

DATA SHEET

CIRCUIT BREAKER

***HD4 24 kV up to 40 kA and up to 3600 A
(3600 A fixed version, 2500 A withdrawable version)***

1.1 General

Item	Description		
1	Manufacturer		ABB T&D S.p.A. - Unità Operativa Sace T.M.S.
1.1	Standard product		Yes
1.2	Quality certification		ISO 9001
1.3	Environmental Management System cert.		ISO 14001
1.4	Country		Italy
1.5	City , Address		Dalmine (BG), via Friuli 4 CAP 24044
2	Type of circuit breaker (SF6, Vacuum, etc)		SF6
2.1	If SF6 which interrupting technology		Autopuffer
3	Type designation		
3.1	Fixed		HD4 Ui.In.Isc
3.2	Withdrawable for CBE / CBF		HD4/C Ui.In.Isc
3.3	" for UniSafe switchboard		HD4/W Ui.In.Isc
3.4	" for UniGear type ZS1 switchboard		HD4/P Ui.In.Isc
4	Testing Authority (Accredited by SINAL)		CESI (Italy) , ABB SACE TMS , ABB SACE LV
5	Standards		IEC 62271-100

1.2 Operating Characteristics

Item	Description		
1	Rated Voltage (U)	kV	24
2	Rated normal current (In) at 40°C	A	1600-2000-2500-3150-3600 (up to 2500 for withdrawable version)
3	Frequency	Hz	50/60
4	Operating Duty		
4.1	Normal sequence		O - 0.3 sec - CO - 3 min - CO
4.2	High speed three phase		O - 0.3 sec - CO - 15 sec - CO
4.3	Out of phase		CO
4.4	Make-break time (C-O)	msec	120
5	Rated Making and Breaking Current during Normal/Reclose Operating sequence		
5.1	Three phase terminal fault rating		
5.1.1	Breaking current (symmetrical)	kA	25 - 31.5 - 40
5.1.2	Breaking current (asymmetrical)	%Idc	30% at 40 kA
5.1.3	Making current	kAp	63(25)-80(31.5)-100(40)
5.1.4	First pole to clear factor		1.5
5.2	Single phase earth fault rating		
5.2.1	Breaking current (symmetrical)	kA	25 - 31.5 - 40
5.2.2	Making current	kAp	63(25)-80(31.5)-100(40)
5.3	Breaking current under out of phase conditions	kA	6.25 - 8 - 10
6	Short time rating - 3 sec	kA	25 - 31.5 - 40

HD4 24 kV up to 40 kA

7	Mechanical performances:		
7.1	Maximum total break time (trip start to final arc extinction)	msec	55-60
7.2	Opening time (trip start to contact separation)		
7.2.1	100% of supply voltage	msec	45
7.2.2	70% of supply voltage	msec	65
7.2.3	110% of supply voltage	msec	42
7.3	Maximum time interval between opening of first and last phase of three phase circuit breaker	msec	2
7.4	Maximum time interval between opening of interrupters of one phase	msec	N.A.
7.5	Closing time from energisation of close coil to latching of circuit breaker in fully close position	msec	60
7.6	Making time (energisation of close coil to contact touch) :		
7.6.1	100% of supply voltage	msec	74
7.6.2	85% of supply voltage	msec	80
7.6.3	110% of supply voltage	msec	70
7.7	Maximum time interval between closure of first and last phase of three phase circuit breaker	msec	2
7.8	Maximum time interval between closure of interrupters of one phase	msec	N.A.
7.9	Maximum time from separation of the contact to their remaking during auto reclosing duty (O-C) ("Dead time")	sec	0.3 (IEC 62271-100)
7.10	Critical current on which maximum arc occur		Absent
8	Switching Overvoltages:		
8.1	Maximum peak value of switching overvoltage when interrupting rated inductive current		=< 2.5 P.U.
8.2	Interruption of no-load MV/LV transformers	A	10
8.3	Interruption of compensation reactance currents	A	1250
8.4	Interruption of MV motor rated currents	A	1250
8.5	Maximum peak value of switching overvoltage when interrupting rated line and cable charging current		=< 2.5 P.U.
8.6	Interruption of no-load cables and lines	A	31.5
8.7	Interruption of capacitive currents (C-O)		
8.7.1	Single capacitor bank	A	1250
8.7.2	Back-to-back capacitor bank	A	1250
8.7.3	Capacitor bank inrush making (IEC 62271-100 class C2)	kA	20 at 4.25 kHz
8.8	Rated characteristic for short line fault		N.A.
8.9	Current chopping level		N.A. for SF6

HD4 24 kV up to 40 kA

9	Basic Insulation Level (BIL 1.2/50 μ sec) phase to phase, phase to earth, across open contact	kVp	125
10	Power frequency withstand voltage phase-phase, to earth, across open contact	kVrms/1min	50
11	Radio influence voltage (RIV) level measured at $\frac{1.U_m}{\sqrt{3}}$ at 1MHz	μ V	N.A.
12	Insulation material of outer contact arms		Glass polyester mass
13	Maximum temperature rise test under normal load conditions	$^{\circ}$ C	According to IEC 62271-100 and IEC 60694
14	Drop voltage with 200A dc at 20 $^{\circ}$ C (CB closed between upper and lower terminal)	mV	12 max
15	Test parameters of the short-circuit interrupting performances: current (rms), TRV (Uc), t3, td, U' , t' , RRRV		Test Duties 1-2-3-4-5 all according IEC 62271-100 (see Annex 1)

1.3 Constructional Features

1.3.1 General

Item	Description		
1	Number of poles		3
2	Number of current interrupting break units in series per phase		1
3	Method of controlling voltage distribution between break units (resistor, capacitor etc)		N.A.
4	Value of resistors where used:		
4.1	Breaking resistors		N.A.
4.2	Making resistors		N.A.
4.3	Insertion time of making resistors		N.A.
5	Type of power device (pneumatic, electro-pneumatic, hydraulic or spring)		
5.1	for closing		Spring
5.2	for opening		Spring
6	Number of opening trip device per phase		
6.1	Single phase mechanism		N.A.
6.2	Three phase mechanism		on request up to 2 coils
7	Mass of complete CB		
7.1	Fixed version	kg	145 - 165
7.2	Withdrawable	kg	177 - 220
8	Live mass of circuit breaker complete	kg	Depending on the panel type
9	Total load of heaters for circuit breakers	W	N.A.
10	Minimum clearance distance (withdrawable version C, W and P)		
10.1	Phase - Phase	mm	319 (pitch 210) - 429 (p 275)
10.2	Phase - Earth	mm	227 (p 210) - 215 (p 275)
10.3	Between upper and lower terminal	mm	408 (p 210) - 526 (p 275)

HD4 24 kV up to 40 kA

11	Minimum creepage distance		
11.1	Fixed version		
11.1.1	Phase - Earth	mm	421 (p 210 - 275)
11.1.2	Between upper and lower terminal	mm	524 (p 210 - 275)
11.2	Withdrawable version		
11.2.1	Phase - Earth	mm	497 (p 210) - 577 (p 275)
11.2.2	Between upper and lower terminal	mm	854 (p 210) - 1108 (p 275)
12	Length of break	mm	30
13	Stroke of moving contacts	mm	70
14	Type of main contacts (and material)		Fingers (Cu silverplated)
15	Type of arcing contacts (and material)		Plug - Pliers (Cu-W)
16	Type of arc control device		N.A.
17	Type of device, if any, used to limit rate of rise of re-striking voltage		N.A.

1.3.2 Sulphure Hexafluoride Circuit Breaker

Item	Description		
1	Dead or live tank design		3 independent sealed insulated poles
2	Quantity of gas required to fill one three-phase circuit breaker	gr	525
3	Quantity of make-up gas required per year per three-phase circuit breaker	gr	Sealed for life (30 years)
4	Normal operating pressure of gas	bar (abs)	3.8 at 20°C
5	Low pressure alarm settings		
5.1	First stage (alarm)	bar (abs)	3.2 at 20°C
5.2	Second stage (block)	bar (abs)	2.8 at 20°C (All dielectric and interrupting performances are guaranteed)
6	Type of pressure monitoring device		Pressure switch
7	Breaking capacity at 0 bar pressure	kA	10
8	Routine leakage test on each pole	Yes/No	Yes
9	Overpressure device		Safety valve
9.1	Number of relief device		1 per pole
9.2	Rupturing pressure of the valve	bar (abs)	16
9.3	Rupturing pressure of the envelope	bar (abs)	>30
10	Material of envelope		Epoxy resin
11	Material of moving contact driving rod		Composite material
12	Type of filter employed for absorption of decompositions of SF6 product		Molecular sieves (synthetic zeolite)

1.3.3 Spring operating mechanism

Item	Description		
1	Type		ESH
2	Number of mechanism per circuit breaker		1
3	Operating mechanism with solenoid or motor charged spring		Motor charged spring
4	Trip springs separate from closing springs	Yes/No	Yes
5	Is the CB trip free?	Yes/No	Yes
6	Operating backup charging mechanism		Manual (provided)
7	Number of closing operation stored in fully		

HD4 24 kV up to 40 kA

	charged springs without rewinding		1
8	Number of tripping and closing operations stored in a fully charged spring systems		
8.1	Circuit breaker initially in closed state		O - CO
8.2	Circuit breaker initially in open state		CO
9	Time to fully charge spring after:		
9.1	Close operation	sec	5...7
9.2	Close - trip operation	sec	5...7
9.3	Trip - close - trip operation	sec	5...7
10	Stored energy of tensioned closing spring	J	400
11	Push button for switch ON/OFF	Yes/No	Yes (standard)
11.1	Mechanical ON/OFF indicator	Yes/No	Yes (standard)
11.2	Mechanical indicator showing the closing springs positions (charged-discharged)	Yes/No	Yes (standard)
12	Microswitch indicators of rack-in and rack-out positions		On the c.b. roof cubicle for CBE, UniSafe and UniGear type ZS1. On the c.b. truck for CBF and UniGear type ZS1 (on request)
13	Mechanical operation counter	Yes/No	Yes (standard)
14	Earthing method		By means of truck tulip for CBE By means of truck wheels for UniSafe and UniGear type ZS1
15	Standard supply voltage (motor, opening and closing coils, ...)		
15.1	DC	V	24-30-48-60-110-125-220
15.2	AC 50 Hz	V	24-48-60-110-127-220-230-240
15.3	AC 60 Hz	V	110-127-220-230-240
16	Antipumping device	Yes/No	Yes, mechanical
17	Power required during spring recharging (inrush/continuous service)	VA, W	1500 / 400
18	Closing release coil (YC)		
18.1	Rated operating voltage	V	See point 15
18.2	Minimum operating voltage	%	85%Vn
18.3	Maximum operating voltage	%	110%Vn
18.4	Rated power (inrush/continuous service)	VA, W	250 / 5
19	Opening release coil (YO1)		
19.1	Rated operating voltage	V	See point 15
19.2	Minimum operating voltage	%	70%Vn for DC , 85%Vn for AC
19.3	Maximum operating voltage	%	110%Vn
19.4	Rated power (duration less than 100ms)	VA, W	125
20	Undervoltage release (YU) (inrush/continuous service)	VA, W	250 / 5
21	Locking electromagnet on operating mechanism (YL1) (inrush/continuous service)	VA, W	250 / 5
22	Auxiliary contacts (c.b. fixed and withdrawable version)	n°	10 or 15
22.1	set of 10 aux.cont. (5 NO + 5 NC) Maximum number of free aux. contact (depending on the accessories)	n°	3 NO + 4 NC
22.2	set of 15 aux.cont. (8 NO + 7 NC) Maximum number of free aux. contact (depending on the accessories)	n°	4 NO + 6 NC
22.3	Auxiliary contacts characteristics		
22.3.1	Rated voltage	V	400 AC (50-60Hz) - 220 DC
22.3.2	Rated current	A	10
22.3.3	Breaking capacity (AC)	A	15 A - 400 V - cosφ 0.4

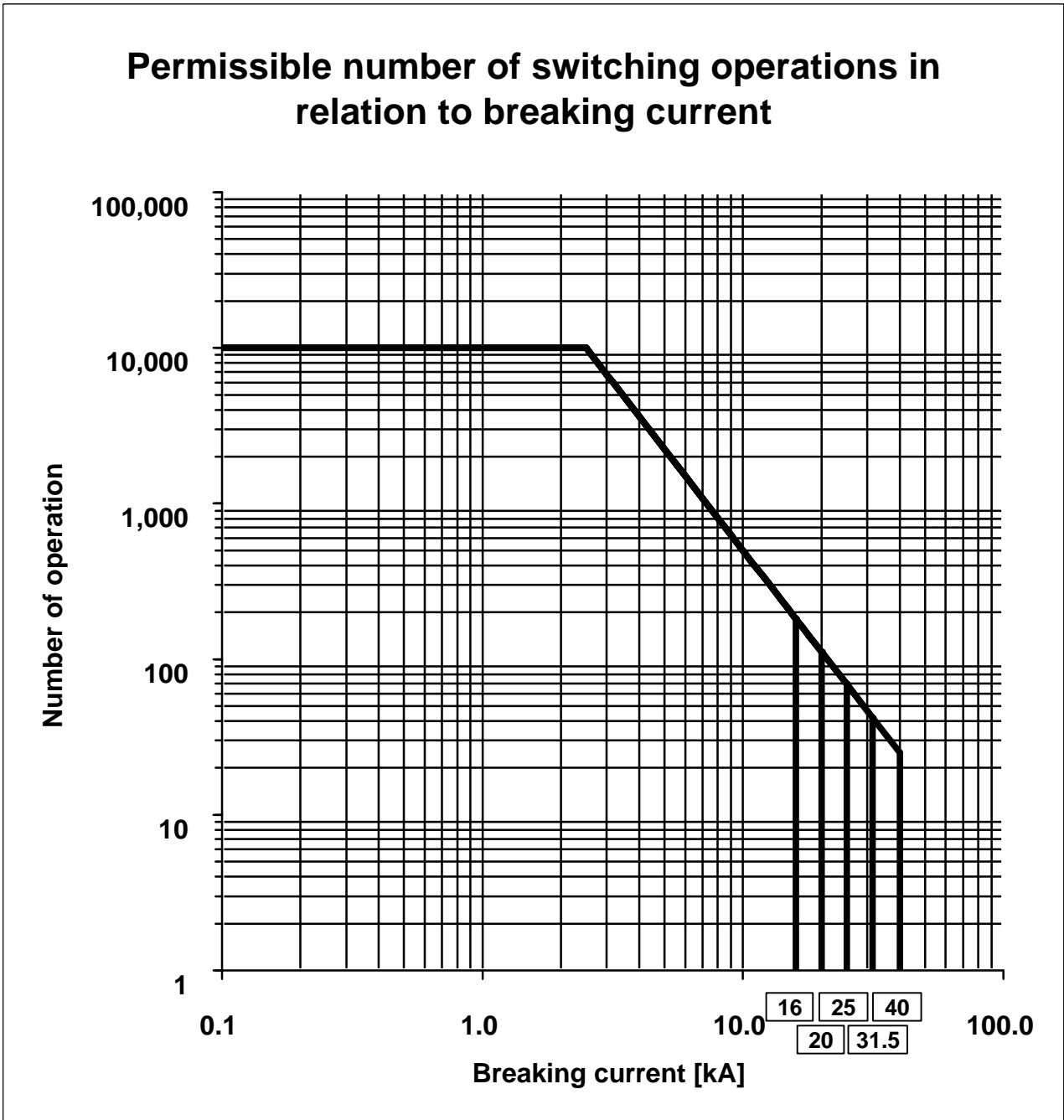
HD4 24 kV up to 40 kA

	22.3.4	Breaking capacity (DC)	A	1.5 A - 220 V - T 10 ms
	22.3.5	Insulating level 50Hz/1min	V	2000
23		Signalling contacts characteristics		
	23.1	Rated voltage	V	400 AC (50-60Hz) - 220 DC
	23.2	Rated current	A	5
	23.3	Breaking capacity (AC)	A	4 A - 110 V - cosf 0.3
	23.4	Breaking capacity (AC)	A	3 A - 230 V - cosf 0.3
	23.5	Breaking capacity (AC)	A	1.5 A - 400 V - cosf 0.3
	23.6	Breaking capacity (DC)	A	0.25 A - 110 V - T 10 ms
	23.7	Breaking capacity (DC)	A	0.13 A - 220 V - T 10 ms
	23.8	Insulating level 50Hz/1min	V	2000
24		Routine tests on the assembly line on each pole and complete CB		
	24.1	Leakage test	Yes/No	Yes
	24.2	Millivolt drop measurement	Yes/No	Yes
	24.3	Mechanical operations	Yes/No	Yes
	24.4	O/C speeds, time spread between poles (max 2msec)	Yes/No	Yes
	24.5	Strokes	Yes/No	Yes
	24.6	Insulating level test	Yes/No	Yes
	24.7	Auxiliary contacts insulating test	Yes/No	Yes

This Data-Sheet refers to the standard version: for particular applications, requirements, performances ask to ABB T&D S.p.A. Unità Operativa SACE T.M.S.

Here below is shown in a bilogarithmic scale the graph of permissible number of switching

fixed version		withdrawable version		
HD4 24 kV		HD4/C - HD4/P 24 kV		HD4/W 24 kV
1600 A 40 kA	2000-2500-3150-3600 A 25-31.5-40 kA	1250 A 31.5-40 kA	1600-2000-2500 A 25-31.5-40 kA	1600-2000 A 16-20-25 kA



ANNEX 1

Standard values of transient recovery voltage (font IEC 62271-100)										
Rated voltage U_r [kV]	Type of test	Test duty	First-pole-to-clear factor K_{pp} [p.p.]	Amplitude factor K_{af} [p.p.]	TRV peak value U_c [kV]	Time t_3 [μs]	Time delay t_d [μs]	Voltage u' [kV]	Time t' [μs]	RRRV U_c/t_3 [kV/μs]
12	Terminal fault	T100	1.5	1.4	20.6	61	9	6.9	29	0.34
		T60	1.5	1.5	22	26	4	7.3	13	0.85
		T30	1.5	1.5	22	13	2	7.3	6	1.70
		T10	1.5	1.5	22	13	2	7.3	6	1.70
17.5	Terminal fault	T100	1.5	1.4	30	71	11	10	35	0.42
		T60	1.5	1.5	32	31	5	11	16	1.04
		T30	1.5	1.5	32	15	2	11	7	2.14
		T10	1.5	1.5	32	15	2	11	7	2.14
24	Terminal fault	T100	1.5	1.4	41	87	13	14	43	0.47
		T60	1.5	1.5	44	38	6	15	18	1.16
		T30	1.5	1.5	44	19	3	15	9	2.32
		T10	1.5	1.5	44	19	3	15	9	2.32
12	Out-of-phase	OP1-OP2	2.5	1.25	30.6	118	18	10	56	0.26
17.5			2.5	1.25	45	145	22	15	70	0.31
24			2.5	1.25	61	174	26	20	83	0.35