1. Description

The medium voltage V-Contact VSC contactors are pieces of apparatus suitable for operating in alternating current and are normally used to control users requiring a high number of hourly operations.

The basic contactors consist of:

- moulded polyester resin monobloc containing the vacuum interrupters
- bistable electromagnet actuator
- multi-voltage feeders
- auxiliary contacts
- mechanical status indicator (open/closed)
- manual emergency opening device.

Apart from what is specified for the fixed contactors, the withdrawable contactors also consist of:

- fuseholders preset for DIN or BS fuses (according to the customer's requirements)
- automatic opening device for intervention of even a single fuse
- truck
- lock which prevents closing during the racking-in/out operation.

The V-Contact VSC contactor introduces the drive with permanent magnets - already widely used, experimented and appreciated in medium voltage circuit-breakers - into the worldwide panorama of medium voltage contactors.
The experience acquired by ABB in the field of medium voltage circuit-breakers fitted with drives with "MABS" permanent magnets, has made it possible to develop an optimised version of the actuator (Bistable MAC drive) for medium voltage contactors.

The drive is operated by means of an electronic feeder able to cover all the power supply voltages required by the major international Standards.

1.1. "MAC" magnetic drive

Based on the experience gained in the field of circuit-breakers with magnetic drive, ABB has implemented this technology in the field of contactors.

The magnetic drive adapts perfectly to this type of apparatus thanks to its precise and linear travel.

This means that a simple and direct axial transmission of the movement to the moving contacts of the vacuum interrupter can be realised, with both electrical and mechanical benefits.

The drive, which is of bistable type, is fitted with an opening and a closing coil.

The two coils - individually energised - allow the drive core to be moved from one of the two stable positions to the other.

The drive shaft is solid with an iron core which is immersed and held in position in a field generated by two permanent magnets (fig. A).

Energising the coil opposite to the magnetic latching position (fig. A) of the core, the magnetic field (fig. B) is generated, which attracts and moves the core into the opposite position (fig. C).

Every opening and closing operation creates a magnetic field concordant with the one generated by the permanent magnets, with the advantage, during service, of keeping the intensity of the field itself constant as the number of operations carried out increases.

The energy needed for operation is not supplied directly by the auxiliary power supply, but is always "stored" in the capacitor which acts as an energy accumulator, and therefore operation always takes place with constant speeds and times, regardless of the divergence of the power supply voltage from the rated value.

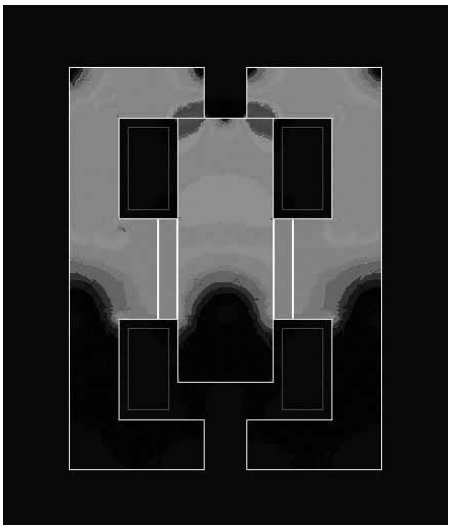

Fig. A
Magnetic circuit in the closed position.

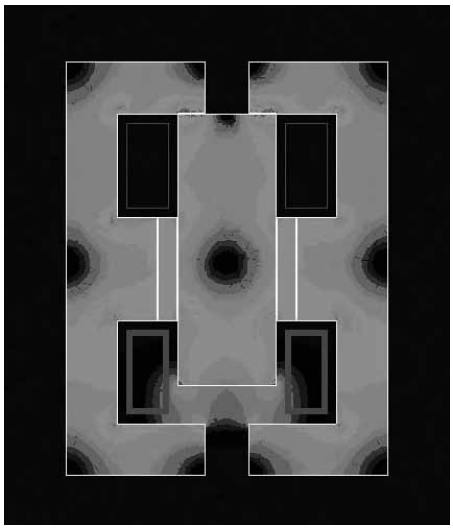

Fig. B
Magnetic circuit with opening coil supplied.

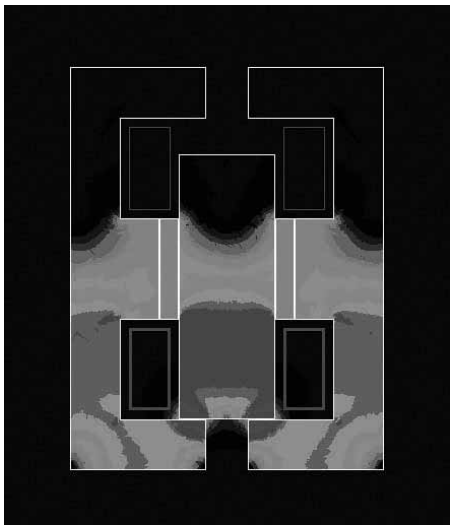

Fig. C
Magnetic circuit in the open position.

The auxiliary power supply only has the aim of keeping the capacitor charged.
Consumption is therefore minimal.

The power required by the electronic device is indicated in the table below:

Power supply voltage	Starting (1)		After closing	After opening	Continuous power consumption
	Inrush for 2 ms	Inrush for 6 sec	Inrush for 1.2 sec	Inrush for 1.2 sec	
24...60 V cc 110...250 V cc	42 A (2)	35 W	25 W	30 W	5 W
110...250 V ac					

(1) This value refers to a discharged capacitor.
(2) The value drops to 8 A for voltage values between 24...30V

Supply from voltage transformer or from UPS (Uninterrupted Power System) not available.
Use the ABB S282UC-C3 thermal-magnetic circuit-breaker or an equivalent type to protect the secondary circuits.
After powering, the electronic board takes 15 seconds to perform self-diagnosis and then prepares for normal operation, depending on the configuration. Do not operate the contactor during this phase. Contact DO1 will remain open, signal “not ready” and will only close after self-diagnosis has terminated (“ready” state).

Careful selection of the components and a precise design make the electronic multi-voltage feeder extremely reliable, unaffected by electromagnetic interference generated by the surrounding environment and free of any emissions which may affect other apparatus placed in the vicinity.

These characteristics have made it possible for the V-Contact VSC contactors to pass the electromagnetic compatibility tests (EMC).

1.2. Versions available

The V-Contact VSC are available in:
– fixed version without fuseholder
– fixed versions with fuseholder: VSC/F e VSC/FN.
– four withdrawable versions with fuseholder:
  - VSC/P (IEC) and VSC/PG or VSC-S/PG (IEC/GB-DL) withdrawable versions for UniGear, PowerCube, CBE and PowerBloc with manual or motorized truck
  - VSC/PN (IEC) and VSC/PG or VSC-S/PNG (IEC/GB-DL) both versions withdrawable for UniGear MCC with manual truck.

1.3. Characteristics

Contactor		Reference IEC 62271-106	VSC7 VSC7/F (1) VSC7/P (1) VSC7/PN (1) VSC7/FN	VSC12 VSC12/F (1) VSC12/P (1) VSC12/PN (1)
Rated voltage	[kV]	4.1	7.2	12
Rated insulation voltage				
Withstand voltage at 50 Hz	[kV]	6.2	23	28
Impulse withstand voltage	[kVbil]	6.2	60	75
Rated frequency	[Hz]	4.3	50-60	50-60
Rated service current	[A]	4.101	400	400
Short-time withstand current				
Short-time withstand current for 1 s	[A]	6.6	6,000	6,000
Short-time withstand current for 2 s	[A]			
Short-time withstand current for 4 s	[A]			
Short-time withstand current for 30 s	[A]	6.6	2,500	2,500
Rated peak current	[kA]	6.6	15	15
Rated values				
Operations / hour (SCO - DCO)	[Nr.]	4.102.4	1.200	1,200
Rated voltage of the voltage characteristics in category of use				
(Category AC4) 100 closing operations	[kA]	6.102.4	4,000	4,000
(Category AC4) 25 opening operations	[kA]	6.102.5	4,000	4,000
Switching devices and auxiliary circuits		4.8, 4.9		
Feeder 1 24÷60 V dc basic			●	●
Feeder 2 24÷60 V dc full option			●	●
Feeder 3 110÷250 V dc/ac basic			●	●
Feeder 4 110÷250 V dc/ac full option			●	●
Normal current	[A]	6.4.6.5	400	400
Mechanical life	[Nr.]	6.101	1,000,000 (2)	1,000,000 (2)
Short-circuit breaking capacity (O-3min-CO-3min-CO)	[A]	6.104	5,000	5,000
Short-circuit making capacity (O-3min-CO-3min-CO)	[A]	6.104	13,000	13,000
Opening time	[ms]		35...60	35...60
Closing time	[ms]		60...90	60...90
Tropicalisation	IEC 721-2-1		●	●

(1) It is possible to combine current limiting fuses with breaking capacity up to 50 kA (IEC 62271-106 - 4.107) - Damage classification "C" (IEC 62271-106 - 4.107.3).
(2) With replacement of auxiliary contacts every 250,000 closing-opening operations.
(3) 42 kV for fixed versions and in dedicated Unigear switchgear

1.4. Weights and overall dimensions

Contactor			VSC7	VSC12 VSC-S/G	VSC7/F	VSC7/FN	VSC12/F VSC-S/F
Weight		[Kg]	23	23	35 (1)	35 (1)	35 (1)
Overall dimensions		[mm] H	371	424	494	598	532
		[mm] W	350	350	466	466	466
		[mm] D	215	215	622	623	702

(1) Without fuses

	Reference		VSC7/PNG (1)	VSC12/PNG (1)	VSC-S/G VSC-S/F (1) VSC-S/PG (1) VSC-S/PNG (1)
	GB/T 14808-2001	DL/T 593-2006			
	4.1		7.2	12	12
	6.2	●	32	42	28 (3)
	6.2		60	75	75
	4.3		50-60	50-60	50-60
	4.101		400	400	250
				6,000	600
	6.6		4,000	4,000	
		●	4,000	4,000	
	6.6		2,500	2,500	2,500
	6.6		15	15	15
	4.102.2		1,200	1,200	1,200
	6.102.4		4,000	4,000	
	6.102.5		4,000	4,000	
	4.8, 4.9				
			●	●	●
			●	●	●
			●	●	●
			●	●	●
	6.4, 6.5		400	400	400
	6.101		1,000,000 (2)	1,000,000 (2)	200,000
	6.104		5,000	5,000	-
	6.104		13,000	13,000	-
			35...60	35...60	35...60
			60...90	60...90	60...90
	●		●	●	●

	VSC7/P	VSC12/P - VSC12/PG VSC-S/PG	VSC7/PN	VSC7/PNG	VSC12/PN	VSC12/PNG VSC-S/PNG
	52 (1)	52 (1)	45 (1)	45 (1)	45 (1)	45 (1)
	636	636	653	653	653	653
	531	531	350	350	350	350
	657	657	673	673	673	673

1.5. Performances

Contactor		VSC7 VSC7/F VSC7/P VSC7/PN VSC7/PNG VSC7/FN				VSC12 VSC12/F VSC12/P VSC12/PN VSC12/PNG
Rated voltage	[kV]	2.2/2.5	3.6	3.6/7.2	6.2/7.2	12
Ultimate performances for:						
Motors	[kW]	1,000	1,500	1,500	3,000	5,000
Transformers	[kVA]	1,100	1,000	2,000	4,000	5,000
Capacitors	[kVAR]	1,000	1,500	1,500	3,000	4,800 (1)

Contactor		VSC-S/G VSC-S/F VSC-S/PG VSC-S/PNG				
Rated voltage	[kV]	2.2/2.5	3.6	3.6/7.2	6.2/7.2	12
Ultimate performances for back-to-back capacitors banks						
Rated current	[A]	250	250	250	250	250
Max. transient current of the capacitor	[kA]	8	8	8	8	8
Max. transient frequency of the capacitor	[kHz]	2.5	2.5	2.5	2.5	2.5

(1) Overvoltage surge arresters are compulsory between phases and between phase and earth.

1.6. Contactor auxiliary circuits

10 auxiliary contacts (5 normally open and 5 normally closed) are available on the contactor for the customer's use, with the following characteristics.

Auxiliary contacts characteristics		
Rated voltage	24 … 660	V
Rated normal current	10	A
Rated short time current (30 ms, 20 times)	100	A
Rated frequency (for AC only)	50	Hz
Rated insulation voltage (DC)	800	V
Rated insulation voltage (AC)	660	V
Insulation test voltage	2500	V
Number of contacts	5	-
Stroke	6 … 7	mm
Maximum contact resistance	10	mΩ
Storage temperature range	-20 … +120	°C
Operating temperature range	-20 … +70	°C
Emperature rise of contacts	30	K
Breaking capacity (single contact τ = 20 ms, 250 V dc)	250	W
Breaking capacity (single contact τ = 20 ms, 110 V dc)	440	W
Breaking capacity (two contacts in series τ = 20 ms, 250 V dc)	440	W

Characteristics of the contacts of the “Coil Continuity Control” and “Capacity Survey” devices	
Technology	Relay with air-insulated contacts
Breaking characteristics:	
Maximum breaking power	1200 VA (on resistive load)
Maximum breaking voltage	277 V AC, 30 V DC
Maximum breaking current	3 A
Rated current	5 A @ 4 s
Contact characteristics:	
Maximum resistance with contact open	150 mohm (measure of voltage drop 6 V DC 1)
Maximum capacity	1.5 pF
Trip times:	
During closing	5.0 ms
During release	2.0 ms
Insulation:	
Between contacts and coil	3000 V rms (50 Hz / 1 min.)
Between open contacts	750 V rms (50 Hz / 1 min.)
Resistance with contacts open	Min. 103 Mohm at 500 V DC

1.7. Compliance with Standards

V-Contact contactors comply with the Standards of the major industrialised countries and in particular with the following Standards:

– IEC 62271-106 (2011);
– IEC 62271-1 (2007);
– GB/T 14808-2001;
– DL/T 593-2006;
– IEC 60278 replaced by IEC 62271-200;
– IEC 60694 (2002) replaced by IEC 62271-1;
– IEC 60056 (4.104) replaced by IEC 62271-100;
– IEC 60470 replaced by IEC 62271-106.

1.8. Protection against short-circuit

The value of the installation short-circuit current could exceed the breaking capacity of the contactor. The contactor must therefore have adequate protection against short-circuit.

Fuse replacement must only be carried out by qualified personnel.