	F mm	G mm	H mm	J mm	M mm
20HC	N	150	145	166	177	20	5	35	46	103	103	M5	6	-
30HC	N	150	145	166	177	20	5	35	46	103	103	M5	6	-
40HC	N	150	145	166	177	20	5	35	46	103	103	M5	6	-
50HC	N	150	170	250	200	10	7	37	47	103	186	M5	7	-
75HC	N	200	170	250	200	10	7	40	60	186	190	M8	7	-
100HC	F	200	170	250	200	10	7	40	60	190	190	M8	7	45
125HC	F	200	170	250	200	10	7	40	60	190	190	M8	7	45
150HC	F	250	170	250	200	10	7	45	80	192	209	M10	7	45
200HC	F	251	280	275	264	20	10	40	85	194	220	M10	9	45
250HC	F	251	280	275	264	20	10	40	85	184	220	M10	9	45
300HC	F	251	280	275	264	20	10	40	85	194	220	M10	9	-
400HC	F	377	330	290	313	20	10	62	126	214	214	M12	9	-
500HC	F	377	340	330	374	20	10	62	126	214	214	M12	9	-

650HC	F	377	430	290	420	20	10	62	126	214	214	M12	9	-
750HC	F	540	500	280	510	12	12	92	178	89	226	M12	11	-
1000HC	F	540	550	280	560	12	12	92	178	89	226	M14	11	-
1250HC	F	540	650	280	660	12	12	92	171	89	226	M16	11	-

SIZING

› Three-phase contactors HCR Type (High Current w/ Reversal) for motors

The Light type allows space and weight savings in applications with low Working Cycle. It can be used in any application, including in acceleration stages of ring motors. The maximum currents of the HCL line are the same as the HC line, but with smaller average of currents dimensions.

Working Cycle or Service Mode is the relation of "On Time" (Ton) over "Total Cycle Time" (Ton + Toff), being valid for On Time (Ton) up to 5 minutes and in categories AC1, AC3 and AC4

› The selection can be made directly from the table, with the approximate working cycle for usual applications, or taking into account the maximum and average currents.

› The table is valid for direct start of motors, with starting current up to 7 times the rated motor and up to 40°C. For higher temperatures it is necessary to oversize the SSC according to the rule established on page 7.

› Find in the power column, for your voltage, the number of Hps (1 HP = 0.746 KW) of your motor and get the model on the left, completing the code with the information in the table below (check the working cycle).

› If you use the formulas or charts on page 6 to calculate the average current, the Working Cycle is already automatically considered, and there is no need to worry about its column.

Three-phase Contactors HCR Type (high Current w/ Reversal)

Contactors for motors activation AC3/AC4. Currents from 20A to 1250A

Complete with: (check out table) B* - Command Tension M** - Auxiliary Contacts D* - Fan Tension	Nominal Current (A)	Average Current (thermal) (A)	Maximum Current (5 sec) (A)	Maximum Power AC1 (kW)		
				220V	380V	440V
VCT-20-HCR-B*-M**-D0	20	30	87	6	10	12
VCT-30-HCR-B*-M**-D0	30	30	140	10	17	20
VCT-40-HCR-B*-M**-D0	40	30	227	15	25	30
VCT-50-HCR-B*-M**-D0	50	45	318	20	35	40
VCT-75-HCR-B*-M**-D0	75	68	455	25	40	50

VCT-100-HCR-B*-M**-D*	100	120	455	30	50	60
VCT-125-HCR-B*-M**-D*	125	125	560	35	60	70
VCT-150-HCR-B*-M**-D*	150	135	735	45	75	90
VCT-200-HCR-B*-M**-D*	200	150	735	50	85	100
VCT-250-HCR-B*-M**-D*	250	250	875	55	100	115
VCT-300-HCR-B*-M**-D*	300	300	875	65	110	130
VCT-400-HCR-B*-M**-D*	400	345	1480	100	170	200
VCT-500-HCR-B*-M**-D*	500	415	1750	125	215	250
VCT-650-HCR-B*-M**-D*	650	485	2660	175	300	350
VCT-750-HCR-B*-M**-D*	750	840	3500	225	390	450
VCT-1000-HCR-B*-M**-D*	1000	950	4200	275	470	550
VCT-1250-HCR-B*-M**-D*	1250	1180	4900	325	560	650

Auxiliary contact combinations are half for each direction of rotation

Maximum voltage = 600VAC *Higher voltages available on request.

ADDITIONAL INFORMATION:

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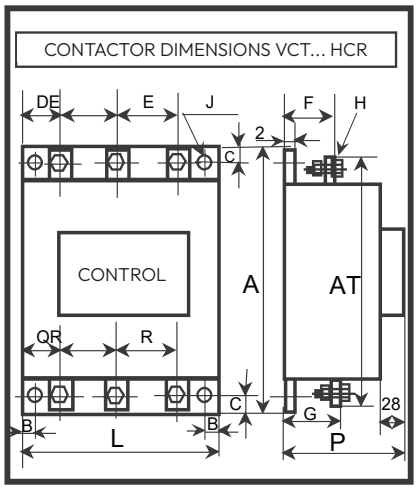
COMPLETE THE MODEL OF THE CONTACTOR ACCORDING TO THE INFORMATIONS BELOW:

Auxiliary contacts

M00 = 0NO/NC
M02 = 2NC
M04 = 4NC
M11 = 1NO + 1NC
M13 = 1NO + 3NC
M20 = 2NO
M22 = 2NO + 2NC
M31 = 3NO + 1NC
M40 = 4NO

Command Tensions:
B2 = 20 a 50 VAC/VDC
B3 = 100 a 240 VAC/VDC

Fan Tensions:
D1 = 110VAC
D2 = 220VAC



Contactor dimensions VCT Models – HCR Type – Three-Phase High Current

VCT Models...	Forced / Natural Ventilation	Length (L) mm	Height (A) mm	Depth (P) mm	Height (AT) mm	B mm	C mm	D mm	E mm	F mm	G mm	H mm	J mm	Q mm	R mm
15HCR	N	220	180	184	150	9	7	59	64	123	123	M5	6	59	64
20HCR	N	220	180	184	150	9	7	59	64	123	123	M5	6	59	64
30HCR	N	220	180	184	150	9	7	59	64	123	123	M5	6	59	64
40HCR	N	220	180	184	150	9	7	59	64	123	123	M5	6	59	64

50HCR	N	220	180	184	150	9	7	59	64	123	123	M5	6	59	64
75HCR	F	220	307	239	279	31	9	49	61	151	151	M6	7	49	61
100HCR	F	220	307	239	279	31	9	49	61	151	151	M6	7	49	61
125HCR	F	220	307	239	279	31	9	49	61	151	151	M6	7	49	61
150HCR	F	303	370	285	331	41	9	62	90	190	190	M8	9,5	62	90
200HCR	F	303	370	285	331	41	9	62	90	190	190	M8	9,5	62	90
250HCR	F	380	337	327	300	60	9	96	95	230	230	M8	9,5	96	95
300HCR	F	380	337	327	300	60	9	96	95	230	230	M8	9,5	96	95
400HCR	F	380	337	327	300	60	9	96	95	230	230	M10	9,5	96	95
500HCR	F	380	385	327	347	60	9	96	95	230	230	M10	9,5	96	95
650HCR	F	540	485	327	447	60	9	96	95	230	230	M10	9,5	96	95
750HCR	F	540	650	280	660	12	12	92	178	89	226	M12	11	98	178
1000HCR	F	540	700	280	710	12	12	92	178	89	226	M14	11	98	178
1250HCR	F	540	750	280	760	12	12	92	178	89	226	M16	11	98	178

SIZING

› Biphasic Contactors type HCL (High Current Light Line)

The Light type allows space and weight savings in applications with low Working Cycle. It can be used in any application, including in acceleration stages of ring motors. The maximum currents of the HCL line are the same as the HC line, but with smaller average of currents dimensions.

Working Cycle or Service Mode is the relation of "On Time" (Ton) over "Total Cycle Time" (Ton + Toff), being valid for On Time (Ton) up to 5 minutes and in categories AC1, AC3 and AC4.

› The selection can be made directly from the table, with the approximate working cycle for usual applications, or taking into account the maximum and average currents.

› The table is valid for direct start of motors, with starting current up to 7 times the rated motor and up to 40°C. For higher temperatures it is necessary to oversize the SSC according to the rule established on page 7.

› Find in the power column, for your voltage, the number of Hps (1 HP = 0.746 KW) of your motor and get the model on the left, completing the code with the information in the table below (check the working cycle).

› If you use the formulas or charts on page 6 to calculate the average current, the Working Cycle is already automatically considered, and there is no need to worry about its column.

Biphasic Contactors type HCL (High Current Light Line)

Biphasic High-Current light line Contactors are intended for starting inductive loads in AC3/AC4. Especially indicated for use in light working cycles or in acceleration circuits of ring motor rotors (Wound Rotor).

Complete with (check out table): B* - Command tension M** - Auxiliary contacts D* - Fan tension	Nominal Current (A)	Average Current (Thermal) (A)	Maximum Current (5sec) (A)	Working cycle (%)	Maximum Power AC1 (KW)		
					220V	380V	440V
VCB-10-HCL-B*-M**-D0	10	10	65	100	2	3	4
VCB-20-HCL-B*-M**-D0	20	10	87	50	6	10	12
VCB-30-HCL-B*-M**-D0	30	10	140	35	10	17	20
VCB-40-HCL-B*-M**-D0	40	30	227	75	15	25	30
VCB-50-HCL-B*-M**-D0	50	30	318	60	20	35	40
VCB-75-HCL-B*-M**-D*	75	60	455	80	25	40	50
VCB-100-HCL-B*-M**-D*	100	60	455	60	30	50	60
VCB-125-HCL-B*-M**-D*	125	60	560	50	35	60	70
VCB-150-HCL-B*-M**-D*	150	80	735	50	45	75	90
VCB-200-HCL-B*-M**-D*	200	80	735	40	50	85	100
VCB-250-HCL-B*-M**-D*	250	90	875	35	55	100	115
VCB-300-HCL-B*-M**-D*	300	90	875	30	65	110	130
VCB-400-HCL-B*-M**-D*	400	180	1480	45	100	170	200
VCB-500-HCL-B*-M**-D*	500	180	1750	35	125	215	250
VCB-650-HCL-B*-M**-D*	650	180	2660	27	175	300	350

Maximum voltage = 600VAC *Higher voltages available on request.

ADDITIONAL INFORMATION:

Main advantages - Page 04
Types Selection - Page 05
Auxiliary contacts - Page 20
Selection Examples - Page 25
Fuses - Page 21
Economy with SSC - Page 22

COMPLETE THE MODEL OF THE CONTACTOR ACCORDING TO THE INFORMATIONS BELOW:

Auxiliary contacts

M00 = 0NO/NC
M02 = 2NC
M04 = 4NC
M11 = 1NO + 1NC
M13 = 1NO + 3NC
M20 = 2NO
M22 = 2NO + 2NC
M31 = 3NO + 1NC
M40 = 4NO

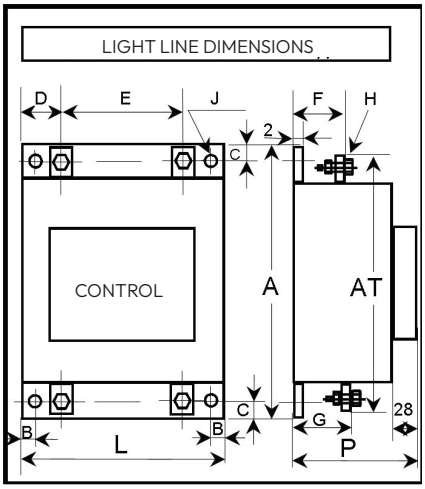
Command Tensions:
B2 = 20 a 50 VAC/VDC
B3 = 100 a 240 VAC/VDC

Fan Tensions:
D1 = 110VAC
D2 = 220VAC

Contactor dimensions Modelos VCB – HCL Type – Three-Phase High Current Light

VCB Models...	Forced / Natural Ventilation	Length (L) mm	Height (A) mm	Depth (P) mm	Height (AT) mm	B mm	C mm	D mm	E mm	F mm	G mm	H mm	J mm
10HCL	N	75	140	95	120	9	5	13	49	70	70	M5	6
20HCL	N	107	190	178	150	9	10	26	45	115	115	M5	6
30HCL	N	107	190	178	150	9	10	26	45	115	115	M5	6

40HCL	N	107	190	178	150	9	10	26	45	115	115	M5	6
50HCL	N	107	190	178	150	9	10	26	45	115	115	M5	6
75HCL	F	129	190	184	205	16	10	40	58	121	121	M8	7
100HCL	F	129	190	184	205	16	10	40	58	121	121	M8	7
125HCL	F	129	190	184	205	16	10	40	58	121	121	M8	7
150HCL	F	168	210	207	230	16	10	53	62	123	140	M10	7
200HCL	F	168	210	207	230	16	10	53	62	123	140	M10	7
250HCL	F	168	210	207	230	16	10	53	62	123	140	M10	7
300HCL	F	168	210	207	230	16	10	53	62	123	140	M10	7
400HCL	F	180	300	300	294	20	10	56	68	190	190	M12	9
500HCL	F	180	300	300	294	20	10	56	68	190	190	M12	9
650HCL	F	180	300	300	294	20	10	56	68	190	190	M12	9



SIZING

› Three-Phase Contactors HCL Type (High Current Light Line)

The Light type allows space and weight savings in applications with low Working Cycle. It can be used in any application, including in acceleration stages of ring motors. The maximum currents of the HCL line are the same as the HC line, but with smaller average of currents dimensions.

Working Cycle or Service Mode is the relation of "On Time" (Ton) over "Total Cycle Time" (Ton + Toff), being valid for On Time (Ton) up to 5 minutes and in categories AC1, AC3 and AC4.

› The selection can be made directly from the table, with the approximate working cycle for usual applications, or taking into account the maximum and average currents.

› Find in the power column, for your voltage, the number of Hps (1 HP = 0.746 kW) of your motor and get the model on the left, completing the code with the information in the table below (check the working cycle).

› The table is valid for direct start of motors, with starting current up to 7 times the rated motor and up to 40°C. For higher temperatures it is necessary to oversize the SSC according to the rule established on page 7.

› If you use the formulas or charts on page 6 to calculate the average current, the Working Cycle is already automatically considered, and there is no need to worry about its column.

Three-Phase Contactors HCL Type (High Current Light Line)

Three-Phase High-Current light line Contactors are intended for starting inductive loads in AC3/AC4. Especially indicated for use in light working cycles or in acceleration circuits of ring motor rotors (Wound Rotor).

Complete with (check out table): **B*** - Command tension **M**** - Auxiliary contacts **D*** - Fan tension	Nominal Current(A)	Average Current (Thermal) (A)	Maximum Current (5sec) (A)	Working cycle (%)	Maximum Power AC1 (KW)		
					220V	380V	440V
VCT-10-HCL-B*-M**-D0	10	15	65	100	2	3	4
VCT-20-HCL-B*-M**-D0	20	15	87	75	6	10	12
VCT-30-HCL-B*-M**-D0	30	15	140	50	10	17	20
VCT-40-HCL-B*-M**-D0	40	25	227	63	15	25	30
VCT-50-HCL-B*-M**-D0	50	25	318	50	20	35	40
VCT-75-HCL-B*-M**-D*	75	80	455	100	25	40	50
VCT-100-HCL-B*-M**-D*	100	80	455	80	30	50	60
VCT-125-HCL-B*-M**-D*	125	80	560	65	35	60	70
VCT-150-HCL-B*-M**-D*	150	110	735	70	45	75	90
VCT-200-HCL-B*-M**-D*	200	110	735	55	50	85	100
VCT-250-HCL-B*-M**-D*	250	110	875	50	55	100	115
VCT-300-HCL-B*-M**-D*	300	120	875	40	65	110	130
VCT-400-HCL-B*-M**-D*	400	300	1480	75	100	170	200
VCT-500-HCL-B*-M**-D*	500	300	1750	60	125	215	250
VCT-650-HCL-B*-M**-D*	650	300	2660	45	175	300	350

Maximum voltage = 600VAC *Higher voltages available on request.

ADDITIONAL INFORMATION:

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Types Selection - Page 05
Auxiliary contacts - Page 20
Selection Examples - Page 25
Fuses - Page 21
Economy with SSC - Page 22

COMPLETE THE MODEL OF THE CONTACTOR ACCORDING TO THE INFORMATIONS BELOW:

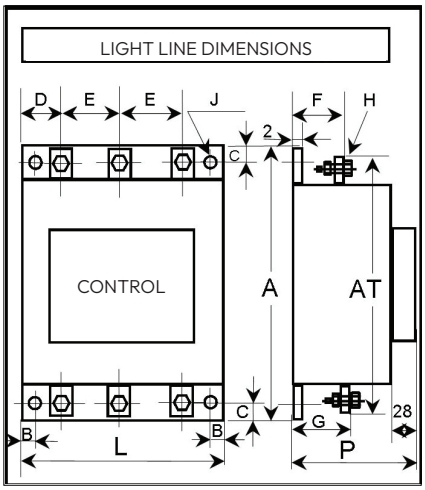
Auxiliary contacts

M00 = 0NO/NC
M02 = 2NC
M04 = 4NC
M11 = 1NO + 1NC
M13 = 1NO + 3NC
M20 = 2NO
M22 = 2NO + 2NC
M31 = 3NO + 1NC
M40 = 4NO

Command Tensions:
B2 = 20 a 50 VAC/VDC
B3 = 100 a 240 VAC/VDC

Fan Tensions:
D1 = 110VAC
D2 = 220VAC

Contactor dimensions VCT Models – HCL Type – Three-Phase High Current Light													
VCT Models...	Forced / Natural Ventilation	Length (L) mm	Height (A) mm	Profund. (P) mm	Height (AT) mm	B mm	C mm	D mm	E mm	F mm	G mm	H mm	J mm
10HCL	N	105	160	100	130	11	7,5	15	22	58	58	M5	6
20HCL	N	105	160	110	130	11	7,5	15	22	68	58	M5	6
30HCL	N	105	160	110	130	11	7,5	15	22	68	58	M5	6
40HCL	N	107	160	151	130	11	7,5	15	22	117	117	M5	6
50HCL	N	107	160	151	130	11	7,5	15	22	117	117	M5	6
75HCL	F	180	190	180	205	16	10	38	57	119	119	M8	7
100HCL	F	180	190	180	205	16	10	38	57	119	119	M8	7
125HCL	F	180	190	180	205	16	10	38	57	119	119	M8	7
150HCL	F	220	200	200	230	16	10	55	54	120	140	M10	7
200HCL	F	220	200	200	230	16	10	55	54	120	140	M10	7
250HCL	F	220	200	200	230	16	10	55	54	170	190	M10	7
300HCL	F	220	200	200	230	16	10	55	54	170	190	M10	7
400HCL	F	251	330	280	324	20	10	55	70	214	214	M12	9
500HCL	F	251	330	280	324	20	10	55	70	214	214	M12	9
650HCL	F	251	330	280	324	20	10	55	70	214	214	M12	9



SIZING

> Tetrapolar Contactors HCL Type (High Current Line Light)

The Light type allows space and weight savings in applications with low Working Cycle. It can be used in any application, including in acceleration stages of ring motors. The maximum currents of the HCL line are the same as the HC line, but with smaller average of currents dimensions.

Working Cycle is the relation of "On Time" (Ton) over "Total Cycle Time" (Ton + Toff), being valid for On Time (Ton) up to 5 minutes and in categories AC1, AC3 and AC4.

› The selection can be made directly from the table, with the approximate working cycle for usual applications, or taking into account the maximum and average currents.

› The table is valid for direct start of motors, with starting current up to 7 times the rated motor and up to 40°C. For higher temperatures it is necessary to oversize the SSC according to the rule established on page 7.

› Find in the power column, for your voltage, the number of Hps (1 HP = 0.746 kW) of your motor and get the model on the left, completing the code with the information in the table below (check the working cycle).

› If you use the formulas or charts on page 6 to calculate the average current, the Working Cycle is already automatically considered, and there is no need to worry about its column.

Tetrapolar Contactors HCL Type (High Current Line Light)

High-Current Light Line Tetrapolar Contactors are intended for starting inductive loads in AC3/AC4.
They are especially indicated for use in light working cycles or in acceleration circuits of ring motors (Wound Rotor).

Complete with (check out table): B* - Command tension M** - Auxiliary contacts D* - Fan tension	Nominal Current (A)	Average Current (Thermal) (A)	Maximum Current (5sec) (A)	Working Cycle (%)	Maximum Power AC1 (KW)		
					220V	380V	440V
VCP-20-HCL-B*-M**-D0	20	15	87	100	6	10	12
VCP-30-HCL-B*-M**-D0	30	15	140	65	10	17	20
VCP-40-HCL-B*-M**-D0	40	25	227	50	15	25	30
VCP-50-HCL-B*-M**-D0	50	25	318	40	20	35	40
VCP-75-HCL-B*-M**-D*	75	80	455	80	25	40	50
VCP-100-HCL-B*-M**-D*	100	80	455	60	30	50	60
VCP-125-HCL-B*-M**-D*	125	80	560	50	35	60	70
VCP-150-HCL-B*-M**-D*	150	110	735	45	45	75	90
VCP-200-HCL-B*-M**-D*	200	110	735	35	50	85	100
VCP-250-HCL-B*-M**-D*	250	110	875	30	55	100	115
VCP-300-HCL-B*-M**-D*	300	120	875	23	65	110	130
VCP-400-HCL-B*-M**-D*	400	300	1480	37	100	170	200
VCP-500-HCL-B*-M**-D*	500	300	1750	30	125	215	250
VCP-650-HCL-B*-M**-D*	650	300	2660	23	175	300	350

Maximum voltage = 600VAC *Higher voltages available on request.

ADDITIONAL INFORMATION:

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COMPLETE THE MODEL OF THE CONTACTOR ACCORDING TO THE INFORMATIONS BELOW:

Auxiliary contacts

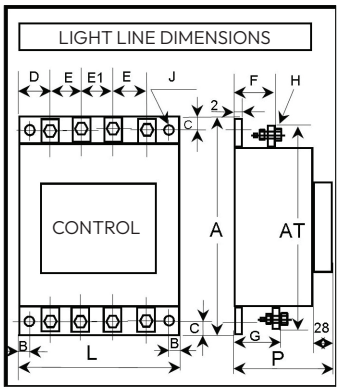
M00 = 0NO/NC
M02 = 2NC
M04 = 4NC
M11 = 1NO + 1NC
M13 = 1NO + 3NC
M20 = 2NO
M22 = 2NO + 2NC
M31 = 3NO + 1NC
M40 = 4NO

Command Tensions:
B2 = 20 a 50 VAC/VDC
B3 = 100 a 240 VAC/VDC

Fan Tensions:
D1 = 110VAC
D2 = 220VAC

Contactor dimensions VCP models – HCL Type – Tetrapolar High Current Light

VCP Models	Forced / Natural Ventilation	Length (L) mm	Height (A) mm	Depth (P) mm	Height (AT) mm	B mm	C mm	D mm	E mm	E1 mm	F mm	G mm	H mm	J mm
20HCL	N	192	170	180	150	16	5	26	45	45	119	119	M5	6
30HCL	N	192	170	180	150	16	5	26	45	45	119	119	M5	6
40HCL	N	192	170	180	150	16	5	26	45	45	119	119	M5	6
50HCL	N	192	170	180	150	16	5	26	45	45	119	119	M5	6
75HCL	F	220	220	180	235	16	10	26	50	50	119	119	M8	7
100HCL	F	220	220	180	235	16	10	26	50	50	119	119	M8	7
125HCL	F	220	220	180	235	16	10	26	50	50	119	119	M8	7
150HCL	F	220	240	200	260	16	10	30	53	53	120	140	M10	7
200HCL	F	220	240	200	260	16	10	30	53	53	120	140	M10	7
250HCL	F	220	240	250	260	16	10	30	53	53	170	190	M10	7
300HCL	F	220	240	250	260	16	10	30	53	53	170	190	M10	7
400HCL	F	251	330	280	324	20	10	34	62	62	214	214	M12	9
500HCL	F	251	330	280	324	20	10	34	62	62	214	214	M12	9
650HCL	F	251	330	280	324	20	10	34	62	62	214	214	M12	9



› Three-phase 8-pole HCR contactors (High current with reversion) for motors

The 8-pole HCR three-phase contactors are appropriate for starting motors with reversal of rotation direction, in the AC3/AC4 categories. They are indicated for overhead cranes systems where power limitation is required for hoisting.

Its selection can be made directly from the table, considering the maximum and average currents as already described. The table also indicates, approximately, the model, from the motor power and voltage, for usual applications.

› This table is valid for the direct starting of motors, with starting current up to 7 times the rated motor current.

› Find in the power column, for your voltage, the number of HPs (1 HP = 0.746 kW) of your motor and get the model in the first column on the left by completing the code with the information in the table below.

› This table applies to ambient temperatures. For higher temperatures it is necessary to oversize the SSC according to the rule established on page 7.

› Likewise, if the average current in the present application, calculated as explained above, is higher than the table prescribes, a larger model should be selected that will support it.

Three-phase 8-pole HCR contactors

Three-Phase High-Current Reversing Contactors for AC3/AC4 motor drives with Nominal Currents from 20 to 1250A

Complete with (check out table): B* - Command tension M** - Auxiliary contacts D* - Fan tension	Nominal Current(A)	Average Current (Thermal) (A)	Maximum Current (5sec) (A)	Maximum Power AC1 (KW)		
				220V	380V	440V
VCT-20-HCR-8P-B*-M**-D0	20	42	87	6	10	12
VCT-30-HCR-8P-B*-M**-D0	30	42	140	10	17	20
VCT-40-HCR-8P-B*-M**-D0	40	42	227	15	25	30
VCT-50-HCR-8P-B*-M**-D0	50	42	318	20	35	40
VCT-75-HCR-8P-B*-M**-D*	75	120	455	25	40	50
VCT-100-HCR-8P-B*-M**-D*	100	120	455	30	50	60
VCT-125-HCR-8P-B*-M**-D*	125	120	560	35	60	70
VCT-150-HCR-8P-B*-M**-D*	150	120	735	45	75	90
VCT-200-HCR-8P-B*-M**-D*	200	220	735	50	85	100
VCT-250-HCR-8P-B*-M**-D*	250	300	875	55	100	115
VCT-300-HCR-8P-B*-M**-D*	300	300	875	65	110	130

VCT-400-HCR-8P-B*-M**-D*	400	345	1480	100	170	200
VCT-500-HCR-8P-B*-M**-D*	500	415	1750	125	215	250
VCT-650-HCR-8P-B*-M**-D*	650	485	2660	175	300	350
VCT-750-HCR-8P-B*-M**-D*	750	840	3500	225	390	450
VCT-1000-HCR-8P-B*-M**-D*	1000	950	4200	275	470	550
VCT-1250-HCR-8P-B*-M**-D*	1250	1180	4900	325	560	650

Maximum voltage = 600VAC *Higher voltages available on request.

ADDITIONAL INFORMATION:

Main advantages - Page 04
Types Selection - Page 05
Auxiliary contacts - Page 20
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Economy with SSC - Page 22

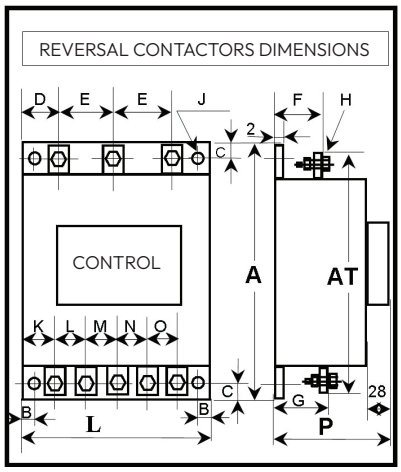
COMPLETE THE MODEL OF THE CONTACTOR ACCORDING TO THE INFORMATIONS BELOW:

Auxiliary contacts

M00 = 0NO/NC
M02 = 2NC
M04 = 4NC
M11 = 1NO + 1NC
M13 = 1NO + 3NC
M20 = 2NO
M22 = 2NO + 2NC
M31 = 3NO + 1NC
M40 = 4NO

Command Tensions:
B2 = 20 a 50 VAC/VDC
B3 = 100 a 240 VAC/VDC

Fan Tensions:
D1 = 110VAC
D2 = 220VAC



Contactor dimensions VCT Models – HCR Type - 8-Pole High Current (Overhead Crane Motors)

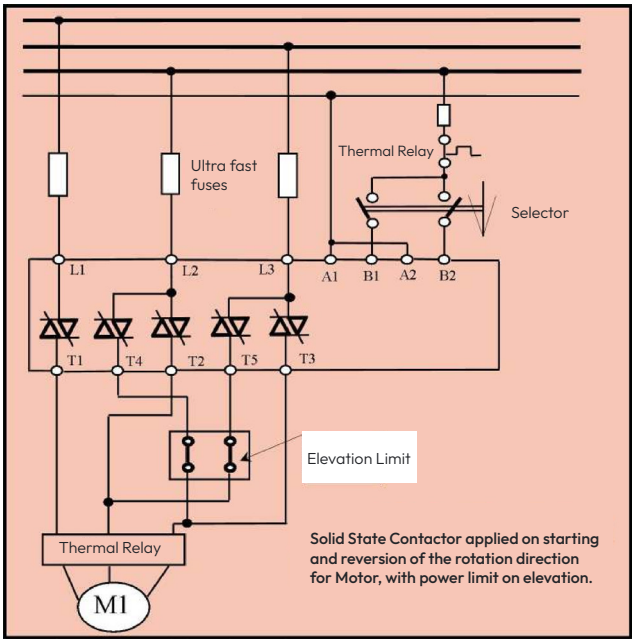
VCT Models...	Forced / Natural Ventilation	Length (L) mm	Height (A) mm	Depth (P) mm	Height (AT) mm	B mm	C mm	D mm	E mm	F mm	G mm	H mm	J mm	K mm	M mm	N mm	O mm
20HCR	N	220	145	166	177	20	5	34	66	103	103	M5	6	34	20	45	20
30HCR	N	220	145	166	177	20	5	34	66	103	103	M5	6	34	20	45	20
40HCR	N	220	145	166	177	20	5	34	66	103	103	M5	6	34	20	45	20
50HCR	N	220	145	166	177	20	5	34	66	103	103	M5	6	34	20	45	20
75HCR	N	251	260	270	270	20	10	36	90	188	191	M8	9	36	45	45	45
100HCR	N	251	260	270	270	20	10	36	90	188	191	M8	9	36	45	45	45
125HCR	N	251	260	270	270	20	10	36	90	188	191	M8	9	36	45	45	45
150HCR	N	377	240	280	280	20	10	60	126	194	213	M10	9	91	58	68	58
200HCR	F	377	280	280	280	20	10	62	126	194	213	M10	9	91	58	68	58
250HCR	F	377	330	280	280	20	10	62	126	194	213	M10	9	91	58	68	58
300HCR	F	377	330	280	280	20	10	62	126	194	213	M10	9	91	58	68	58

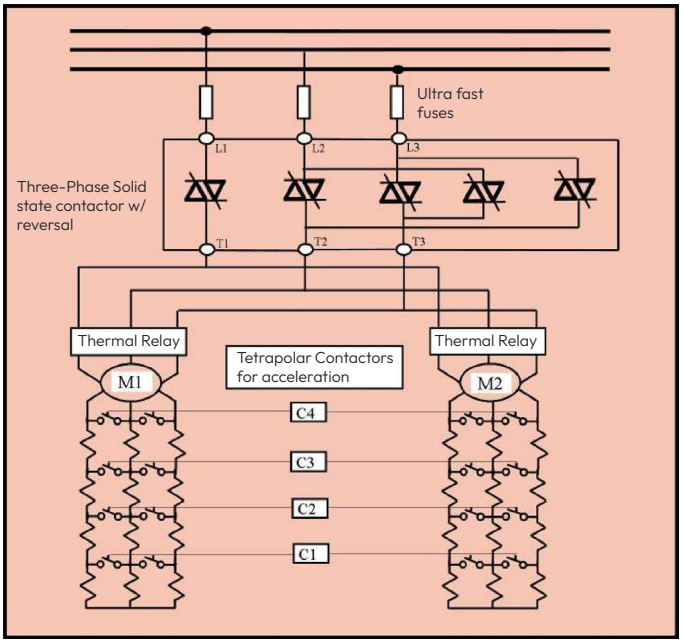
400HCR	F	377	330	290	290	20	10	62	126	214	214	M10	9	63	63	63	63
500HCR	F	377	380	290	290	20	10	62	126	214	214	M10	9	63	63	63	63
650HCR	F	377	430	290	290	20	10	62	126	214	214	M10	9	63	63	63	63
750HCR	F	540	650	300	300	12	12	92	178	89	240	M12	11	139	81	93	81
1000HCR	F	540	700	300	300	12	12	92	178	89	240	M14	11	139	81	93	81
1250HCR	F	540	750	300	300	12	12	92	178	89	240	M16	11	139	81	93	81

Application Examples

In the picture beside we have the control of a motor with reversion. A 5-output VCT...HCR contactor with internal reversion can be used. This contactor is used in a overhead crane that has a lifting power limit. Note that a differential thermal relay should also be used, in the same way as for a conventional contactor and ultra-fast fuses with appropriate i².t. Ultra-fast fuses are suitable for protecting thyristors in the event of a short circuit and are as common and inexpensive as delay fuses. On page 21 we present fuse tables from various manufacturers, for each contactor model with their i².t. Note that SSC can operate in AC4, with reversion during start-up or during rated rotation, therefore with "Coupling" braking.

In the second figure we see an application of a VCT-HCR contactor, in the stator of two motors and four-pole contactors for acceleration in the rotor of the ring motor, note that one four-pole contactor does the closing for two motors.

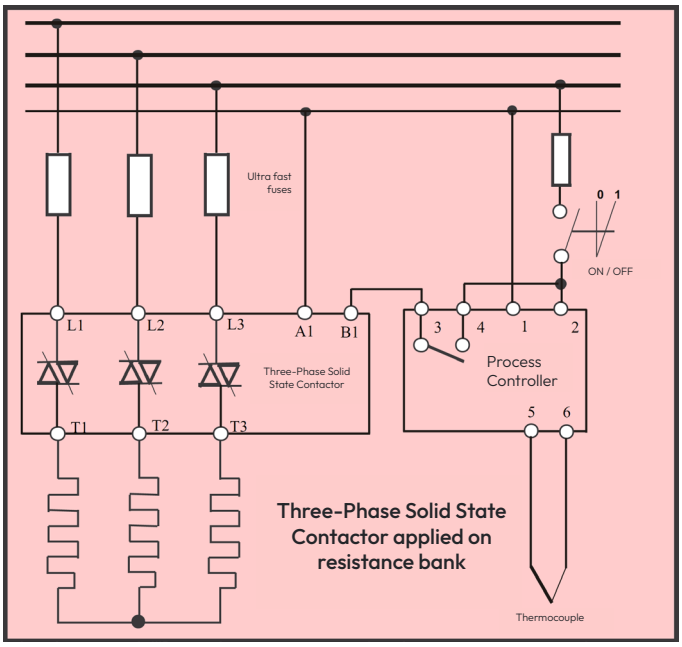


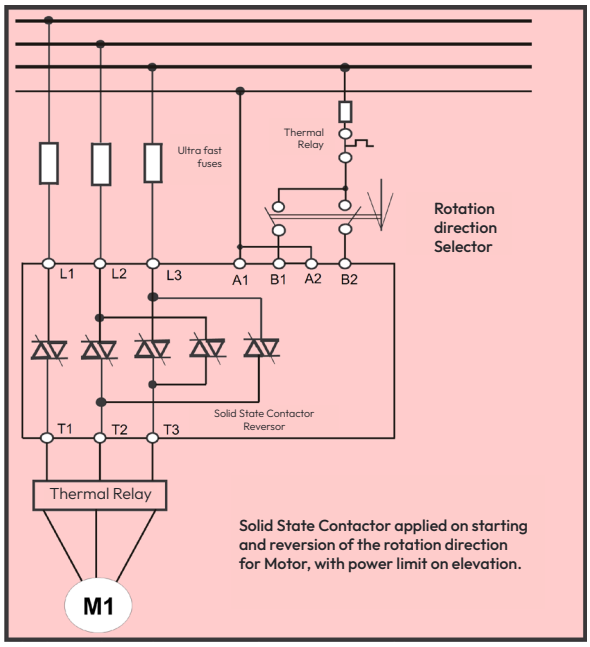


The application of SSC is as simple as for conventional contactors, as can be seen. In the picture on the right, for controlling a reversing motor, you can use a VCT...HCR contactor, which replaces two conventional contactors. Note that a thermal differential relay must also be used, in the same way as for a conventional contactor, and appropriate i2t ultra-fast fuses. Ultra-fast fuses are well suited for protecting thyristors in the event of a short circuit and are now as common and inexpensive as delay fuses. Note that SSC can operate in AC4, with

reversion during start-up or during nominal rotation.

In the second picture we see an application with resistive load of a VCT...N contactor with ON/OFF or PWM control. In this case only the ultra-fast fuses are required, and the thermal differential relay is not necessary (but it could also be used for overcurrent and unbalanced load protection).





› Command Modules

Varixx Solid State Contactors have various types of control modules, which can be seen in the corresponding table, and these modules perform the equivalent function of the contactor coil and in some cases of the corresponding auxiliary contacts.

› The modules do not need a power supply, just the command voltage as in a conventional contactor.

› SSC have a deliberate switch-on delay, so that it is possible to safely reverse the direction of rotation of motors.

› Models, on request, can be supplied with a shorter delay for use in PWM controllers.

› The control modules are interchangeable, with and without auxiliary contacts for VAC/VDC, for the user's best convenience of choice. Once the best option is chosen, the same control module serves the entire current range of a contactor of the same type, from 40A to 2000A.

› The nominal current of 1 Ampere, of the auxiliary contacts, is sufficient to activate any conventional contactor, auxiliary or not, since it supports peaks of up to 7 Amperes for 30 seconds. The supportable voltage is 250 VAC/VDC, all of them isolated and static.

Timing

› Upon command, the contactor switches on after a 20 mS delay just as in a conventional contactor.

› Withdrawing the command, the switch-off occurs in approximately 20 mS, also as in a conventional contactor

› Switching on always occurs by passing voltage zero, and switching off always by passing current zero, causing no noise, sparking, or transients.

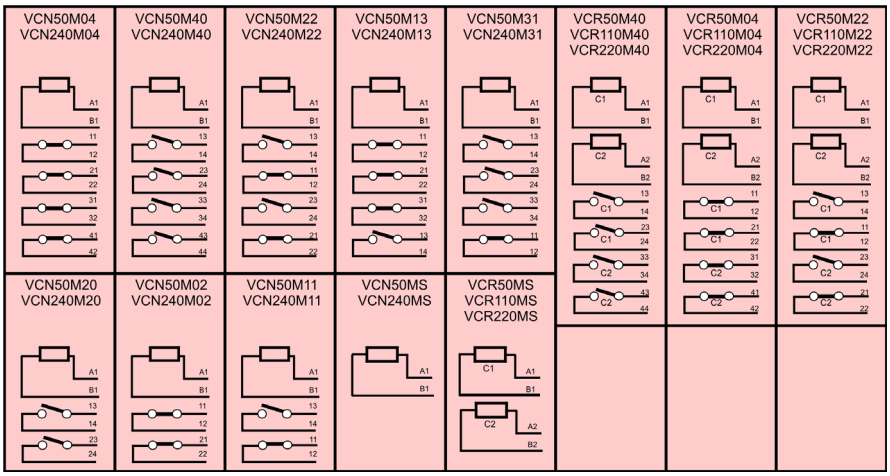
Auxiliary Contators

› In addition to the incorporated auxiliary contacts, optionally, in contactors above 30 Amperes, auxiliary contactors are also available, with 4 NO or NC auxiliary contacts in all combinations (no power contacts).

› Auxiliary contactors are for use on rails.

› The contacts are fully static and isolated from each other, from the power, and from the command.

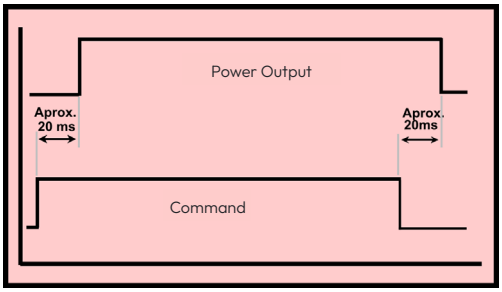
› Current Capacity: 1 Continuous Ampere, 7 Peak Amperes. Maximum voltage 250 VAC/VDC.



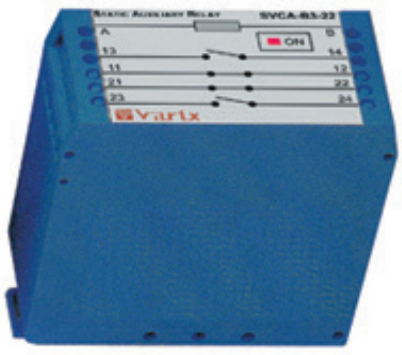
Auxiliary Contacts		
Complete model with:	NO Contacts	NC Contacts
VCA-M40-B*	4	0
VCA-M04-B*	0	4
VCA-M13-B*	1	3
VCA-M31-B*	3	1
VCA-M22-B*	2	2

* Command Tensions

B2 = 20 to 50 VAC/VDC
B3 = 100 to 240 VAC/VDC



TIMING



AUXILIARY STATIC CONTACTOR

› Ultra-fast fuses recommended for short circuit protection

In the adjacent table, some examples of recommended ultra-fast fuses from some manufacturers are listed.

› Fuses can be changed in their characteristics by their manufacturers at any time. Therefore, the user is responsible for the correct specification and for checking the characteristics with the manufacturer.

› When using fuses in parallel, the i2t should be multiplied by 4 and not by 2 as it might seem. Therefore, be careful when using fuses in parallel. Other brands may be used as long as the i2t is the recommended one.

› In the second column the i2t value of the contactors is being specified.

› For safe protection, the i2t values for fuses should be 20% smaller than for contactors

› Ultrafast fuses are now as common as lagging fuses, and almost as inexpensive. If delay fuses are used they will protect the system from a short circuit, but they will not adequately protect the contactor thyristors.

› The motor overcurrent protection must be maintained (thermal or overcurrent relays), since fuses only protect in the event of a short circuit and have no function in the event of small overcurrents.

PROTECTION	**Ultra fast fuses recommended for Contactores apllied on Resistive Loads** VCT...N / VCB...N / VCM...N Contactors																
Contactors Features	Siemens Fuses applied on Resistive Loads					TEE Fuses				Ferraz Fuses				Bussmann Fuses			
Model VCT...N	I2T (A2.S)	IN (A)	I2T (A2.S)	Model (Refer.)	Size	IN (A)	I2T (A2.S)	Model (Refer.)	Size	IN (A) (A)	I2T (A2.S)	Model (Refer.)	Size	IN (A)	I2T (A2.S)	Model (Refer.)	Size
20	510	25	200	5SD4-40	E27	25	150	25UD2750	E27	-	-	-	-	-	-	-	-
25	510	30	410	5SD4-80	E27	35	320	35UD3350	-	-	-	-	-	-	-	-	-
30	510	35	410	5SD4-50	E33	35	730	50UD3350	E33	-	-	-	-	-	-	-	-
40	1300	50	590	3NE4-217	1	50	810	50SP150N	1	50	470	6,9URD00PV0050	-	50	515	170M3159	1*
50	5000	63	1050	3NE4-218	1	63	1900	63SP150N	1	63	700	6,9URD1PV0063	1	63	770	170M3160	1*
75	9800	100	3980	3NE4-221	1	100	4410	100SP150N	1	100	570	6,9URD1PV0100	1	100	2450	170M3162	1*
100	9800	125	8060	3NE4-222	1	125	6900	125SP150N	1	125	3320	6,9URD1PV0125	1	125	3700	170M3163	1*
125	17100	160	15600	3NE4-224	1	160	9600	160SP150N	1	160	6270	6,9URD1PV0160	1	160	7500	170M3164	1*
150	84000	250	18700	3NE4-327	2	200	20000	200SP250N	2	250	8700	6,9URD2PV0250	2	250	21000	170M4159	1
200	84000	315	38200	3NE4-330	2	300	70000	300SP250N	2	315	6900	6,9URD2PV0315	2	315	42000	170M4160	1
250	97000	315	38200	3NE4-330	2	300	70000	300SP250N	2	400	2300	6,9URD2PV0400	2	350	59000	170M4161	1
300	168000	450	120000	3NE4-333	2	400	154000	400SP250N	2	450	13000	6,9URD2PV0450	2	450	105000	170M5159	2
400	245000	500	173000	3NE4-334	2	450	185000	450SP350N	3	500	47000	6,9URD2PV0500	2	500	145000	170M5160	2
500	320000	500	173000	3NE4-334	2	500	260000	500SP350N	3	560	6000	6,9URD2PV0560	2	550	190000	170M5161	2
650	781000	710	580000	3NE4-337	2	-	-	-	-	800	78000	6,9URD3PV0800	3	800	575000	170M5164	2
750	781000	-	-	-	-	-	-	-	-	900	66000	6,9URD3PV0900	3	900	840000	170M5165	2

1000	1800000	-	-	-	-	-	-	-	-	-	-	-	-	1100	1300000	170M6215	3
1250	2530000	-	-	-	-	-	-	-	-	-	-	-	-	1400	2450000	170M6217	3
1500	4500000	-	-	-	-	-	-	-	-	-	-	-	-	1600	3900000	170M6219	3
1750	4500000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
2000	4500000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0

PROTECTION

Ultra fast Fuses recomended for Contactors applied on Motors

VCT...HC / VCB...HC / VCT...HCR / VCT...HCL Contactors

Contactors Features		Siemens Fuses applied on Resistive Loads				TEE Fuses				Ferraz Fuses				Bussmann Fuses			
Model VCT...N	I2T (A2.S)	IN (A)	I2T (A2.S)	Model (Refer.)	Size	IN (A)	I2T (A2.S)	Model (Refer.)	Size	IN (A) (A)	I2T (A2.S)	Model (Refer.)	Size	IN (A)	I2T (A2.S)	Model (Refer.)	Size
10	510	20	95	5SD4-30	E27	20	100	20UD2750	E27	-	-	-	-	-	-	-	-
20	1300	50	590	3NE4-217	1	50	810	50SP150N	1	50	470	6,9URD00PV0050	0	50	515	170M3159	1*
30	5000	63	1050	3NE4-218	1	63	1900	63SP150N	1	63	700	6,9URD1PV0063	1	63	770	170M3160	1*
40	9800	100	3980	3NE4-221	1	100	4410	100SP150N	1	100	1570	6,9URD1PV0100	1	100	2450	170M3162	1*
50	17100	125	8060	3NE4-222	1	125	6900	125SP150N	1	125	3320	6,9URD1PV0125	1	125	3700	170M3163	1*
75	84000	160	15700	3NE4-224	1	160	14000	160SP155N	1	160	6270	6,9URD1PV0160	1	160	7500	170M3164	1*
100	97000	250	18500	3NE4-327	2	250	40000	250SP255N	2	250	18700	6,9URD2PV0250	2	250	21000	170M4159	1
125	97000	315	38200	3NE4-330	2	300	70000	300SP250N	2	315	36900	6,9URD2PV0315	2	315	42000	170M4160	1
150	168000	315	38200	3NE4-330	2	300	70000	300SP250N	2	400	72300	6,9URD2PV0400	2	350	59000	170M4161	1
200	168000	450	120000	3NE4-333	2	400	154000	400SP250N	2	450	113000	6,9URD2PV0450	2	450	105000	170M5159	2
250	245000	500	173000	3NE4-334	2	450	185000	450SP350N	3	500	147000	6,9URD2PV0500	2	500	145000	170M5160	2
300	245000	500	173000	3NE4-334	2	450	185000	450SP350N	3	500	147000	6,9URD2PV0500	2	500	145000	170M5160	2
400	781000	710	580000	3NE4-337	2	630	280000	630SP355N	3	700	478000	6,9URD2PV0700	2	630	275000	170M5162	2
500	1051000	-	-	-	-	-	-	-	-	800	478000	6,9URD3PV0800	3	800	465000	170M6812	3
650	1051000	-	-	-	-	-	-	-	-	900	666000	6,9URD3PV0900	3	900	670000	170M6813	3
750	1530000	-	-	-	-	-	-	-	-	1000	959000	6,9URD3PV1000	3	1100	1300000	170M6165	3
1000	2530000	-	-	-	-	-	-	-	-	-	-	-	-	1250	1950000	170M6166	3
1250	4500000	-	-	-	-	-	-	-	-	-	-	-	-	1500	3100000	170M6168	3

› Table of comparison between contactor types.

In the table to the right, the characteristics of Electromechanical, Vacuum, and Solid State contactors are being compared.

› Note in the “Electrical Life” column of the contactors in categories AC3 and AC4 that the value for SSC is infinitely higher than for Electromechanical or Vacuum.

› Another important data is the number of maneuvers per hour, which for SSC is up to 20000 against 900 and 2400 for the others, and the others if used at this frequency of maneuvers will have a very low useful life, around 1200 hours (1.1 million / 900) and 800 hours (2 million / 2400) respectively. The SSC, on the other hand, would last more than 10 years with 2000 maneuvers/hour.

› Also note that the coil consumption for SSC is 0.5 VA for any model, and for electromechanical models it can be as high as 1730 VA.

› As a disadvantage, SSC present higher power dissipation as a function of current, on the order of 0.7% of the controlled power for 440 VAC. The electromechanical ones, on the other hand, present low dissipation when new, however, this dissipation tends to increase with aging and wear of the contacts.

Comparison table between types of Contactors Electromechanical ,Vaccum and Solid State							
Nominal Current of Motors. (Amperes)	Vaccum	135A	160A	270A	320A	540A	610A
	Electromechanical	150A	185A	265A	330A	500A	630A
	Solid State	150A	200A	300A	400A	500A	650A
Motor Power 440V AC3** Category - (HP)	Vaccum	100	125	150	200	400	400
	Electromechanical	100	130	190	270	400	545
	Solid State	90	100	130	200	250	350
Motor Power 440V AC4** Category - (HP)	Vaccum	100	125	150	200	400	400
	Electromechanical	90	100	130	200	250	350
	Solid State	90	100	130	200	250	350
Eletrical Life of the Contactors on AC3** operating mode. (millions of maneuvers)	Vaccum	1,1	0,8	0,7	0,7	0,3	0,3
	Electromechanical	2	1,7	1,2	0,8	1,2	0,8
	Solid State	200	200	200	200	200	200
Eletrical Life of the Contactors on AC4** operating mode. (millions of maneuvers)	Vaccum	0,12	0,1	0,046	0,038	0,05	0,044
	Electromechanical	-	-	-	-	-	-
	Solid State	200	200	200	200	200	200
Mechanical Life of the Contactors. (millions of maneuvers)	Vaccum	-	-	-	-	-	-
	Electromechanical	10	10	10	10	10	10
	Solid State	200	200	200	200	200	200

Closing time (Make). (milisegundos)	Vaccum	22	22	32	32	32	32
	Electromechanical	35	35	65	65	75	80
	Solid State	35	35	35	35	35	35
Opening Time (Break). (miliseconds)	Vaccum	115	115	115	115	115	115
	Electromechanical	15	15	170	170	170	200
	Solid State	10	10	10	10	10	10
Coil Consumption. (VA)	Vaccum	-	-	-	-	-	-
	Electromechanical	660/55	970/66	700/10	1150/18	1150/20	1730/25
	Solid State	0,5	0,5	0,5	0,5	0,5	0,5
Maximum Room Temperature (C)	Vaccum	-10 a +75					
	Electromechanical	-40 a +75					
	Solid State	-40 a +75					
Dissipated power per pole. (watts)	Vaccum	-	-	-	-	-	-
	Electromechanical	19	12	22	31	45	48
	Solid State	110	140	200	240	300	450
Maximum altitude above the sea level. (meters)	Vaccum	3600					
	Electromechanical	3000					
	Solid State	4000*					
Maximum number of Cicles per hour. (cicles/hour)	Vaccum	900	900	900	900	900	900
	Electromechanical	2400	2400	2400	2400	2400	1200
	Solid State	20000	20000	20000	20000	20000	20000
Generates overvoltage at shutdown?	Vaccum	Yes					
	Electromechanical	Yes					
	Solid State	No					
Turns on at zero tension and turns off at zero current?	Vaccum	No					
	Electromechanical	No					
	Solid State	Yes					
Does it shows wear traces and necessity for periodic maintenance?	Vaccum	Yes					
	Electromechanical	Yes					
	Solid State	No					
Does it has a good functioning at harsh and dirty environments?	Vaccum	Yes					
	Electromechanical	No					
	Solid State	Yes					
Silent operation not causing Vibrations to the other components?	Vaccum	No					
	Electromechanical	No					
	Solid State	Yes					
Aproximated Cost (US$) Dollar	Vaccum	1328	1328	1670	1670	3545	3545
	Electromechanical	223	366	867	1189	1973	3060
	Solid State	1322	1640	1760	2507	2665	3048

* Altitude up to 4000 with IN reduction in 1% for each 100m over 1000m.

** AC3 operating mode; Command of squirrel cage asynchronous motors with motor shutting down in operating mode. The IC current interrupted in AC3 is equal to the Nominal Current absorved by the motor.

*** AC4 operating mode; Command of squirrel cage asynchronous motors with motor shutting down during start. The IC current interrupted in AC3 is equal to 6x the Nominal Current absorved by the motor.

> Comparison between eletromechanic contactors and solid state contactors

Case Study 1 - Overhead crane application according to customer information.

The table on the left compares the costs with solid-state and electromechanical contactors over a period of 10 years for a real case with 600 maneuvers per hour. Note in the table, that in this period 32 sets of auxiliary contacts and 04 electromechanical contactors are changed, and in the SSC there is no change of components.

In this period, with just one Varixx solid-state contactor you get savings of $27,914.00 for the 630A and $11,830.00 for the 300A without counting labor and production loss savings that can be much higher than this.

Comparison example between the Electromechanical Contactors and Solid State Contactors applied on Ring Motor Stator in Overhead Cranes (based on client information and catálogo de fabricantes).

Application features:

01 – Number of maneuvers per hour = 600

02 – Contact lifetime of the Electromechanical Contactors in this regime = 6 moths.

03 – Electromechanical Contactors lifetime in this regime = 5 years.

04 – Solid State Contactors lifetime = 20 years.

05 – Preventive maintenance frequency on the Eletromechanical Contactors = 15 days. (Verification of contact deterioration, retightening of connections, adjustments to the fixed and mobile contacts and substitution of the contacts if necessary).

06 – Preventive maintenance frequency on the Solid State Contactors = 90 days (retightening of connections and cleaning).

Expenses with Electromechanical Contactors of 630A in a period of 10 years		
Quantity	Price per Unit	Total Price
2 x 02 Contactors	US$ 6.221,00	US$ 12.442,00
32 sets of auxiliary Contacts	US$ 641,00	US$ 20.512,00
Total Cost =		US$ 32.954,00
Expenses with Solid State Contactors of 650A in a period of 10 years		
Quantity	Price per Unit	Preço Total
01 Reversing Contactor	US$ 5.040,00	US$ 5.040,00
Total Cost =		US$ 5.040,00

Obs: Economy of US$ 27.914,00 in 10 years for 01 Varixx contactor without taking into account labor and production loss.

Expenses with Electromechanical Contactors of 300A in a period of 10 years		
Quantity	Price per Unit	Total Price
2 x 02 Contactors	US$ 2.384,00	US$ 4.768,00
32 sets of auxiliary Contacts	US$ 315,00	US$ 10.080,00
Total Cost =		US$ 14.848,00
Expenses with Electromechanical Contactor of 300A in a period of 10 years		
Quantity	Price per Unit	Total Price
01 Reversing Contactor	US$ 3.018,00	US$ 3.018,00
Total Cost =		US$ 3.018,00

Obs: Economy of US$ 11.830,00 in 10 years for 01 Varixx contactor without taking into account labor and production loss.

> Comparison between eletromechanic contactors and solid state contactors

Case Study 2 - Apllication on steel companies according to client informations.

In the following table, the costs for solid-state and electromechanical contactors are compared over a period of 10 years for a real case. Note that in this period 100 sets of auxiliary contacts and 20 electromechanical contactors are changed, and in the SSC no components or contactors are changed.

In this period, with just one Varixx solid-state contactor you get savings of $52,322.00 for the 300A and $11,839.00 for the 150A without counting labor and production loss savings that can be much higher than this.

Comparison example between the Electromechanical Contactors and Solid State Contactors applied on Ring Motor Stator in Overhead Cranes (based on client information and catálogo de fabricantes).

Application features:

01 – Number of maneuvers per hour = 900

02 – Contact lifetime of the Electromechanical Contactors in this regime = 2 months.

03 – Electromechanical Contactors lifetime in this regime = 1 year.

04 – Solid State Contactors lifetime = 20 years.

05 – Preventive maintenance frequency on the Eletromechanical Contactors = 15 days. (Verification of contact deterioration, retightening of connections, adjustments to the fixed and mobile contacts and substitution of the contacts if necessary).

06 – Preventive maintenance frequency on the Solid State Contactors = 90 days (retightening of connections and cleaning).

Expenses with Electromechanical Contactors of 300A in a 10 year period		
Quantity	Price per Unit	Total Price
10 x 02 Contactors	US$ 2.384,00	US$ 23.840,00
10 sets of auxiliary Contacts	US$ 315,00	US$ 31.500,00
Total Cost =		**US$ 55.340,00**
Expenses with Solid State Contactors of 300A in a 10 year period		
Quantity	Price per Unit	Preço Total
01 Reversing Contactor	US$ 5.040,00	US$ 3.018,00
Total Cost =		**US$ 3.018,00**

Obs: Economy of US$ 52.332,00 in 10 years for 01 Varixx contactor without taking into account labor production loss.

Expenses with Electromechanical Contactors of 150A in a 10 year period		
Quantity	Price per Unit	Total Price
10 x 02 Contactors	US$ 446,00	US$ 4.460,00
100 sets of auxiliary Contacts	US$ 95,00	US$ 9.500,00
Total Cost =		**US$ 13.960,00**
Expenses with Solid State Contactors of 150A in a 10 year period		
Quantity	Price per Unit	Preço Total
01 Reversing Contactor	US$ 2.121,00	US$ 2.121,00
Total Cost =		**US$ 2.121,00**

Obs: Economy of US$ 11.839,00 in 10 years for 01 Varixx contactor without taking into account labor production loss.

CONTACTOR SELECTION EXAMPLES

> Selection tables for 55 °C and 65 °C.

The tables at the side can be used for simplified selection of two-phase contactors connected to three-phase loads or three-phase contactors. Note that the tables consider a 100% working cycle, that is, all the time connected. The choice by these tables is only a simplification, but the correct choice is to use the Working Cycle chart or formula as well as the temperature chart or formula on pages 6 and 7 respectively.

Choice by Temperatures of 55°C and 65°C
on AC1

Three-Phase and Biphasic Contactors N-Type for the activation of Resistive Loads on AC1.

Room Temperature		55 °C			65 °C		
To complete the model consult the corresponding page: Normal model contactor pages 8 and 9	Nominal Current (A)	Maximum Power AC1 - (KW)			Maximum Power AC1 – (KW)		
		220V	380V	440V	220V	380V	440V
VCT-20-N	20	5,2	8,5	10,4	3,6	5,8	7,2
VCT-25-N	25	6,5	10,4	13	4,5	7,2	9
VCT-30-N	30	7,8	13	15,6	5,4	9	10,8
VCT-40-N	40	9,7	16,9	19,5	6,7	11,7	13,5
VCT-50-N	50	12,3	21,5	24,7	8,5	14,8	17
VCT-75-N	75	19	32	38	13	22	26
VCT-100-N	100	25	42	49	17	29	34
VCT-125-N	125	31	53	62	21	37	43
VCT-150-N	150	38	64	75	26	44	52
VCT-200-N	200	49	84	97	34	58	67
VCT-250-N	250	62	104	123	43	72	85
VCT-300-N	300	75	130	149	52	90	103
VCT-400-N	400	97	169	195	67	117	135
VCT-500-N	500	123	214	247	85,5	148	171
VCT-650-N	650	162	279	325	112	193	225
VCT-750-N	750	185	318	370	128	220	256
VCT-1000-N	1000	580	429	494	171	297	342
VCT-1250-N	1250	309	533	617	214	369	427
VCT-1500-N	1500	370	643	741	256	445	513
VCT-1750-N	1750	419	728	838	290	504	580
VCT-2000-N	2000	494	855	998	342	592	684

Choice by Temperatures of 55°C and 65°C
on AC3 e AC4

Three-Phase and Biphasic Contactors HC and HCR Types for the activation of Motors on AC3/AC4.

Room Temperature		55 °C			65 °C		
To complete the model consult the corresponding page: HCN contactor - pages 10 / 11 HCR contactor - pages 12	Nominal Current (A)	Maximum Power AC3/AC4 (HP)			Maximum Power AC3/AC4 (HP)		
		220V	380V	440V	220V	380V	440V
VCT-20-A	20	3,9	6,5	7,8	2,7	4,5	5,4
VCT-30-A	30	6,5	11	13	4,5	7,6	9
VCT-40-A	40	9,7	16,5	19,5	6,7	11	13,5
VCT-50-A	50	13	22,7	26	9	15,7	18
VCT-75-A	75	16,5	26	32,5	11,2	18	22,5
VCT-100-A	100	19,5	32,5	39	13,5	22,5	27
VCT-125-A	125	23	39	45	16	27	31
VCT-150-A	150	29	49	58	20	34	40
VCT-200-A	200	32	56	65	22	38	45
VCT-250-A	250	36	65	75	25	45	52
VCT-300-A	300	42	71	84	29	49	58
VCT-400-A	400	65	110	84	45	76	90
VCT-500-A	500	81	139	162	56	97	112
VCT-650-A	650	115	195	227	79	135	157
VCT-750-A	750	146	253	292	101	175	202
VCT-1000-A	1000	178	305	357	123	211	247
VCT-1250-A	1250	221	364	422	146	252	292
VCT-1250-N	1250	309	533	617	214	369	427

Example 01

100HP, 800 Starts/Hour, 55 °C

1- Let's consider a 100 HP motor at 440 VAC, without reversion, with nominal current of 108 A, starting current of 650 A, and starting time of 0.625 seconds and 800 starts per hour, with a working cycle of 50% and surrounding air temperature of 55 °C.

2- From the temperature tables beside, the choice would be the VCT-500-HC

3- By the formula or chart on pages 5 and 6 we find the average current of the process, which is 129.5 A.

4- From the temperature chart on page 7, at 55 °C we see that the average contactor current should decrease by 35%, that is, it should be multiplied by 0.65. This is equivalent to increasing the average process current to 199 A = (129.5/ 0.65) to fit the table of choice for 40°C on page 10.

5- Therefore, we have to consider a maximum current of 650A and average current of 199A. In the table on page 10 we selected the VCT-300-HC contactor that supports an average current of 300A (above the 199A needed) and a maximum current of 875 A (above the 650 A needed) generating savings if we compare with the simple table choice that would be the 500 A contactor.

6- Final choice: VCT-300-HC

Reposition Parts for Normal Contactors (N) and High Current Contactors (HC)

Description	Model	Quantity used Three-Phase	Quantity used Biphasic
Thyristor	Thyristor	3	2
Control Module	See Page D14	1	1
Triggering Module	VDN-440V	3	2
Thermostat turns fan on	VR-N2-45-C1-P	*	*
Thermostat turns contactor off	VR-N1-90-C1-P	**	***
Fan	Consult	**	***

* Up to 75A, not used; over 75A = 1
** Up to 75A, not used; from 100 to 200A = 1; from 250 and 300A = 2; over 300A = 3
*** Up to 75A, not used; from 100A to 250A = 1; over 250A = 2

Reposition Parts for High Current Contactors W/ Reversal (HCR)

Description	Model	Quantity used
Thyristor	Consult	5
Control Module	See Page D14	1
Triggering Module	VDN-440V	4
Triggering Module	VDR-440V	1
Thermostat turns fan on	VR-N2-45-C1-P	*
Thermostat turns contactor off	VR-N1-90-C1-P	**
Fan	Consultar	***

* Up to 150A, not used; over 150A = 1
** Up to 150A, not used; over 150A = 6
*** Up to 150A, not used; over 150A = 3

Example 02

100HP, 800 Starts/Hour, 40 °C

1- Consider a 100 HP motor on 440 VAC, non-reversing, with rated current of 108 A, starting current of 650A, and starting time of 0.625 seconds and 800 starts per hour, with 50% working cycle and surrounding air temperature of 40°C.

2- From the tables on page 10, by direct choice, we would have the VCT-200-HC model.

3- Using the formula or graph on pages 5 and 6 we find the average current of the process, which is 129.5 A.

4- From the temperature chart on page 7, at 40°C we see that the average contactor current does not need to increase or decrease, that is, it must be multiplied by 1. The average process current is 129.5 A, therefore, to enter the choice table for 40°C on page 10.

5- We then have to consider a maximum current of 650 A and average current of 129 A. In the table on page 10 we selected the VCT-150-HC contactor that supports average current of 135 A (above the 129.5 A needed) and maximum current of 735 A (above the 650 A needed) generating, therefore, an economy if we compare with the choice by the table simply that would be the 200 A contactor.

6- Final choice: VCT-150-HC

Example 03 — 100HP, 200 Starts/Hour, 40 °C

1- Let's consider the same 100 HP motor at 440 VAC, without reversion, with nominal current of 108 A, starting current of 650 A, and starting time of 0.6 seconds and 200 starts per hour, with a working cycle of 25% and surrounding air temperature of 40°C.

2- From the tables on page 10, by direct choice we would have the VCT-200-HC model.

3- Using the formula or graph on pages 5 and 6 we find the average current of the process, which is 45 A.

4- From the temperature chart on page 7, at 40°C we see that the average contactor current need not increase or decrease, that is, it must be multiplied by 1. The average process current is 45 A. Therefore, to enter the choice table for 40°C.

5- Since the average current is low, we can select a contactor from the Light line in the table on page 14. Then, we have to consider a maximum current of 650 A and average current of 45 A. In the table on page 14 we select the VCT-150-HCL contactor that supports an average current of 48 A (above the 45 A needed) and a maximum current of 735 A (above the 650 A needed) generating, therefore, an economy in cost, size and weight if we compare with the choice by the table simply that would be the VCT-200-HCL contactor.

6- Final choice: VCT-150-HCL.

Example 04 — Ring motor rotor, 600 P/H, 40 °C.

1- Let's consider a contactor in one of the acceleration stages of a motor, with rotor current in the stage of 90 A, stage time 1 second, and 600 starts per hour, and surrounding air temperature of 40°C.

2- Therefore, the work cycle is: 1 / (3600 / 600) = 16,6 %. 3- Using the formula or graph on pages 5 and 6 we find the average process current, which is 15 A.

3- Using the formula or graph on pages 5 and 6 we find the average current of the process, which is 15 A.

4- From the temperature chart on page 7, at 40°C, we see that the average contactor current does not need to increase or decrease, that is, it must be multiplied by 1. Therefore, to enter the choice table for 40°C, the average process current is 15 A.

5- As the average current is low, we can select a contactor from the Light line in the table on page 14. Then, we have to consider a maximum current of 100 A and average current of 15 A. In the table on page 14 we selected the VCT-30-HCL contactor that supports an average current of 15 A (equal to the 15 A needed) and a maximum current of 140 A (above the 90 A needed).

6- Choice: VCT-30-HCL.