HD4

Gas insulated MV circuit-breakers

12 ... 40.5 kV - 630 ... 3600 A - 16 ... 50 kA

1 DESCRIPTION

- Autopuffer breaking technique
- Electric arc extinction without chopped current
- No restriking after breaking
- Rapid recovery of the dielectric properties of the means of extinction
- Withstand insulation voltage even at zero relative pressure (*)
- Breaking up to 30% of the rated breaking capacity even at zero relative pressure (*)
- Sealed-for-life poles
- Test for checking gas tightness carried out three times on each piece of apparatus
- Compact dimensions
- Fixed and withdrawable version
- Stored energy operating mechanism with anti-pumping device as standard common to the whole circuit-breaker series
- Mechanical safety locks against incorrect operations
- Simple personalisation thanks to a complete range of accessories
- Maintenance-free
- SF6 gas pressure control device (on request).

(*) Up to 24 kV.

General information

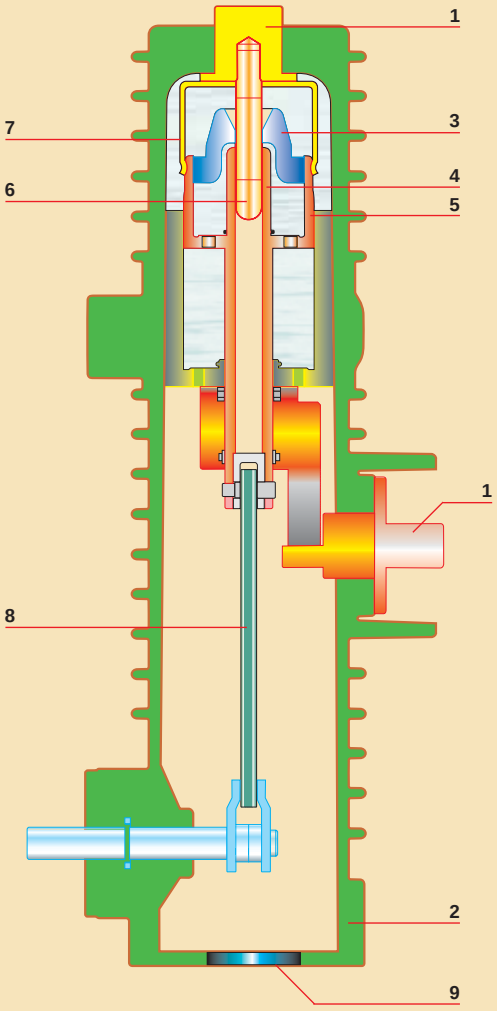
HD4 medium voltage circuit-breakers use sulphur hexafluoride gas (SF6) to extinguish the electric arc and as the insulating medium.
Breaking in SF6 gas takes place without any arc chopping and without generation of overvoltages. These characteristics ensure long electrical life of the circuit-breaker and limited dynamic, dielectric and thermal stresses on the installation.
The circuit-breaker poles, which make up the breaking part, are systems with lifelong sealed pressure (IEC 62271-100 and CEI 17-1 Standards) and are maintenance-free.
The ESH type mechanical operating mechanism, with stored energy has free release and allows opening and closing operations independently of the operator's actions.
The operating mechanism and the poles are fixed to the metal structure which also acts as a support for the kinetics for operating the moving contacts.
Circuit-breakers in the withdrawable version are fitted with a truck to allow racking in and racking out of the switchgear or enclosure.
The light and compact structure of the circuit-breaker ensures great sturdiness and excellent mechanical reliability.

Available versions

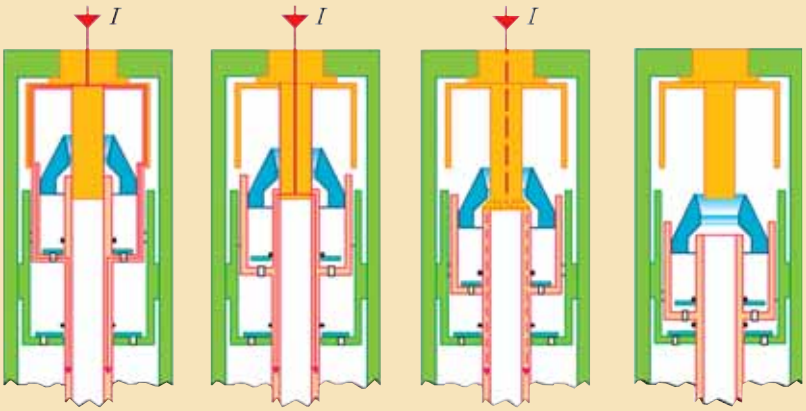
HD4 circuit-breakers are available in the fixed and withdrawable version with front operating mechanism.
The withdrawable version is available for: CBE enclosures, CBF fixed parts, PowerCube modules and UniGear type ZS1 switchgears.

Fields of application

HD4 circuit-breakers are used in power distribution to control and protect lines, transformer and distribution substations, motors, transformers, capacitor banks, etc.
Thanks to the SF6 **autopuffer** breaking technique,



1 Terminal
2 Insulating case
3 Blasting nozzle
4 Moving arcing contact
5 Main moving contact
6 Fixed arcing contact
7 Main fixed contact
8 Insulating tie-rod
9 Anti-explosion valve



Circuit-breaker closed | Main contact separation | Arcing contact separation | Circuit-breaker open

Main contact separation
No electric arc strikes as the current flows through the arcing contacts.
During its run downwards, the moving part compresses the gas contained in the lower chamber. The compressed gas flows out of the lower chamber into the upper chamber, taking them both to the same pressure.

Arcing contact separation
The current flows thanks to the electric arc which has struck between the arcing contacts.
The gas cannot get out through the nozzle because the hole is still closed by the fixed arcing contact and cannot get out through the inside of the moving arcing contact either because the electric arc closes this (clogging effect).

- **with low currents**, when the current passes through natural zero and the arc is quenched, the gas flows through the contacts. The low pressure reached cannot chop the current and the modest amount of compressed gas is sufficient to restore dielectric resistance between the two contacts, preventing restriking on the rising front of the return voltage.
- **with high short-circuit currents**, the pressure wave generated by the electric arc closes the valve between the two chambers so that the circuit-breaker starts to operate as a “pure self-blast”. The pressure increases in the upper volume thanks to heating of the gas and molecular disassociation due to the high temperature. The increase in pressure generated is proportional to the arc current and ensures quenching on first passage through current zero.

Circuit-breaker open
The arc has been interrupted, the self-generated pressure in the upper volume is reduced because the gas is flowing through the contacts. The valve re-opens and so a new flow of fresh gas comes into the breaking chamber. The apparatus is therefore immediately ready to close and trip again up to its maximum breaking capacity.

the HD4 circuit-breakers do not generate operating overvoltages, and are therefore also highly suitable for retrofitting, upgrading and enlarging older installations where the motor, cable, etc. insulating materials may be particularly sensitive to dielectric stresses.

Breaking technique

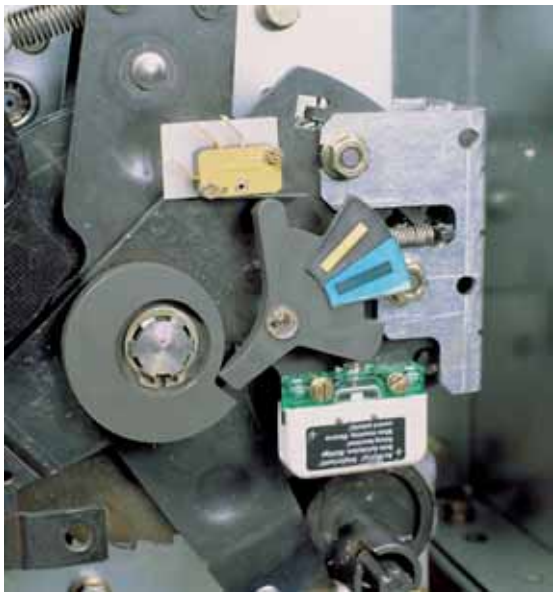
The breaking technique of HD4 circuit-breakers is based on compression and self-blast techniques to obtain top performances at all service current values, with minimum arc times, gradual arc extinction without chopping, and no restriking or operating overvoltages.
The HD4 series brings to medium voltage the advantages of the “autopuffer” breaking technique already used in high voltage.

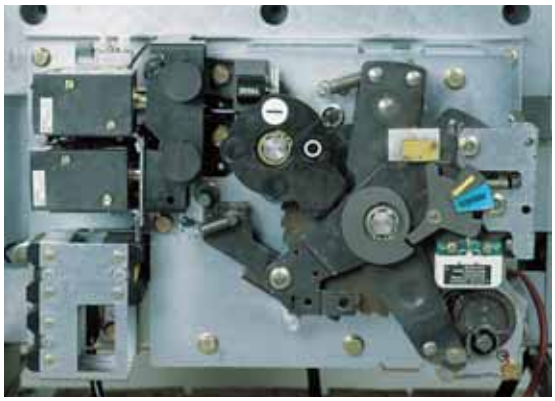
Standards and approvals

HD4 circuit-breakers comply with IEC 62271-100, CEI 17-1 file 1375 Standards and with those of major industrialised countries.
They have undergone the following tests and guarantee safety and reliability of the apparatus in service in all installations.

- **Type tests:** heating, withstand insulation at industrial and impulse frequency, short-time and peak withstand current, mechanical duration, making and breaking of short-circuit currents;
- **Individual tests:** insulation with voltage at industrial frequency in the main circuits and insulation of the auxiliary and control circuits, measurement of the main circuit resistance, mechanical and electrical operation.

The HD4 circuit-breakers are tested according to the requirements of the IEC 62271-100 Standard (class E2 - table 21) and guarantee suitability for use in overhead lines, with rapid reclosing cycle.
Versions approved according to the GOST Standard are also available (please contact us).





The terminals and isolating contacts are silver-plated.

The withdrawable circuit-breakers feature a device enabling them to be racked in/out with the door closed.

Service safety

Thanks to the availability of a complete range of mechanical and electrical locks (on request), safe distribution switchgear can be constructed using HD4 circuit-breakers. The locking devices have been designed to prevent incorrect operations and to carry out inspection of the installation, ensuring maximum operator safety.

Accessories

HD4 circuit-breakers have a complete range of accessories which fulfil all installation requirements.
The operating mechanism is the same type for the whole series and has a standardized range of accessories and spare parts which are easy to identify and order.
Apparatus use, maintenance and service have been simplified and require less use of resources.

ESH operating mechanism

- Just one device for the whole series.
- The same set of accessories for all the types of HD4 circuit-breaker.
- Fixed strikers to facilitate assembly or replacement of accessories.
- Accessory cabling with socket and plug.

The self-supplied PR512 switchgear release is available for protection of the installations.
In its basic version, the PR512 carries out the following functions:

- 50-51-50N-51N protection
- current measurement with display of the maximum value between phases
- dialogue.

For further information about the PR512 release, please consult technical catalogue 649092.

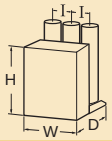
The nameplate, located on the front panel, enables all the circuit-breaker characteristics to be identified.

All the control and signalling devices are located on the front of the circuit-breaker.
Suitable locks prevent incorrect operations.
The antipumping device is always provided on the actuator.

Luminous indicator of SF6 gas present (on request). (Application of the pressure switch is required).

General characteristics of fixed circuit-breakers (12 - 17.5 - 24 kV)

Circuit-breaker		**HD4 12**										
Standards	IEC 62271-100	■										
	CEI 17-1 (file 1375)	■										
Rated voltage	Ur [kV]	12										
Rated insulation voltage	Us [kV]	12										
Withstand voltage at 50 Hz	Ud (1 min) [kV]	28										
Impulse withstand voltage	Up [kV]	75										
Rated frequency	fr [Hz]	50-60										
Rated normal current (40°C) (1)	Ir [A]	630	1250	1600	630	1250	1600	1600	2000	2500	3150	3600
Rated breaking capacity	Isc [kA]	16	16	16	16	16	16	—	—	—	—	—
		—	—	—	—	—	—	—	—	—	—	—
		25	25	25	25	25	25	—	25	25	25	25
		31.5	31.5	31.5	31.5	31.5	31.5	—	31.5	31.5	31.5	31.5
		—	—	—	—	—	—	40	40	40	40	40
		—	—	—	—	—	—	50	50	50	50	50
Rated short-time	Ik [kA]	16	16	16	16	16	16	—	—	—	—	—
		—	—	—	—	—	—	—	—	—	—	—
		25	25	25	25	25	25	—	25	25	25	25
		31.5	31.5	31.5	31.5	31.5	31.5	—	31.5	31.5	31.5	31.5
		—	—	—	—	—	—	40	40	40	40	40
		—	—	—	—	—	—	50	50	50	50	50
Making capacity	Ip [kA]	40	40	40	40	40	40	—	—	—	—	—
		50	50	50	50	50	50	—	—	—	—	—
		—	—	—	—	—	—	—	63	63	63	63
		80	80	80	80	80	80	—	80	80	80	80
		—	—	—	—	—	—	100	100	100	100	100
		—	—	—	—	—	—	125	125	125	125	125
Operation sequence	[O-0.3s-CO-15s-CO]	■										
Opening time	[ms]	45										
Arcing time	[ms]	10-15										
Total breaking time	[ms]	55-60										
Closing time	[ms]	80										
Maximum overall dimensions	H [mm]	640			649			655		655		
	W [mm]	493			618			618		730		
	D [mm]	496			496			561		603		
Pole centre distance	I [mm]	150			210			210		275		
Weight	[kg]	114			114			145		165		
Standardised table of dimensions		TN 7177			TN 7178			TN 7163		TN 7165		
Absolute SF6 gas pressure (2)	[kPa]	380										
Operating temperature	[°C]	- 5 ... + 40										
Tropicalization	IEC: 60068-2-30, 60721-2-1	■										
Electromagnetic compatibility	IEC: 60694	■										

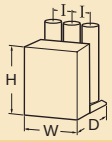


(1) Rated normal current defined in free air.
(2) Rated service value.
(3) Including insulating shields (available on request).

	HD4 17								HD4 24									
■																		
■																		
17.5									24									
17.5									24									
38									50									
95									125									
50-60									50-60									
630	1250	1600	1600	2000	2500	3150	3600		630	1250	1600	630	1250	1600	1600	2000	2500	3150	3600
16	16	16	—	—	—	—	—		16	16	16	16	16	16	—	—	—	—	—
—	—	—	—	—	—	—	—		20	20	20	20	20	20	—	—	—	—	—
25	25	25	—	25	25	25	25		25	25	25	25	25	25	25	25	25	25	25
31.5	31.5	31.5	—	31.5	31.5	31.5	31.5		—	—	—	—	—	—	31.5	31.5	31.5	31.5	31.5
—	—	—	40	40	40	40	40		—	—	—	—	—	—	40	40	40	40	40
—	—	—	50	50	50	50	50		—	—	—	—	—	—	—	—	—	—	—
16	16	16	—	—	—	—	—		16	16	16	16	16	16	—	—	—	—	—
—	—	—	—	—	—	—	—		20	20	20	20	20	20	—	—	—	—	—
25	25	25	—	25	25	25	25		25	25	25	25	25	25	25	25	25	25	25
31.5	31.5	31.5	—	31.5	31.5	31.5	31.5		—	—	—	—	—	—	31.5	31.5	31.5	31.5	31.5
—	—	—	40	40	40	40	40		—	—	—	—	—	—	40	40	40	40	40
—	—	—	50	50	50	50	50		—	—	—	—	—	—	—	—	—	—	—
40	40	40	—	—	—	—	—		40	40	40	40	40	40	—	—	—	—	—
50	50	50	—	—	—	—	—		50	50	50	50	50	50	—	—	—	—	—
—	—	—	—	63	63	63	63		63	63	63	63	63	63	63	63	63	63	63
80	80	80	—	80	80	80	80		—	—	—	—	—	—	80	80	80	80	80
—	—	—	100	100	100	100	100		—	—	—	—	—	—	100	100	100	100	100
—	—	—	125	125	125	125	125		—	—	—	—	—	—	—	—	—	—	—
■									■									
45									45									
10-15									10-15									
55-60									55-60									
80									80									
649			655		655				818 (4)			730			655		818 (3)	
618			618		730				618			748			730		730	
496			561		603				600 (4)			496			561		620 (3)	
210			210		275				210			275			275		275	
114			145		165				119			119			145		165	
TN 7178			TN 7163		TN 7165				TN 7179			TN 7242			TN 7174		TN 7165	
380									380									
- 5 ... + 40									- 5 ... + 40									
■									■									
■									■									

General characteristics of withdrawable circuit-breakers for UniGear type ZS1 switchgear (12 - 17.5 - 24 kV) (4)

Circuit-breaker		**HD4/P 12**						
Standards	IEC 62271-100	■						
	CEI 17-1 (file 1375)	■						
Rated voltage	Ur [kV]	12						
Rated insulation voltage	Us [kV]	12						
Withstand voltage at 50 Hz	Ud (1 min) [kV]	28						
Impulse withstand voltage	Up [kV]	75						
Rated frequency	fr [Hz	50-60						
Rated normal current (40 °C) (1)	Ir [A]	630	1250	1250	1600	2000	2500	3150 (3)
Rated breaking capacity	Isc [kA]	16	16	—	—	—	—	—
		—	—	—	—	—	—	—
		25	25	—	25	25	25	25
		31.5	31.5	—	31.5	31.5	31.5	31.5
		—	—	40	40	40	40	40
		—	—	—	50	50	50	50
Rated short-time	Ik [kA]	16	16	—	—	—	—	—
withstand current (3 s)		—	—	—	—	—	—	—
		25	25	—	25	25	25	25
		31.5	31.5	—	31.5	31.5	31.5	31.5
		—	—	40	40	40	40	40
		—	—	—	50	50	50	50
Making capacity	Ip [kA]	40	40	—	—	—	—	—
		50	50	—	—	—	—	—
		—	—	—	63	63	63	63
		80	80	—	80	80	80	80
		—	—	100	100	100	100	100
		—	—	—	125	125	125	125
Operation sequence	[O-0.3s-CO-15s-CO]	■						
Opening time	[ms]	45						
Arcing time	[ms]	10-15						
Total breaking time	[ms]	55-60						
Closing time	[ms]	80						
Maximum overall dimensions	H [mm]	628		702		702	702	746
	W [mm]	532		682		682	882	882
	P [mm]	659		640		640	643	643
Pole centre distance	I [mm]	150		210		210	275	275
Weight	[kg]	120		177		177	220	230
Standardised table of dimensions		TN 7286		TN 7350		TN 7351	TN 7352	TN7371
Absolute SF6 gas pressure (2)	[kPa]	380						
Operating temperature	[°C]	- 5 ... + 40						
Tropicalization	IEC: 60068-2-30, 60721-2-1	■						
Electromagnetic compatibility	IEC: 60694	■						



(1) Rated normal current with circuit-breaker in UniGear type ZS1 switchgear and 40 °C ambient temperature outside the switchgear
(2) Rated service value
(3) The circuit-breaker can reach rated currents higher than 3150 A with appropriate forced ventilation of the switchgear (for further information, consult the technical catalogue of the UniGear type ZS1 switchgear).

	HD4/P 17							HD4/P 24					
	■							■					
	■							■					
	17.5							24					
	17.5							24					
	38							50					
	95							125					
	50-60							50-60					
	630	1250	1250	1600	2000	2500	3150 (3)	630	1250	1250	1600	2000	2500 (5)
	16	16	—	—	—	—	—	16	—	—	16	16	—
	—	—	—	—	—	—	—	20	20	—	20	20	20
	25	25	—	25	25	25	25	25	25	—	25	25	25
	31.5	31.5	—	31.5	31.5	31.5	31.5	—	—	31.5	31.5	31.5	31.5
	—	—	40	40	40	40	40	—	—	—	—	—	—
	—	—	—	50	50	50	50	—	—	—	—	—	—
	16	16	—	—	—	—	—	16	—	—	16	16	—
	—	—	—	—	—	—	—	20	20	—	20	20	20
	25	25	—	25	25	25	25	25	25	—	25	25	25
	31.5	31.5	—	31.5	31.5	31.5	31.5	—	—	31.5	31.5	31.5	31.5
	—	—	40	40	40	40	40	—	—	—	—	—	—
	—	—	—	50	50	50	50	—	—	—	—	—	—
	40	40	—	—	—	—	—	40	—	—	40	40	—
	50	50	—	—	—	—	—	50	50	—	50	50	50
	—	—	—	63	63	63	63	63	63	—	63	63	63
	80	80	—	80	80	80	80	—	—	80	80	80	80
	—	—	100	100	100	100	100	—	—	—	—	—	—
	—	—	—	125	125	125	125	—	—	—	—	—	—
	■							■					
	45							45					
	10-15							10-15					
	55-60							55-60					
	80							80					
	628		702		702	702	746	736		792	821	821	
	532		682		682	882	882	636		653	842	842	
	659		640		640	643	643	799		799	788	788	
	150		210		210	275	275	210		210	275	275	
	120		177		177	220	230	125		177	177	220	
	TN 7286		TN 7350		TN 7351	TN 7352	TN7371	TN 7354		1VCD000099	TN 7355	TN 7356	
	380							380					
	- 5 ... + 40							- 5 ... + 40					
	■							■					
	■							■					

(4) In the standard fitting, the truck locking electromagnetic (-RL2) is included to prevent circuit-breaker racking-in with auxiliary circuits not connected (plug not inserted in the socket).
(5) Rated current in switchgear with forced ventilation; with natural ventilation the rated current is 2300 A.