

DISTRIBUTION SOLUTIONS

HD4/R - HD4/RE

MV gas circuit breakers
for secondary distribution



HD4/R circuit-breakers can be used for all medium voltage secondary distribution applications and in the MV/LV transformer substations of factories, industrial workshops in general and the services-providing sector.



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HD4/R - HD4/RE:

its strengths, your benefits



Productivity



Reliability



Efficiency



Productivity

Maximizing your output



Continuous operation

- Reduced spares and maintenance
 - 10.000 mechanical close-open operations assured (M2 class)
- Sealed for life pressure system



Easy to installing

- Satisfy different customer needs in a simple fast way
 - Version with on board protection relay and current sensors available
 - Full range of plug and play accessories
- Interchangeability with VD4/R granted



Services and training

- Rely on programs enabling to produce your solution taking advantage of ABB products and know how
 - Technical cooperation / license based on a modular concept of support allowing the OEM to choose in a flexible way the level of added value which better fits its individual needs

Reliability

Protecting your assets



Safety and protection

- Proven reliability
 - Same operating mechanism (“ESH” family) of the HD4/R front operated
 - Long electrical and mechanical life (E2 and M2 class)
- Hazardous situations prevented
 - Integrated mechanical anti-pumping system to prevent accidental reclosing
 - Gas pressure monitoring device available, allowing constant monitoring that the circuit breaker is able to protect the load



Reliable in extreme conditions

- Good performance in demanding applications
 - SF6 auto-puffer quenching technique for smooth switching operations



Global availability

- ABB by your side
 - Count on a worldwide presence for any support you may need



Efficiency

Optimizing your investments



Affordable Range

- Technical / License cooperation agreement
 - Rely on ABB technical support for new panel development based on ABB proven design
- Design a competitive switchgear solution for low duty applications
 - HD4/RE optimized solution for low end application



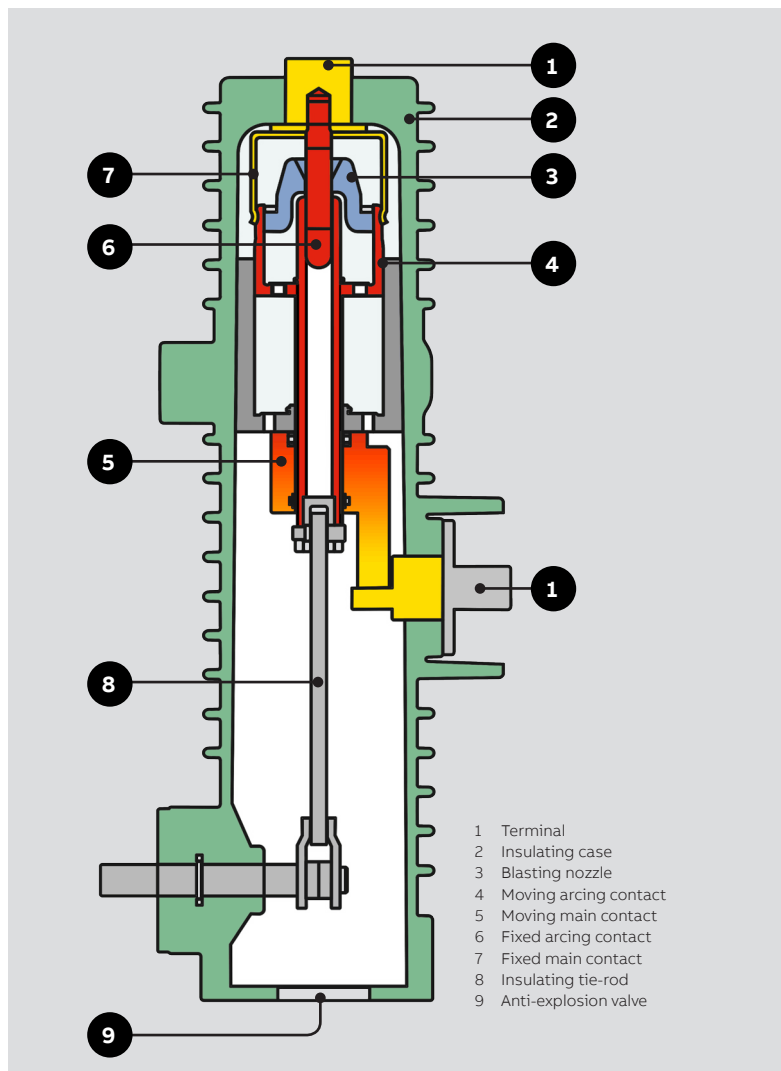
Description



01 HD4/R circuit breaker
with ESH operating
mechanism
02 HD4/RE circuit
breaker with EL operating
mechanism

HD4/R series medium voltage circuit breakers with lateral operating mechanism for indoor installation use sulphur hexafluoride (SF6) to extinguish the electric arc and as an insulating medium between the main fixed and moving contacts. They are constructed using the separate pole technique. Two families of circuit breakers are available: HD4/R and HD4/RE. The HD4/R series is equipped with the ESH type trip-free stored energy operating mechanism with opening and closing speed independent of the operator. The operating mechanism for HD4/RE is the EL trip-free stored energy type with opening and closing time independent of the operator.

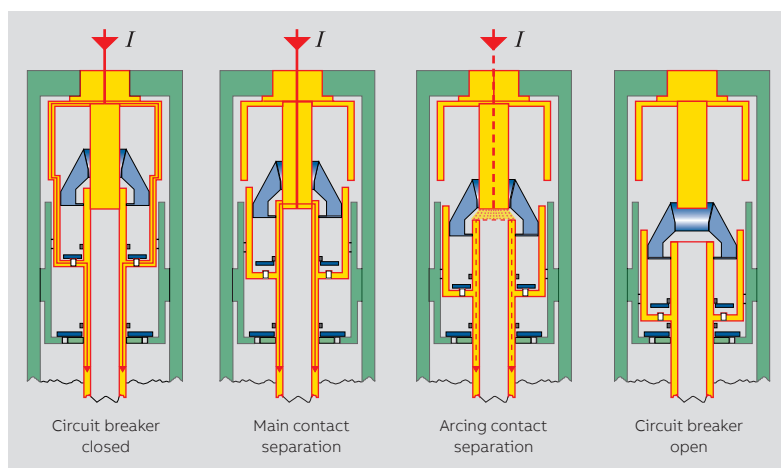
The circuit breaker can be remote controlled when fitted with dedicated electrical accessories (gearmotor, shunt opening release, etc.). The operating mechanism, the three poles and accessories if any) are installed on a metal frame without wheels. The construction is extremely compact, strongly built and low in weight. HD4/R circuit breakers are “sealed for life” pressure systems (Standards IEC 62271-100 and CEI EN 62271-100).



- Complete range of accessories and ample scope for customizing
- Wide range of electrical accessory power supply voltages
- Gas pressure monitoring device (on request)
- Insulation withstand voltage even at zero relative pressure (*)
- Breaking up to 30% of rated breaking capacity even with SF6 gas at zero relative pressure (*)
- Limited maintenance
- Remote control
- Suitable for installation in prefabricated substations and switchgear
- Application (on request) of current sensors and protection device REF601 (in accordance with IEC Standards or CEI 0-16), with fully tested actuation chain for facilitated installation
- High number of operations (class E2, C2, M2 -10.000 operations)

Note: the fast delivery option can be requested for HD4/R and HD4/RE series circuit breakers.

(*) Up to 24 kV rated voltage



Breaking technique

The breaking principle of HD4/R circuit breakers is based on the compression and self-blast techniques so as to obtain top performance at all breaking current values, with minimum arcing time, gradual arc extinction and no re-striking or operating overvoltage.

The HD4/R series brings to medium voltage the advantages of the "autopuffer" breaking technique already used in high voltage.

Description

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, bringing them both to the same pressure.

Arcing contact separation

The current flows thanks to the electric arc that 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

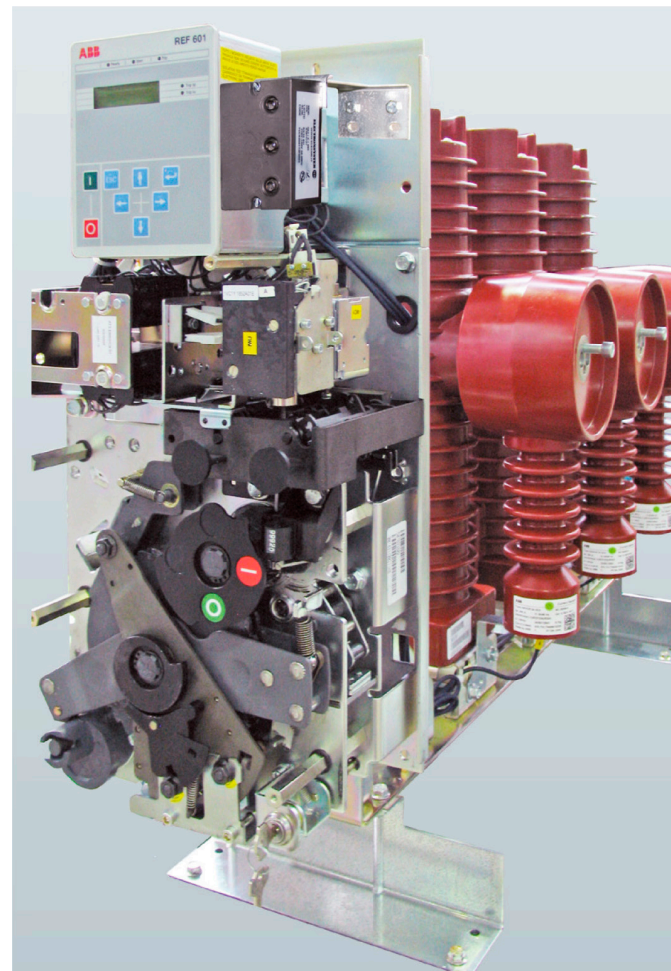
The arc has been interrupted, the self-generated pressure in the upper volume is reduced because the gas is flowing through the contacts. The valve re-opens and so a new flow of fresh gas enters the breaking chamber. The apparatus is therefore immediately ready to close and trip again up to its maximum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

ESH operating mechanism

- The same one is used for the entire HD4/R series.
- The same accessories are available for all types of circuitbreaker.
- Fixed strikers make the accessories easy to assemble or replace.
- Accessories wired with sockets and plugs.
- Integrated mechanical anti-pumping system to prevent accidental re-closing.
- Available with Low Smoke Zero Halogen (LSOH) cabling with V0 flammability rating

EL operating mechanism

- Used for the HD4/RE series.
- The same accessories are available for all types of circuitbreaker.
- Fixed strikers make the accessories easy to assemble or replace.
- Accessories wired with sockets and plugs.
- Integrated spring loading lever.
- Integrated mechanical anti-pumping system to prevent accidental re-closing.
- Available with Low Smoke Zero Halogen (LSOH) cabling with V0 quenching degree.

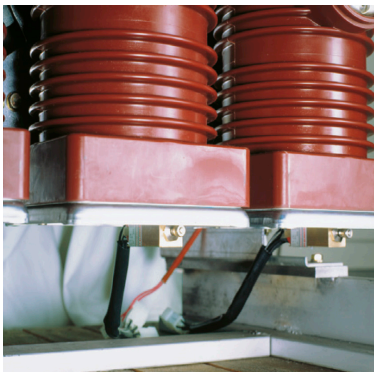




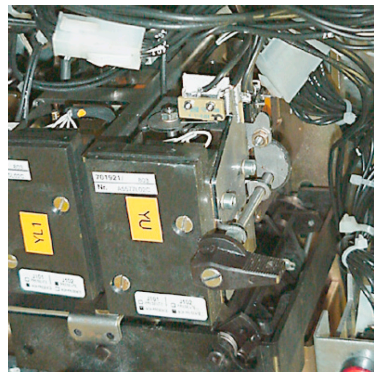
01



02



03



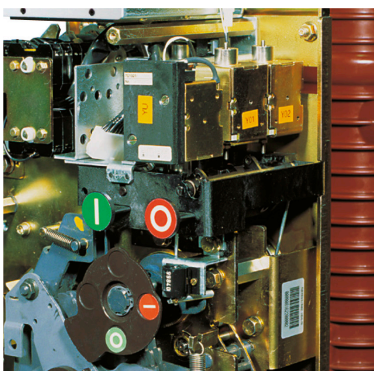
04



05



06



07



08

Anti-pumping device

The ESH or EL operating mechanisms of HD4/R circuitbreakers (in each version) are equipped with a mechanical anti-pumping device that prevents reclosing due to both electrical and mechanical operating mechanisms. If both the closing operating mechanism and any one of the opening operating mechanisms were active at the same time, there would be a continuous succession of opening and closing commands. The anti-pumping device prevents this from occurring and ensures that each closing operation is only followed by an opening operation and by no other closing operation after this latter. The closing control must be released and then re-activated again in order to obtain a new closing operation. Moreover, the anti-pumping device will only allow the circuit breaker to close if the following conditions have all occurred at the same time:

- springs of the operating mechanism fully loaded
- opening pushbutton and/or shunt opening release (-MBO1) not activated
- main circuit breaker contacts open and at their end of travel.

Fields of use

These HD4/R circuit breakers can be used in all medium voltage secondary distribution systems and MV/LV transformer substations in factories, industrial workshops and in the services-providing sector in general.

- 01 SF6 gas pressure status signalling device (on request)
- 02 Nameplate with circuit breaker specifications on front panel
- 03 SF6 gas detector (available on request)
- 04 Electrical accessories with simplified assembly
- 05 REF 601 relay coordinated with circuit breaker and with the current sensors
- 06 Current sensors (on request), easily replaced
- 07 Mechanical anti-pumping device
- 08 EL operating mechanism

Description



REF 601 Protection Device

On request, HD4/R circuitbreakers with lateral operating mechanisms and rated voltage up to 24 kV can be equipped with the REF 601 protection device. The HD4/R version for UniSec switchgear can be equipped on request with the REF 601 protection device only. REF 601 requires an auxiliary power supply in order to function. The device is available in two different versions:

- **REF 601 version IEC** (time-current curves in compliance with IEC 255-3): protects against overloads (51), instantaneous and delayed short-circuits (50-51) and against instantaneous and delayed homopolar earth faults (50N and 51N). It also detects the magnetizing current of a threephase transformer, thus preventing untimely tripping when the transformer (68) connects.

- **REF 601 version CEI** (protections and time-current curves in compliance with CEI 0-16 and thresholds that can be set in accordance with CEI 0-16 2012-12 3rd. Ed. specifications): this version has been specifically designed for medium voltage user connection to the Italian electricity main. It protects against overload (51 - not required by all public utility companies), instantaneous and delayed shortcircuits (50 and 51), instantaneous and delayed homopolar earth faults (50N and 51N).

The device can operate with up to 3 inputs from current sensors of the Rogowsky coil type and 4 rated current values can be entered by a keyboard: 40 - 80 - 250 - 1250 A for the IEC version, while 2 rated current values can be selected for the CEI 0-16 version, i.e. 80 - 250 A.

The current sensors are available in two versions: for circuitbreakers with 630 A rated current and for circuit breakers with rated current values that are higher than 630 A.

REF 601 possesses features, such as:

- pushbuttons for the circuit breaker's local switching operations (opening and closing pushbutton. The lateral operation mechanism is always supplied with a shunt opening release. Application of the shunt closing release must obviously be requested to operate the closing command via REF 601)
- 5 separate indicators: "relay operating", "relay at tripping threshold", "relay tripped", "relay tripped due to phase overcurrent", "relay tripped due to earth fault overcurrent"
- HMI consisting of an LCD display and by "arrow", "enter" and "esc" keys for user-friendly browsing amongst the "measuring", "data recording",

“event recording”, “settings”, “configuration” and “test” menus

- three user levels with different operations allowed and two passwords
- continuous display of the current in the most loaded phase and the earth current
- recording of the values of the currents that caused the device to trip
- storage of the number of openings caused by the device
- event recording (storage of the previously described parameters in the last 5 tripping actions of the device) in a non-volatile memory
- curves “ $\beta = 1$ ” or “ $\beta = 5$ ” and curve “RI”, specifically for the Belgian market (only the IEC version of REF 601)
- circuit breaker opening by means of the undervoltage release (only the CEI 0-16 version of REF 601)
- on request, version with RS485 Full Duplex serial link - MODBUS RTU (version not available for installation on the circuit breaker)
- 48-240 V integrated TCS function
- 24...240 V AC/DC multivoltage feeder, both 50 Hz and 60 Hz.

Standards and approvals

HD4/R circuit breakers conform to standards IEC 62271-100, CEI EN 62271-100 and to those in force in the main industrial countries. They have been subjected to the tests described below and guarantee that the equipment is safe and reliable for use in all types of installation.

- Type tests: temperature rise, power frequency withstand and lightning impulse withstand voltage, short-time and peak withstand current, mechanical life, short-circuit current making and breaking capacity.
- Individual tests: power-frequency insulation of the main circuits, insulation of the auxiliary and operating circuits, main circuit resistance measurements, mechanical and electrical operation.

Safe service

Safe distribution switchgear can be constructed with HD4/R circuit breakers thanks to the full range of mechanical and electrical locks (available on request).

The locks have been designed to prevent incorrect manoeuvres and to allow the installations to be inspected while guaranteeing the utmost safety for the operator.

All the operating, monitoring and indicating devices are installed on the front of the circuit breaker.

There is always an anti-pumping device on the actuator.

Description



Electrical specifications

Circuit breaker		HD4/R 12	HD4/R 17	HD4/R 24	HD4/R 36
Rated voltage	[kV]	12	17.5	24	36
Rated thermal current	[A]	630/800/1250	630/800/1250	630/800/1250	630/800/1250
Rated duty breaking capacity	[kA]	12.5...25	12.5...25	12.5...20	12.5...16

Technical literature

Order the following publications for more details about the technical aspects and applications of HD4/R circuit breakers:

- UniSec switchgear Cat. 1VFM200001
- REF601 Cat. YN1MDB07212-YN

Quality Assurance System

Conforms to ISO 9001 Standards, certified by an independent third party.

Health and Safety Management System

Conforms to ISO 45001 Standards, certified by an independent third party.

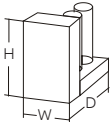
Test laboratory

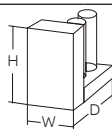
Conforms to UNI CEI EN ISO/IEC 17025 Standards, certified by an independent third party.

How to choose and order the circuit breakers

General specifications of fixed circuit breakers
with right lateral operating mechanisms
(12 - 17.5 - 24 - 36 kV)



Circuit breaker		HD4/R 12			HD4/R 17		
Standards	IEC 62271-100	•			•		
	CEI EN 62271-100	•			•		
Rated voltage	Ur [kV]	12				17.5	
Rated insulation voltage	Us [kV]	12				17.5	
Withstand voltage at 50 Hz	Ud (1 min) [kV]	28				38	
Impulse withstand voltage	Up [kV]	75				95	
Rated frequency	fr [Hz]	50-60				50-60	
Rated normal current (40 °C)	Ir [A]	630	800	1250	630	800	1250
Rated duty breaking capacity (symmetrical rated short-circuit current)	Isc [kA]	12.5	—	—	12.5	—	—
		16	16	16	16	16	16
		20	20	20	20	20	20
		25	25	25	—	—	25
Short-time withstand current (3s)	Ik [kA]	12.5	—	—	12.5	—	—
		16	16	16	16	16	16
		20	20	20	20	20	20
		25	25	25	—	—	25
Making capacity	Ip [kA]	31.5	—	—	31.5	—	—
		40	40	40	40	40	40
		50	50	50	50	50	50
		63	63	63	—	—	63
Operation sequence	[O - 3m - CO - 3m - CO]	•			•		
Mechanical class	M2 - 10.000 CO	•			•		
Electrical class	E2	•			•		
Cable chargin class	C2	•			•		
Opening time	[ms]	45				45	
Arcing time	[ms]	10 ... 15				10 ... 15	
Total break-time	[ms]	50 ... 60				50 ... 60	
Closing time	[ms]	80				80	
Overall dimensions (maximum)		H [mm]	764.5			764.5	
		W [mm]	321			321	
		D [mm]	1049 ⁽¹⁾ / 1189 ⁽²⁾			1049 ⁽¹⁾ / 1189 ⁽²⁾	
		Pole center-distance P [mm]	230 / 300			230 / 300	
Weight	[kg]	103 ⁽¹⁾ - 105 ⁽²⁾				103 ⁽¹⁾ - 105 ⁽²⁾	
Absolute gas pressure (nominal duty value)	[kPa]	380				380	
Application of REF 601 protection device ⁽⁶⁾		• ⁽²⁾			• ⁽²⁾		
Standardized dimensions table		TN 7237 ⁽¹⁾			TN 7237 ⁽¹⁾		
		TN 7234 ⁽²⁾			TN 7234 ⁽²⁾		
Circuit diagram	without protection device installed	1VCD400017			1VCD400017		
	with REF 601	1VCD400114			1VCD400114		
Operating temperature	[°C]	- 5 ... + 40			- 5 ... + 40		
Tropicalization	IEC: 60068-2-30, 60721-2-1	•			•		
Electromagnetic compatibility	IEC: 62271-1	•			•		



HD4/R 24			HD4/R 36		
•			•		
•			•		
24			24		
24			24		
50			70		
125			170		
50-60			50-60		
630	800	1250	630	800	1250
12.5	—	—	12.5	—	—
16	16	16	16	16	16
20	20	20	—	—	—
—	—	—	—	—	—
12.5	—	—	12.5	—	—
16	16	16	16	16	16
20	20	20	—	—	—
25	25	25	—	—	—
31.5	—	—	31.5	—	—
40	40	40	40	40	40
50	50	50	—	—	—
63	63	63	—	—	—
•			• (*) O – 0,3s-CO–15s -CO		
•			•		
•			•		
•			•		
45			45		
10 ... 15			10 ... 15		
50 ... 60			50 ... 60		
80			80		
764.5			810		
321			409		
1049 ⁽¹⁾ / 1189 ⁽²⁾			1348		
230 / 300			350		
103 ⁽¹⁾ - 105 ⁽²⁾			110		
380			380		
• ⁽⁵⁾			—		
TN 7237 ⁽¹⁾			TN 7238		
TN 7234 ⁽²⁾					
1VCD400017			1VCD400017		
1VCD400114			—		
- 5 ... + 40			- 5 ... + 40		
•			•		
•			•		

⁽¹⁾ 230 mm pole center distance

⁽²⁾ 300 mm pole center distance

⁽³⁾ increase the indicated weight REF 601 devices and 3 current sensors (15 kg only with 2 current sensors)

⁽⁵⁾ the REF 601 device and the current sensors are available on request. The rated current of the REF 601 must be set in the relay and must be compatible with the rated current of the circuit breaker. The rated current that can be set with CEI 0-16 is 80 A or 250 A. With the CEI 0-16 version of REF 601, the circuit breaker is always supplied with 3 phase sensors (Rogowsky coils) on the circuit breaker itself, one 40/1 A closed-core toroidal TA and a -MBU undervoltage release for relay-controlled opening

⁽⁶⁾ at 12 and 17.5 kV and at 630 A rated current, the rated short-time withstand current is 20 kA for 1 second

How to choose and order the circuit breakers

General specifications of fixed circuit breakers
with right lateral operating mechanisms
(12 - 17.5 - 24 kV)



Circuit breaker		HD4/RE 12	HD4RE 17	HD4/RE 24
Standards	IEC 62271-100	•	•	•
Rated voltage	Ur [kV]	12	17.5	24
Rated insulation voltage	Us [kV]	12	17.5	24
Withstand voltage at 50 Hz	Ud (1 min) [kV]	28	38	50
Impulse withstand voltage	Up [kV]	75	95	125
Rated frequency	fr [Hz]	50-60	50-60	50-60
Rated normal current (40 °C)	Ir [A]	630	630	630
Rated duty breaking capacity (rated symmetrical short-circuit current)	Isc [kA]	12.5	12.5	12.5
		16	16	16
Rated admissible short-time current (1s)	Ik [kA]	12.5	12.5	12.5
		16	16	16
Making capacity	Ip [kA]	31.5	31.5	31.5
		40	40	40
Operation sequence	[O - 3m - CO - 3m - CO]	•	•	•
Mechanical class	M1 - 2.000 CO	•	•	•
Electrical class	E1	•	•	•
Opening time	[ms]	77	77	77
Arcing time	[ms]	10 ... 15	10 ... 15	10 ... 15
Total break-time	[ms]	87 ... 2	87 ... 92	87 ... 92
Closing time	[ms]	50	50	50
Overall dimensions (maximum)		H [mm]	764.5	764.5
		W [mm]	321	321
		D [mm]	1049	1049
		Pole center-distance P [mm]	230	230
Weight (°)	[kg]	74	74	74
Absolute gas pressure (nominal duty value)	[kPa]	380	380	380
Application of REF 601 protection device	• (°)	• (°)	• (°)	• (°)
Standardized dimensions table		1VCD000207	1VCD000207	1VCD000207
Circuit diagram	without protection device installed	1VCD400150	1VCD400150	1VCD400150
	with REF 601	1VCD400150	1VCD400150	1VCD400150
Operating temperature	[°C]	- 5 ... + 40	- 5 ... + 40	- 5 ... + 40
Tropicalization	IEC: 60068-2-30, 60721-2-1	•	•	•
Electromagnetic compatibility	IEC: 62271-1	•	•	•

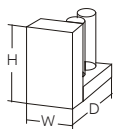
(°) the REF 601 and current sensors are available on request; the rated current of the REF 601 device must be set in the relay in accordance with the circuit breaker's rated current

(°) increase the indicated weight by 20 kg for circuit breakers with REF 601 devices and 3 current sensors (15 kg only with 2 current sensors)

General specifications of fixed circuit breakers with rh lateral operating mechanisms for ABB UniSec switchgear (12 - 17.5 - 24 kV)



Circuit breaker		HD4/R-SEC 12		HD4/R-SEC 17		HD4/R-SEC 24
Standards	IEC 62271-100	•		•		•
	CEI EN 62271-100	•		•		•
Rated voltage	Ur [kV]	12		17.5		24
Rated insulation voltage	Us [kV]	12		17.5		24
Withstand voltage at 50 Hz	Ud (1 min) [kV]	28		38		50
Impulse withstand voltage	Up [kV]	75		95		125
Rated frequency	fr [Hz]	50-60		50-60		50-60
Rated normal current (40 °C)	Ir [A]	630	800	630	800	630
		12.5	12.5	12.5	—	12.5
		16	16	16	16	16
		20	20	20 (*)	20 (*)	20
		25	25	—	—	—
Rated duty breaking capacity (rated symmetrical short-circuit current)	Isc [kA]	12.5	12.5	12.5	—	12.5
		16	16	16	16	16
		20	20	20 (*)	20 (*)	20
		25	25	—	—	—
		31.5	31.5	31.5	—	31.5
Rated admissible short-time current (3s)	Ik [kA]	12.5	12.5	12.5	—	12.5
		16	16	16	16	16
		20	20	20 (*)	20 (*)	20
		25 (*)	25 (*)	—	—	—
		31.5	31.5	31.5	—	31.5
Making capacity	Ip [kA]	40	40	40	40	40
		50	50	50	50	50
		63	63	—	—	—
		—	—	—	—	—
Operation sequence (*)	0-0,3s-CO- 15s - CO	•		•		•
Mechanical class	M2 - 10.000 CO	•		•		•
Electrical class	E2	•		•		•
Cable charging class	C2	•		•		•
Opening time	[ms]	45		45		45
Arcing time	[ms]	10 ... 15		10 ... 15		10 ... 15
Total break-time	[ms]	55 ... 60		55 ... 60		55 ... 60
Closing time	[ms]	80		80		80
Overall dimensions (maximum)	H [mm]	740		740		740
	W [mm]	315		315		315
	D [mm]	1049		1049		1049
	Pole center-distance P [mm]	230		230		230
Weight (*)	[kg]	103		103		103
Absolute gas pressure (nominal duty value)	[kPa]	380		380		380
Application of REF 601 protection device	• (*)			• (*)		• (*)
Standardized dimensions table		1VCD003536		1VCD003536		1VCD003536
Circuit diagram	with / without REF 601	1VCD400119		1VCD400119		1VCD400119
Operating temperature	[°C]	- 5 ... + 40		- 5 ... + 40		- 5 ... + 40
Tropicalization	IEC: 60068-2-30, 60721-2-1	•		•		•
Electromagnetic compatibility	IEC: 62271-1	•		•		•



(*) over 630 A and 16 kA Isc 0-0,3s-CO-3m-CO

(*) increase the indicated weight by 20 kg for circuit breakers with REF 601 device and 3 current sensors (15 kg only with 2 current sensors)

(*) the REF 601 device and the current sensors are available on request. The rated current of the REF 601 must be set in the relay and must be compatible with the rated current of the circuit breaker. The rated current that can be set with CEI 0-16 is 80 A or 250 A. With the CEI 0-16 version of REF 601, the circuit breaker is always supplied with 3 phase sensors (Rogowsky coils) on the circuit breaker itself, one 40/1 A closed-core toroidal TA and a -MBU undervoltage release for relay-controlled opening

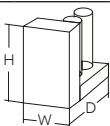
(*) at 12, the rated short-time withstand current is 25 kA for 2 seconds

(*) at 17.5 kV, the breaking capacity is 21 kA and the rated short-time withstand current is 21 kA for 3 seconds

How to choose and order the circuit breakers

General specifications of fixed circuit breakers
with rh lateral EL operating mechanisms for ABB
UniSec switchgear (12 - 17.5 - 24 kV)



Circuit breaker		HD4/RE-SEC 12	HD4/RE-SEC 17	HD4/RE-SEC 24
Standards	IEC 62271-100	•	•	•
	CEI EN 62271-100	•	•	•
Rated voltage	Ur [kV]	12	17.5	24
Rated insulation voltage	Us [kV]	12	17.5	24
Withstand voltage at 50 Hz	Ud (1 min) [kV]	28	38	50
Impulse withstand voltage	Up [kV]	75	95	125
Rated frequency	fr [Hz]	50-60	50-60	50-60
Rated normal current (40 °C)	Ir [A]	630	630	630
Rated duty breaking capacity (rated symmetrical short-circuit current)	Isc [kA]	12.5	12.5	12.5
		16	16	16
Rated admissible short-time current (1s)	Ik [kA]	12.5	12.5	12.5
		16	16	16
Making capacity	Ip [kA]	31.5	31.5	31.5
		40	40	40
Operation sequence	[O - 3m - CO - 3m - CO]	•	•	•
Mechanical class	M1 - 2.000 CO	•	•	•
Electrical class	E1	•	•	•
Opening time	[ms]	40...60	40...60	40...60
Arcing time	[ms]	10 ... 15	10 ... 15	10 ... 15
Total break-time	[ms]	50...75	50...75	50...75
Closing time	[ms]	50...70	50...70	50...70
Overall dimensions (maximum)		H [mm]	740	740
		W [mm]	315	315
		D [mm]	1049	1049
		Pole center-distance P [mm]	230	230
Weight (°)	[kg]	74	74	74
Absolute gas pressure (nominal duty value)	[kPa]	380	380	380
Application of REF 601 protection device	In [A]	• (°)	• (°)	• (°)
Standardized dimensions table		1VCD000196	1VCD000196	1VCD000196
Circuit diagram	with REF 601	1VCD400150	1VCD400150	1VCD400150
Operating temperature	[°C]	- 5 ... + 40	- 5 ... + 40	- 5 ... + 40
Tropicalization	IEC: 60068-2-30, 60721-2-1	•	•	•
Electromagnetic compatibility	IEC: 62271-1	•	•	•

(°) increase the indicated weight by 20 kg for circuit breakers with REF 601 device and 3 current sensors (15 kg only with 2 current sensors)

(°) the REF 601 device and the current sensors are supplied at the time of purchase. The rated current of the REF 601 must be set in the relay and must be compatible with the rated current of the circuit breaker. The rated current that can be set with CEI 0-16 is 80 A or 250 A. With the CEI 0-16 version of REF 601, the circuit breaker is always supplied with 3 phase sensors (Rogowsky coils) on the circuit breaker itself, one 40/1 A closed-core toroidal TA and a -MBU undervoltage release for relay-controlled opening

Available versions

HD4/R circuit breakers with lateral operating mechanism are available in the following versions:

- fixed, with rh lateral ESH or EL operating mechanism and 230 mm pole center-distance
- fixed, with lateral right ESH operating mechanism and 300 or 350 mm pole center-distance
- plug-in, with ESH or EL rh or lh lateral operating mechanism, version for UniSec switchgear, 230 mm pole center-distance.

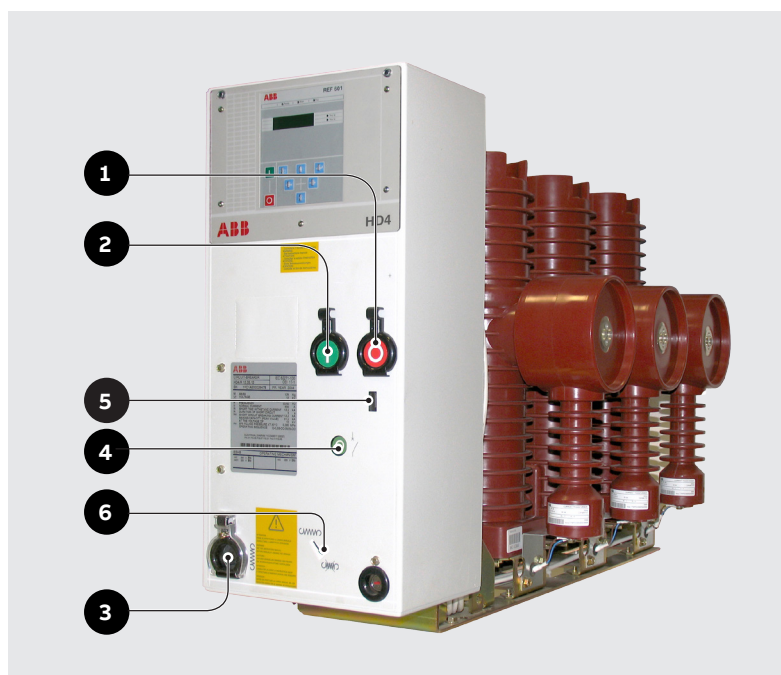
Depending on the version, they can be equipped on request with two or three current sensors and with a REF 601 series device for protection against overcurrents.

Standard equipment

1. Fixed circuit breakers with rh lateral operating mechanism

The coded basic version of the fixed circuit breakers is always the three-pole type and comes equipped with:

- 1 opening pushbutton
- 2 closing pushbutton
- 3 shaft for loading closing springs in the manual mode
- 4 circuit breaker open/closed indicator
- 5 SF6 gas pressure status locking and signaling device (applied on request only to circuit breakers with pressure switch)
- 6 indicator for closing springs loaded/discharged.



The circuit breakers are also equipped with basic wiring, terminal box and spring-loading handle. The basic wiring ends in the terminal box. This latter is equipped with a withdrawable part that allows the customer to create a disconnectable connection.

The basic version also includes the following accessories, which must be specified on order (see Kits 1, 2, 3 described on page 24):

Kit 1 Set of standard open/closed signalling contacts

N.B. a NO auxiliary contact is used for de-energizing the shunt opening release after the circuit breaker has opened, thus there is one NO auxiliary contact less available for each shunt opening release.

Kit 2 Shunt opening release

Kit 3 Key lock

2. Circuit breakers for UniSec switchgear with rh lateral operating mechanisms

The coded basic version of the circuit breakers for UniSec switchgear is the same as that of the fixed circuit breakers, with the following specific exceptions and equipment:

- the enclosure of the operating mechanism is equipped with a specific side frame for the UniSec switchgear
- the base is equipped with wheels to make the switchgear easier to move and rack-in to the compartment
- the wiring ends at the terminal box equipped with a withdrawable part and can be accessed without removing the operating mechanism's enclosure. The terminal box is actually situated at the front and projects over the upper edge of the enclosure
- 9 auxiliary contacts are available as an alternative, and subject to a surcharge. An NO auxiliary contact is used for de-energizing the shunt opening release after the circuitbreaker has opened, thus there is one NO auxiliary contact less available for each shunt opening release.
- on request, the HD4/R circuit breaker can be supplied with the REF 601 protection device. The HD4/RE-Sec circuit breaker is only available in conjunction with the REF 601 protection device.

How to choose and order the circuit breakers

HD4/R 12-17-24-36

(right lateral operating mechanism)

U [kV]	In [A]	Isc [kA]	Description	Pole centre distance			Circuit diagram ⁽¹⁾
				230 mm	300 mm	350 mm	
				TN 7237	TN 7234	TN 7238	
12	630	12.5	HD4/R 12.06.12	•	•		
		16	HD4/R 12.06.16	•	•		
		20 ⁽¹⁾	HD4/R 12.06.20				
		25	HD4/R 12.06.25	•	•		
	800	16	HD4/R 12.08.16	•	•		
		20	HD4/R 12.08.20	•	•		
		25	HD4/R 12.08.25	•	•		
	1250	16	HD4/R 12.12.16	•	•		without relay 1VCD400017
		20	HD4/R 12.12.20	•	•		
		25	HD4/R 12.12.25	•	•		
17.5	630	12.5	HD4/R 17.06.12	•	•		
		16	HD4/R 17.06.16	•	•		
		20 ⁽¹⁾	HD4/R 17.06.20	•	•		
	800	16	HD4/R 17.08.16	•	•		
		20	HD4/R 17.08.20	•	•		
		25	HD4/R 17.08.25				
	1250	16	HD4/R 17.12.16	•	•		with relay REF 601 1VCD400114
		20	HD4/R 17.12.20	•	•		
		25	HD4/R 17.12.25	•	•		
24	630	12.5	HD4/R 24.06.12	•	•		
		16	HD4/R 24.06.16	•	•		
		20	HD4/R 24.06.20	•	•		
	800	16	HD4/R 24.08.16	•	•		
		20	HD4/R 24.08.20	•	•		
	1250	16	HD4/R 24.12.16	•	•		
36 ⁽²⁾	600	12.5	HD4/R 36.06.12			•	
		16	HD4/R 36.06.16			•	
	800	12.5	HD4/R 36.08.12			•	without relay 1VCD400017
		16	HD4/R 36.08.16			•	
	1250	12.5	HD4/R 36.12.12			•	
		16	HD4/R 36.12.16			•	

⁽¹⁾ the admissible rated short-time withstand current is 20 kA for 1 second

⁽²⁾ no type of relay or sensor can be installed on board at 36 kV rated voltage

HD4/RE 12-17-24

(EL right lateral operating mechanism)

U [kV]	In [A]	Isc [kA]	Description	Pole centre distance 230 mm	Maximum	Circuit diagram
12	630	12.5	HD4/RE 12.06.12	•	1VCD000207	without relay / with REF 601 relay 1VCD400150
		16	HD4/RE 12.06.16	•		
17.5	630	12.5	HD4/RE 17.06.12	•		
		16	HD4/RE 17.06.16	•		
24	630	12.5	HD4/RE 24.06.12	•		
		16	HD4/RE 24.06.16	•		

HD4/R-SEC 12-17-24

(right lateral operating mechanism, version for UniSec switchgear)

U [kV]	In [A]	Isc [kA]	Description	Pole centre distance 230 mm	Maximum	Circuit diagram
12	630	12.5	HD4/R-SEC 12.06.12	•	1VCD003536	without relay / with relay REF 601 1VCD400119 ⁽³⁾
		16	HD4/R-SEC 12.06.16	•		
		20	HD4/R-SEC 12.06.20	•		
		25	HD4/R-SEC 12.06.25	•		
	800	12.5	HD4/R-SEC 12.08.12	•		
		16	HD4/R-SEC 12.08.16	•		
		20	HD4/R-SEC 12.08.20	•		
		25	HD4/R-SEC 12.08.25	•		
17.5	630	12.5	HD4/R-SEC 17.06.12	•		
		16	HD4/R-SEC 17.06.16	•		
		20	HD4/R-SEC 17.06.20	•		
	800	12.5	HD4/R-SEC 17.08.12	•		
		16	HD4/R-SEC 17.08.16	•		
		20	HD4/R-SEC 17.08.20	•		
24	630	12.5	HD4/R-SEC 24.06.12	•		
		16	HD4/R-SEC 24.06.16	•		
		20	HD4/R-SEC 24.06.20	•		

⁽¹⁾ the breaking capacity is 21 kA and the admissible rated short-time withstand current is 21 kA for 3 seconds⁽²⁾ the breaking capacity is 25 kA and the admissible rated short-time withstand current is 25 kA for 2 seconds

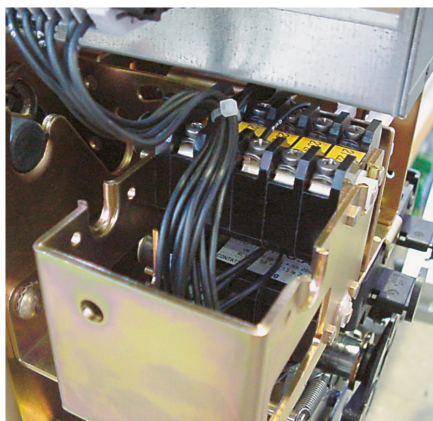
HD4/RE-SEC 12-17-24

(EL right lateral operating mechanism, version for UniSec switchgear)

U [kV]	In [A]	Isc [kA]	Description	Pole centre distance 230 mm	Maximum	Circuit diagram
12	630	12.5	HD4/RE-SEC 12.06.12	•	1VCD000196	with relay REF 601 1VCD400150
		16	HD4/RE-SEC 12.06.16	•		
17.5	630	12.5	HD4/RE-SEC 17.06.12	•		
		16	HD4/RE-SEC 17.06.16	•		
24	630	12.5	HD4/RE-SEC 24.06.12	•		
		16	HD4/RE-SEC 24.06.16	•		

How to choose and order the circuit breakers

Accessories included for the HD4/R series



KIT 1

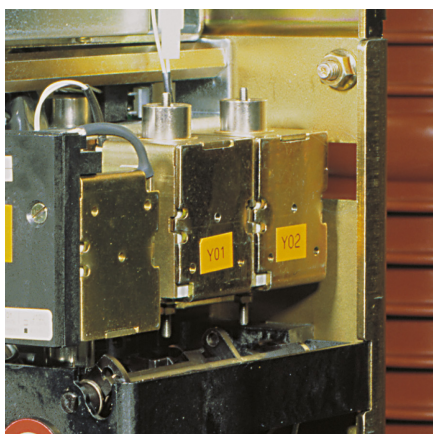
Open/closed signalling contacts (-BGB1...-BGB3)

Electrical specifications of the contacts			
Un	Icu	cosφ	T
400 V~	15 A	0.4	–
220 V–	1.5 A	–	10 ms

The auxiliary contacts (available on request and subject to a surcharge) supplied as alternatives to the standard set of five contacts, vary depending on the version:

(¹) each shunt opening release requires a normally open contact (with circuit breaker open) in order to self-de-energize. Thus the quantities given above must be reduced by one unit per shunt opening release ordered

Number of auxiliary contacts (¹)		without relay	with REF 601
HD4/R	diagram	1VCD400017	1VCD400114
	5 auxiliary contacts	standard equipment	standard equipment
	10 auxiliary contacts	alternative	alternative
HD4/R-SEC	diagram	1VCD400119	1VCD400119
	5 auxiliary contacts	standard equipment	standard equipment
	9 auxiliary contacts	alternative	alternative

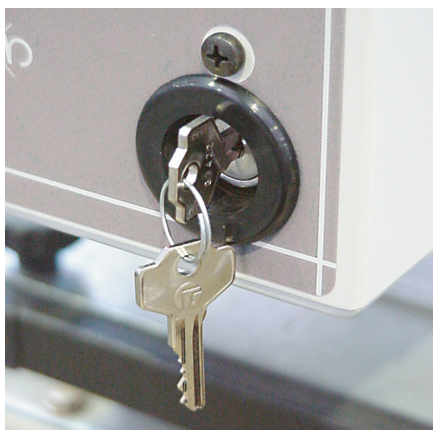


KIT 2

Instantaneous opening release (-MBO1)

Specify the power supply voltage. The power supply voltage of the shunt opening release must match that of the shunt closing release (and of the lamps, if supplied) when the circuit breaker locking device for insufficient pressure is required.

Electrical characteristics	
Inrush power	125 VA/ W
Voltages available	
24-30-48-60-110-125-132-220-250 V–	
48-110-120-127-220-230-240 V 50 Hz	
110-120-127-220-230-240 V 60 Hz	



KIT 3

Open position key lock

Specify the type of lock required:

3A Lock with different keys

3B Lock with the same keys.

Optional accessories for the HD4/R series

1. Spring-loading gearmotor (-MAS)

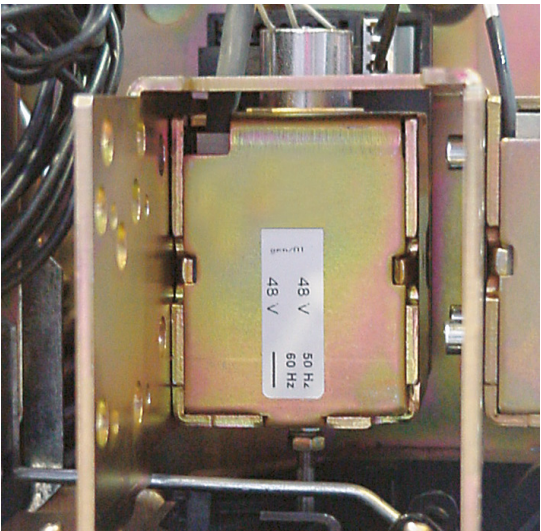
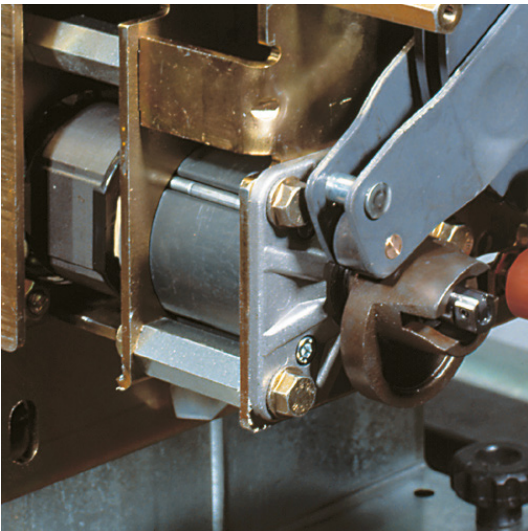
Automatically loads the springs of the operating mechanism after the closing operation.
The 24 V DC gearmotor is always supplied with the protecting thermal relay.

Electrical characteristics	
Inrush power	1500 VA / W
Continuous power	400 VA / W
Loading time	from 7 to 10 s
Voltages available	
24-30-48-60-110-125-220 V-	
24-30-48-60-110-120-127-220-230-240 V 50 Hz	
110-120-127-220-230-240 V 60 Hz	

2. Shunt closing release (-MBC)

This is an electromechanical device that operates the operating mechanism's release lever after an electromagnet has energized, thus closing the circuit breaker. When permanently powered, the shunt closing release accomplishes the anti-pumping function.

Electrical characteristics	
Inrush power	250 VA / W
Continuous power	5 VA / W
Note. If a circuit breaker with pressure switch and locking circuit is ordered in the case of insufficient gas pressure, the supply voltage of the shunt opening release, the shunt closing release and the lamps (if installed) must always be the same.	
Voltages available	
24-30-48-60-110-125-132-220-250 V-	
24-30-48-60-110-120-127-220-230-240 V 50 Hz	
110-120-127-220-230-240 V 60 Hz	



How to choose and order the circuit breakers

3. Additional shunt opening release (-MBO2)

This is an electromechanical device which, after an electromagnetic has been energized, activates the operating mechanism’s release lever, thus opening the circuit breaker.

The additional shunt opening release is not compatible with the -MBO3 opening solenoid.

This application uses one of the auxiliary contacts to cut off its power supply with the circuit breaker open.

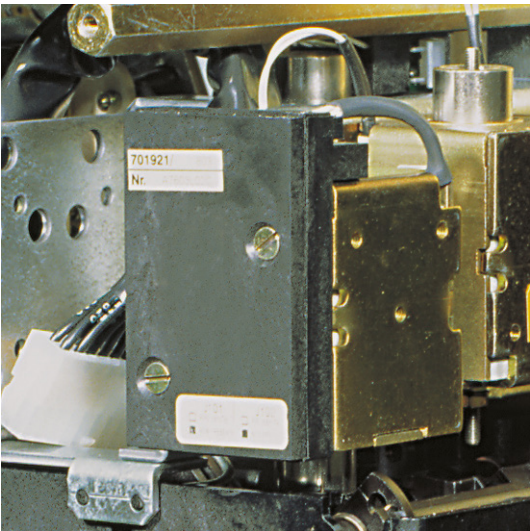
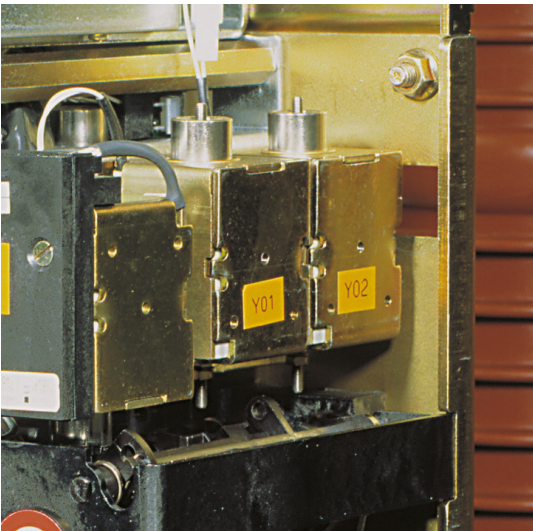
Electrical characteristics	
Inrush power	125 VA / W
Voltages available	
24-30-48-60-110-125-132-220-250 V–	
48-110-120-127-220-230-240 V 50 Hz	
110-120-127-220-230-240 V 60 Hz	

4. Undervoltage release (-MBU)

The undervoltage release opens the circuit breaker when the relative power supply drops or is cut off. It is only available in the version for power supplies branched on the supply side of the circuit breaker.

Electrical characteristics	
Inrush power	250 VA / W
Continuous power	5 VA / W
Voltages available	
24-30-48-60-110-125-132-220-250 V–	
24-48-60-110-120-127-220-230-240 V 50 Hz	
110-120-127-220-230-240 V 60 Hz	

- Notes
- The undervoltage release is incompatible with the locking circuit of the circuit breaker in the state in which it is found owing to insufficient gas pressure, but it is compatible with the opening circuit and lock of the circuitbreaker in the open position for insufficient gas pressure.
 - The undervoltage release can be used in conjunction with the electronic time delay device (see accessory 12).
 - The undervoltage release can be fitted with a mechanical override (see accessory 6).
 - The undervoltage release can be fitted with electrical signalling of release energized or release de-energized (see accessory 5).



5. Contact for signalling undervoltage release energized or de-energized

Installed in an electric circuit, this indicates the state of the undervoltage release.

It is available in two alternative versions:

5A Signals undervoltage release energized

5B Signals undervoltage release de-energized

Electrical specifications of the contacts			
Un	In	cosφ	T
110 V~	4 A	0.3	–
220 V~	3 A	0.3	–
380 V~	1.5 A	0.3	–
110 V–	0.25 A	–	10 ms
220 V–	0.13 A	–	10 ms

6. Mechanical override of undervoltage release

Overrides the mechanical action of the undervoltage release (4), allowing the circuit breaker to close with the undervoltage release de-energized.

The undervoltage release is activated / de-activated by means of a dedicated two-position selector switch installed on the front of the circuit breaker operating mechanism.

It is available in two alternative versions:

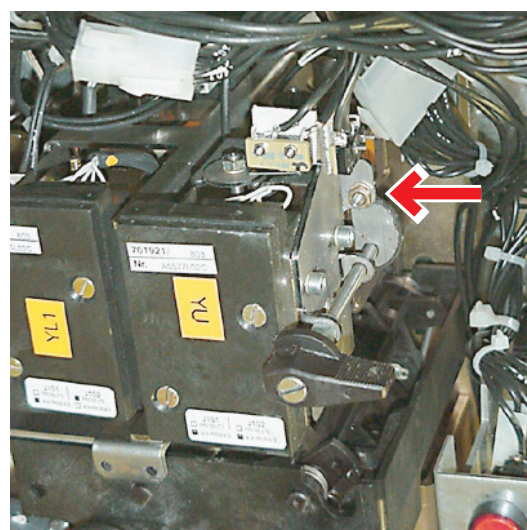
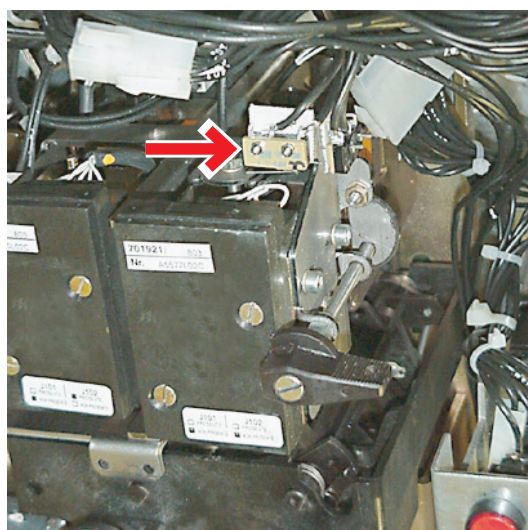
6A Permanent mechanical override

6B Temporary mechanical override

The permanent mechanical override remains in the active position (undervoltage coil excluded) once it has been activated by the two-position selector switch.

It is always fitted with electrical signalling of release excluded (-BGB6). It cannot be supplied when the CEI 0-16 version of the REF 601 protection device is required.

The temporary mechanical override must be manually maintained in the active position by means of the selector on the front of the operating mechanism, otherwise it automatically returns to the de-activated position (undervoltage coil not excluded), as required by CEI 0-16. It is not equipped with electrical signalling of release excluded.



How to choose and order the circuit breakers

7. Signalling contact for closing springs loaded or discharged (-BGS2)

Installed in an electric circuit, this signals the state of the operating mechanism's closing springs.

It is available in two alternative versions:

7A Springs loaded signalling contact

7B Springs discharged signalling contact

Electrical specifications of the contacts			
Un	In	cosφ	T
110 V~	4 A	0.3	–
220 V~	3 A	0.3	–
380 V~	1.5 A	0.3	–
110 V–	0.25 A	–	10 ms
220 V–	0.13 A	–	10 ms

8. Locks on operating pushbuttons

Allow the circuit breaker's operating mechanism knobs to be locked.

The following versions are available:

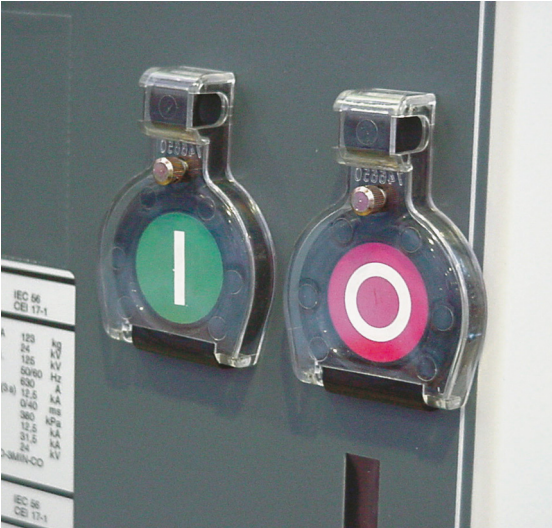
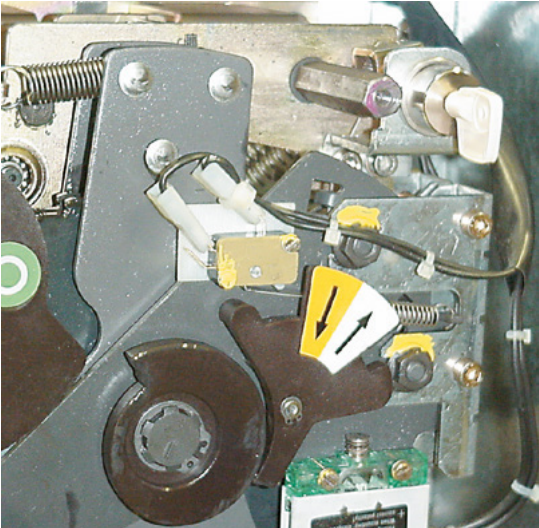
8A Opening pushbutton without padlock

8B Opening pushbutton with padlock

8C Closing pushbutton without padlock

8D Closing pushbutton with padlock

- Notes
- The padlocks for the locks "without padlock" are to be provided by the customer (hook diameter = 4 mm).
 - The lock on the closing pushbutton is always provided if the device for signalling the of state SF6 gas pressure for tripping due to insufficient pressure with automatic circuit breaker opening is ordered.
 - The locks on both the closing and opening pushbuttons are always provided if the device for signalling the state of SF6 gas pressure for tripping due to insufficient pressure with circuit breaker locking in the position in which it is found is ordered.



9. Release lever (12 - 17 - 24 kV)

The kit consists of the lever, which allows the circuit breaker to be hooked up and locked into the compartment.

Note.

The release lever only prevents translation of the circuit breaker.
Lever operation does not automatically open the circuit breaker.



How to choose and order the circuit breakers

Accessories included in the standard equipment for HD4/RE

KIT 1

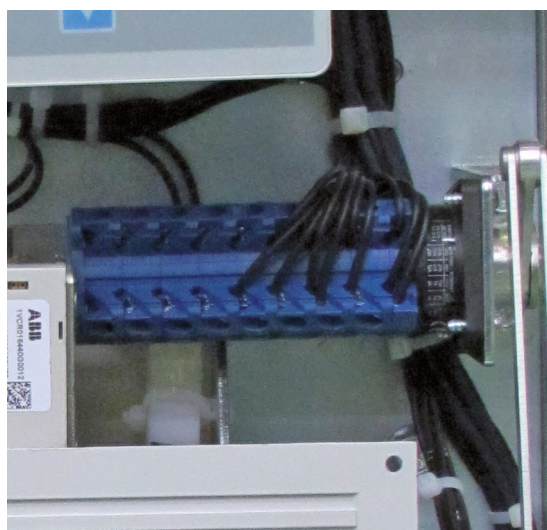
Open/closed signalling contacts (-BGB1)

Standard equipment includes a set of 10 auxiliary contacts for HD4/RE and 9 auxiliary contacts for HD4/ RE-SEC

Note. Each shunt opening release requires a normally open contact (with circuit breaker open) in order to self-de-energize. Thus the quantities given above must be reduced by one unit per shunt opening release ordered

Electrical characteristics	
Insulation voltage to standard VDE 0110, Group C	660 V AC 800 V DC
Rated voltage	24 V ... 660 V
Test voltage	2 kV for 1 min
Maximum rated current	10 A - 50/60 Hz
Breaking capacity	Class 1 (IEC 62271-1)
Number of contacts	6/12
Contact travel	90°
Actuating force	0.6 Nm
Resistor	<6.5 mΩ
Storage temperature	-30 °C ... +120 °C
Operating temperature	-20 °C ... +70 °C (-30° acc. to UL 37.09)
Contact temperature rise	10 K
Mechanical life	30.000 mechanical operations
Protection class	IP20
Cable section	1 mm ²

Additional requirements (IEC 60947)		
Rated current Un		Breaking capacity (10.000 breaks)
220 V AC	Cosφ = 0.70	20 A
220 V DC	Cosφ = 0.45	10 A
24 V DC	1 ms	12 A
	15 ms	9 A
	50 ms	6 A
60 V DC	1 ms	10 A
	15 ms	6 A
	50 ms	4.6 A
110 V DC	1 ms	7 A
	15 ms	4.5 A
	50 ms	3.5 A
220 V DC	1 ms	2 A
	15 ms	1.7 A
	50 ms	1.5 A
250 V DC	1 ms	2 A
	15 ms	1.4 A
	50 ms	1.2 A



KIT 2**Shunt opening release (-MBO1)**

Allows the device to be opened by remote control. The release operates with both direct and alternate current.

This release is suitable for both instantaneous and permanent duty. However, an auxiliary contact shuts off the power supplied to the opening release after the circuit breaker has been opened. To guarantee the release action, the current impulse must last at least 100 ms.

Functionality and continuity can be monitored with the STU device (accessory 10, available on request), or with devices that integrate CCC or TCS.

The power supply voltage of the shunt opening release must match that of the shunt closing release (and of the lamps, if supplied) when the circuit breaker locking device for insufficient pressure is required.

Characteristics	
Un	LV: 24...30 VDC; 48...60 VDC/AC 50-60 Hz
Un	HV: 110...132 - 220...250 VDC/AC 50-60 Hz
Operating limits	65 ... 120% Un
Inrush power (Ps)	70...100 W
Inrush time	150 ms
Holding power (Pc)	1.5 W
Opening time	77 ms
Insulation voltage	2000 V 50 Hz (for 1 min)

KIT 3**Open position key lock**

This lock prevents the closing operation (local and remote) when the key has been removed. To activate the lock, open the circuit breaker, keep the opening pushbutton depressed, turn and remove the key.

Specify the type of lock required:

3A Lock with different keys

3B Lock with the same keys.



How to choose and order the circuit breakers

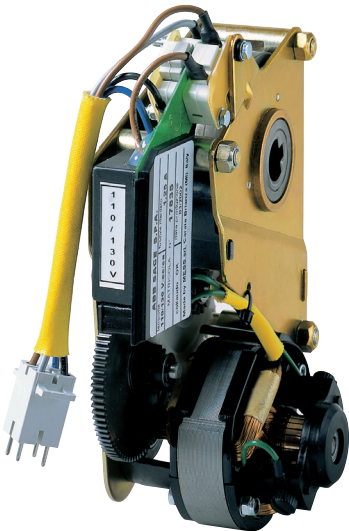
Optional accessories for the HD4/RE series

1. Spring-loading gearmotor (-MAS)
Automatically loads the closing spring of the circuit breaker’s operating mechanism. The gearmotor immediately reloads the closing spring after the circuit breaker has closed. The closing spring can still be loaded in the manual mode (using the relative lever built into the operating mechanism) in a power failure or during maintenance work.

Note: The 24 V DC gearmotor is always supplied with the protecting thermal magnetic circuit breaker (accessory 11).

Characteristics	
Un	24...30 - 48...60 - 110...130 - 220...250 V–
Un	100 - 130 - 220 - 250 - 50 V~ 60 Hz
Operating limits	85...110 % Un
Inrush power (Ps)	DC=600 W; AC=600 VA
Rated power (Pn)	DC=200 W; AC=200 VA
Inrush time	0.2 s
Loading time	6-7 s
Insulation voltage	2000 V 50 Hz (for 1 min)

2. Shunt closing release (-MBC)
The shunt closing release (-MBC) allows the device to be closed by remote control. The release can function with both direct and alternate current and is fit for both instantaneous and continuous service. When permanently energized, the release provides the electric anti-pumping function. In the case of instantaneous service, the current impulse must last at least 100 ms.



3. Additional shunt opening release (-MBO2)

Similarly to shunt opening release -MBO1, this allows the opening command of the apparatus to be transmitted in the remote mode and can be energized by a circuit that is completely separate from release -MBO1.

The release operates with both direct and alternating current.

This release is suitable for both instantaneous and permanent duty. However, an auxiliary contact shuts off the power supplied to the opening release after the circuit breaker has been opened. To guarantee the release action, the current impulse must last at least 100 ms. Functionality and continuity can be monitored with the STU device (accessory 10, available on request), or with devices that integrate CCC or TCS.

Characteristics	
Un	LV: 24...30 VDC; 48...60 VDC/AC 50-60 Hz
Un	HV: 110...132 - 220...250 VDC/AC 50-60 Hz
Operating limits	65 ... 120% Un
Inrush power (Ps)	70...100 W
Inrush time	150 ms
Continuous power consumption (Pc)	1.5 W
Opening time	77 ms
Insulation voltage	2000 V 50 Hz (for 1 min)

4. Undervoltage release (-MBU)

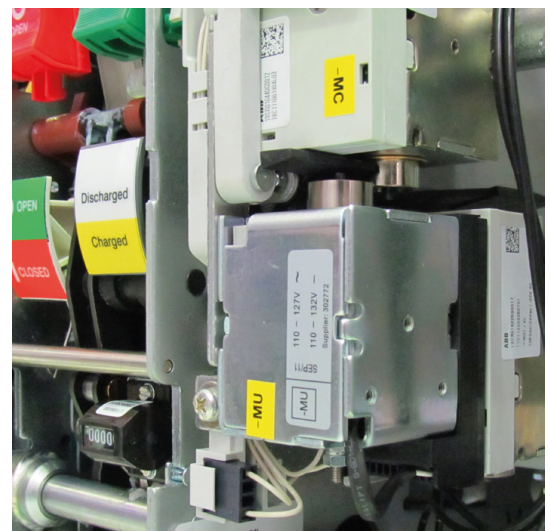
The undervoltage release opens the circuit breaker when there is a sensitive reduction or lack of the voltage that powers it.

It can be used for remote release (by means of a pushbutton of the normally closed type), for locking on closing or for monitoring the voltage in auxiliary circuits. The circuit breaker can only close when the release is energized (the closing lock is obtained mechanically).

The release operates with both direct and alternate current.

This accessory is supplied as part of the standard equipment when the CEI 0-16 version of protection device REF 601 is ordered (with the same power supply voltage as the one requested for REF 601).

Characteristics	
Un	LV: 24...30 VDC; 48...60 VDC/AC 50-60 Hz
Un	HV: 110...132 - 220...250 VDC/AC 50-60 Hz
Operating limits	- circuit breaker opening: 35-70% Un - circuit breaker closing: 85-110% Un
Inrush power (Ps)	150 W
Inrush time	150 ms
Continuous power consumption (Pc)	3 W
Opening time	60...80 ms
Insulation voltage	2000 V 50 Hz (for 1 min)



How to choose and order the circuit breakers

5. Electrical signalling of undervoltage voltage trip (-BGB5)

The undervoltage release can be equipped with a contact (normally closed or open, as required) that signals when the undervoltage release is energized or de-energized, so as to signal the status of the release in the remote mode.

Specify the type of signalling required:

5A Undervoltage release energized signal

5B Undervoltage release de-energized signal

6. Mechanical override of the undervoltage release

This is a mechanical device that allows the operation of the undervoltage release to be de-activated.

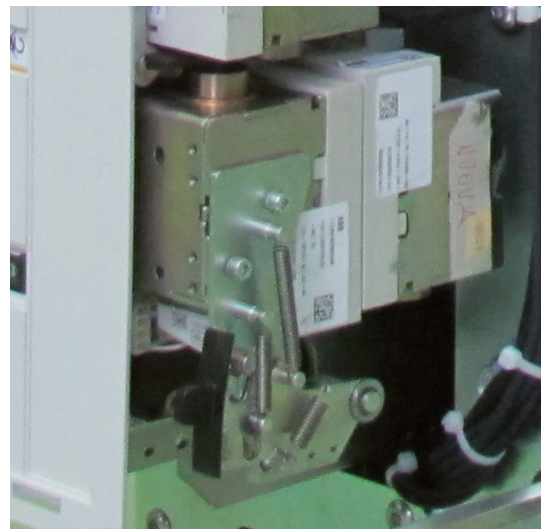
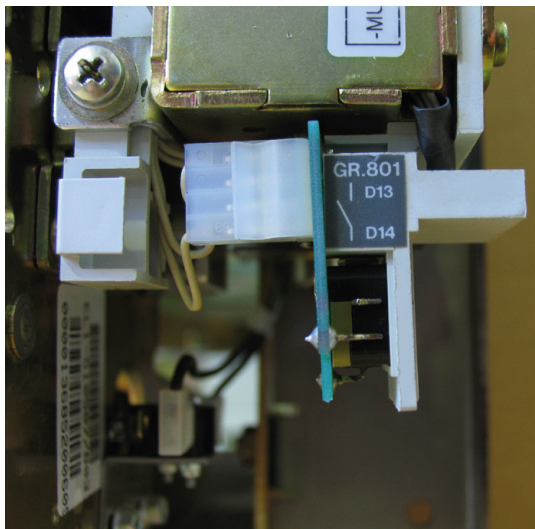
This allows the circuit breaker to be closed even when the undervoltage release is not energized. The undervoltage release is activated / de-activated by means of a dedicated two-position selector switch installed on the front of the circuit breaker operating mechanism.

The undervoltage override is always equipped with an electrical device for signalling when the undervoltage release is de-activated (-BGB6).

The mechanical undervoltage override cannot be supplied when the CEI 0-16 version REF 601 protection device is required.

The “Temporary mechanical override” version is available on request. This allows the action of the de-energized undervoltage release to remain de-activated for as long as the control knob on the front of the circuit breaker’s operating mechanism remains depressed in the manual mode.

The temporary mechanical override cannot be supplied when the CEI 0-16 version REF 601 protection device is required.



7. Closing spring loaded and discharged signalling contacts (-BGS2)

Two pairs of contacts (one open and the other closed) allow the status of the circuit breaker's closing spring to be signalled in the remote mode. Only one contact can be wired, thus spring loaded or spring discharged can be signalled in the remote mode.

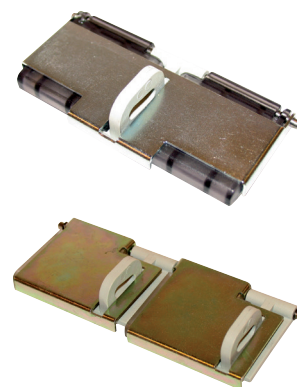
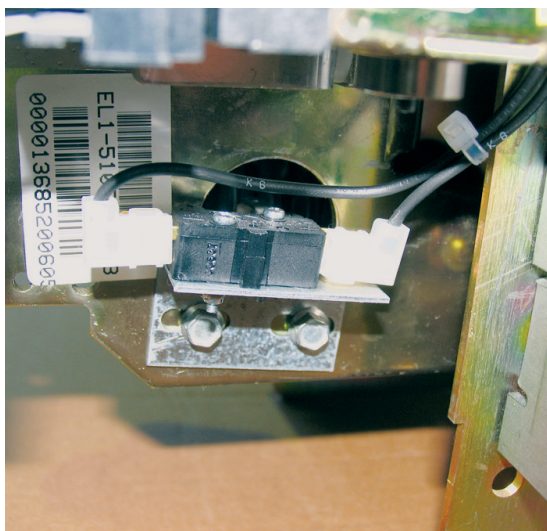
8. Padlock device for the opening and closing pushbuttons

Allows the opening and closing pushbuttons to be locked with up to three 4-mm diameter padlocks (not supplied).

This locking system is available in three versions:

- 9A** Locking of both pushbuttons without distinction
- 9B** Separate locking of the opening and/or closing pushbuttons
- 9C** Locking for HD4/RE-Sec. circuit breakers without distinction

Note. Lock 9A prevents closing by remote control; lock 9B does not prevent closing by remote control.



How to choose and order the circuit breakers

9. Device for monitoring the functionality and continuity of shunt opening/closing releases (STU Shunt Test Unit)

The STU device can be used in conjunction with the shunt opening release (-MBO1; -MBO2) or shunt closing release (-MBC) for functionality and continuity tests (one device for each release to be tested).

The testing/monitoring Shunt Test Unit can be used to test the continuity of releases with rated operating voltage between 24 V and 250 V (AC and DC), as well as the functionality of the release's electronic circuit. The continuity test is performed in cycles with a 20-second interval between one test and the next. The unit has optical LED indicators on the front. The following information is given:

- POWER ON: power is being supplied
- -MBO/-MBC TESTING: the test is being performed
- TEST FAILED: this signal is given after a test has failed or when there is no auxiliary power being supplied
- ALARM: this signal is given after three consecutive tests have failed.



Common accessories for the HD4/R, HD4/RE series

10. Thermal magnetic circuit breaker for protecting the gearmotor (-FCM1, -FB1)

Protects the spring loading motor if an overload occurs. It is always pre-engineered with a signalling contact. It is available in two versions:

- 10A** Protecting thermal magnetic circuit breaker with circuit breaker closed signalling contact
- 10B** Protecting thermal magnetic circuit breaker with circuit breaker open signalling contact

Note. The gearmotor-protecting thermal magnetic circuit breaker for the ESH operating mechanism cannot be installed on the EL operating mechanism, and vice versa.

Electrical specifications of the contacts			
Un	In	cosφ	T
110 V~	4 A	0.3	–
220 V~	3 A	0.3	–
110 V–	0.25 A	–	10 ms
220 V–	0.13 A	–	10 ms

Voltages available

24/60 V–
 110/125 V–
 220 V–
 24/60 V 50-60 Hz
 110/127 V 50-60 Hz
 220-240 V 50-60 Hz

11. Electronic time-lag device (-KT)

This allows circuit breaker opening to be delayed (from 0.5 s to 3 s) when the power supply voltage drops or is cut off.

It consists of a device (to be installed outside the circuitbreaker by the customer), which is interposed on the undervoltage release's power supply.

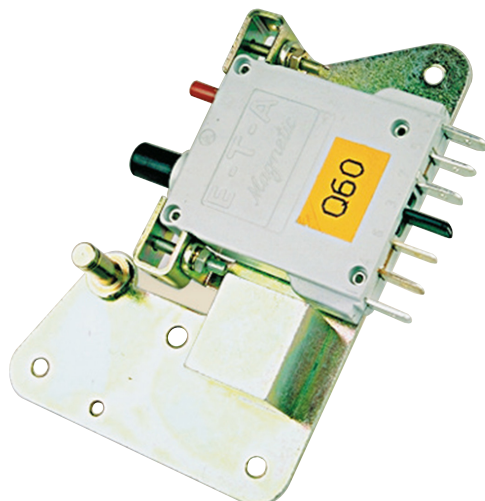
The undervoltage release must be the type for direct current power supply.

Voltages available

24/60 V–
 48 V– 48 V 50-60 Hz
 60 V– 60 V 50-60 Hz
 110/127 V– 110/127 V 50-60 Hz
 220/240 V– 220/240 V 50-60 Hz

Note. The electronic time delay device must be supplied between terminals 1 and 2. The undervoltage release must be connected to terminals 3 and 4. The delay is selected (by the customer) in the following way:

- 0.5 s bridge between terminals 6 and 7;
- 1 s bridge between terminals 6 and 8;
- 1.5 s bridge between terminals 6 and 9;
- 2 s bridge between terminals 6 and 10;
- 3 s no bridge.



How to choose and order the circuit breakers

12. External toroidal transformer (-BN)

The external toroidal transformer is essential for detecting earth fault currents when the circuit breaker is equipped with just two current sensors. It also allows earth fault currents of less than ten or so Amperes to be detected.

It is available in the following versions (with $I_n = 50/1$ A transformer ratio):

- 13A** with closed core and 110 mm internal diameter (in the photograph)
- 13B** with openable core and 110 mm internal diameter
- 13C** with closed core and 110 mm internal diameter, CEI version with 100/1A transformer ratio (for use in conjunction with the IEC version REF 601).

13. REF 601 protection device (-BR51)

REF 601 needs auxiliary voltage in order to function. On request, it can be equipped with all the HD4/R series circuit breakers with lateral operating mechanisms. It is the only protection device that can be installed on the HD4/R-Sec versions.

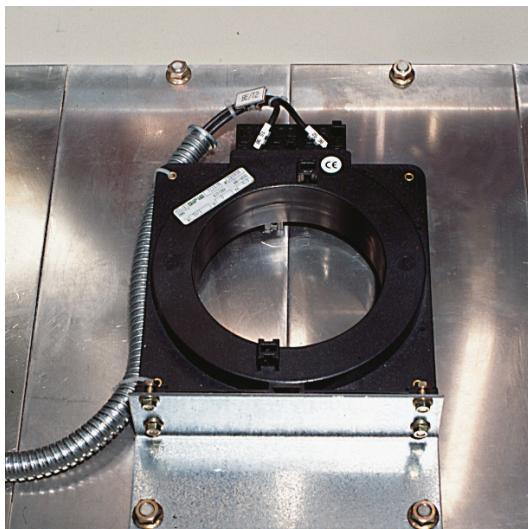
REF 601 trips the circuit breaker owing to:

- overload (51)
- delayed and instantaneous short-circuit (50 and 51)
- delayed and instantaneous homopolar earth fault (50N and 51N)

It also detects the magnetizing current of a three-phase transformer to prevent untimely tripping on switch-in (68).

It is available in the following versions:

- 14A** REF 601 version IEC (time-current curves according to IEC 255-3 and with " $\beta = 1$ " or " $\beta = 5$ " and specific curve "RI" for the Belgian market)
- 14B** REF 601 version IEC as 16A with RS485 serial communication, MODBUS RTU protocol
- 14C** REF 601 version CEI 0-16 (tripping curves in compliance with CEI 0-16). Not available for HD4/RE
- 14D** REF 601 version CEI 0-16 as 16C with RS485 serial communication, MODBUS RTU, FULL DUPLEX protocol. Not available for HD4/RE



The REF 601 protection device has pushbuttons for electrical operation of circuit breaker opening and closing. The electrical opening control is always operative because the HD4/R circuit breaker is supplied with opening release -MBO1 (kit 2) as part of the standard equipment. For the electrical closing control to function, the circuit breaker must be equipped with closing release -MBC.

The power supply voltage of the opening release -MBO1 (and of the closing release -MBC if required), must be the same as the power supply voltage of the REF 601 device.

Protection device REF 601 cannot operate in conjunction with the opening solenoid -MBO3.

Note

In order for the IEC version of the REF 601 protection device to function, the circuit breaker must be equipped with two or three current sensors -BCS1...-BCS3.

Three current sensors are required for protection functions 50N and 51N for the vector sum of the phase currents. Only two current sensors need be installed if functions 50N and 51N are performed with an external toroidal transformer. The external toroidal transformer -BN is available on request.

The CEI 0-16 version of REF 601 is a specific version for the Italian market. In order to conform to CEI 0-16, it opens the circuit breaker by means of the undervoltage release -MBU (accessory 4), which is supplied as part of the standard equipment with the CEI 0-16 version of REF 601.

The power supply voltage of undervoltage release -MBU must be the same as the power supply voltage of the REF device. In order for the CEI 0-16 version of the REF 601 relay to function, the circuit breaker must always be equipped with three current sensors -BCS1...-BCS3 (accessory 15), and with the external toroidal transformer for homopolar protection -BN (accessory 13).

14. Current sensors for protection device REF 601 (-BCS1...-BCS3, -BC1...-BC3)

The current sensors for REF 601 are Rogowsky coils encapsulated in epoxy resin. The following sensors are available:

Kit Quantity

14A 2 (three) KEVCR 24 OC2 sensors with 630 A internal feed-through

14B 3 (three) KEVCR 24 OC2 sensors with 630 A internal feed-through

14C 2 (two) KEVCR 24 AC2 sensors with 1250 A internal feed-through

14D 3 (three) KEVCR 24 AC2 sensors with 1250 A internal feed-through.

The current sensors for the REF 601 protection device can be installed in the following ways:

- circuit breakers up to 24 kV with 230 to 300 mm pole center-distance: the sensors can be installed on each pole regardless of the circuit breaker's rated voltage
- circuit breakers up to 17.5 kV with 210 mm pole centerdistance: the sensors can be installed on each pole regardless of the circuit breaker's rated voltage
- circuit breakers up to 24 kV with 210 mm pole centerdistance: the circuit breaker can be used in conjunction with the REF 601 protection device installed in the switchgear and connected to KECA sensors on insulated medium voltage cables.

Note:

The rated current of the REF 601 protection device must be set on the device itself and does not depend on the type of sensor. The choice between the sensor with 630 A feed-through and that with 1250 A feed-through solely depends on the rated current of the circuit breaker on which the sensors will be installed. It is always obligatory to use 3 sensors for the CEI 0-16 version of REF 601.

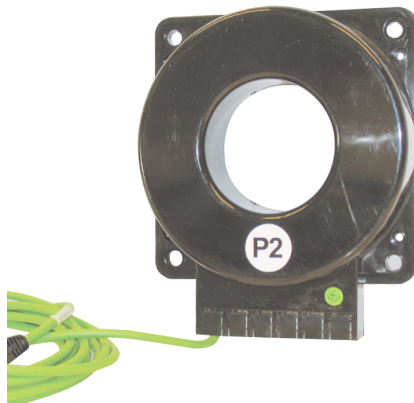


How to choose and order the circuit breakers

15. KECA current sensors for relay REF601

KECA sensors are used when the REF 601 relay is installed in the switchboard instead of being built into the circuit breaker.

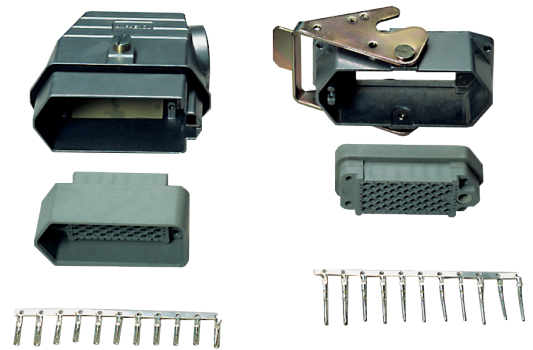
The following Rogowsky sensors with fixed core and 70 mm internal diameter are available: KECA250B1.



17. Socket and plug (12 - 17 - 24 - 36 kV)

This kit consists of a 58-pin connector of the male (loose plug) and female (fixed socket) type, and the pins required for wiring.

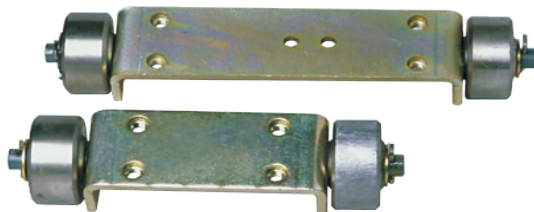
Note. Cables, sheath and assembly are at the customer's charge.



16. Set of wheels (12 - 17 - 24 kV)

This kit consists of the front and rear wheel unit which can be assembled instead of the fixing brackets of the HD4/R and HD4/RE version of the circuit breaker.

Note: Assembly is at the customer's charge. The wheels are part of the standard equipment supplied for HD4/R-Sec and HD4/RE-Sec circuit breakers.



18. Two-level pressure switch

First level - intervention for low pressure: indication is given when the gas pressure drops from 380 kPa absolute to a value below 310 kPa absolute.

Second - intervention for insufficient pressure: the indication is given when the gas pressure drops below 280 kPa absolute.

Note. The pressure switch must be requested at the time of ordering because it must be assembled and tested in the factory.



19. Circuit breaker locking device (with/without lamps) for insufficient SF6 gas pressure

This device can only be supplied for circuit breakers provided with a pressure switch (accessory 19).
The locking circuit is an optional application and can only be installed by ABB.

The following configurations are available:

- 19A** Circuit for automatic circuit breaker opening (by means of the -MBO1 shunt opening release) and lock in the open position (by preventing the supply of power to the -MBC shunt closing release and mechanical lock on the closing pushbutton). Version **without signalling lamps**.
- 19B** Circuit for locking the circuit breaker in the position in which it is to be found (by means of power supply, prevention of the shunt opening and shunt closing releases from activating and with mechanical locks on the opening and closing pushbuttons). Version **without signalling lamps**.
- 19C** Circuit for automatic circuit breaker opening (by means of the -MBO1 shunt opening release) and lock in the open position (by preventing the supply of power to the -MBC shunt closing release and mechanical lock on the closing pushbutton). Version **with three signalling lamps**.
- 19D** Circuit for locking the circuit breaker in the position in which it is to be found (by means of power supply, prevention of shunt opening release -MBO1 and shunt closing release -MBC from activating, with mechanical locks on the opening and closing pushbuttons). Version **with three signalling lamps**.

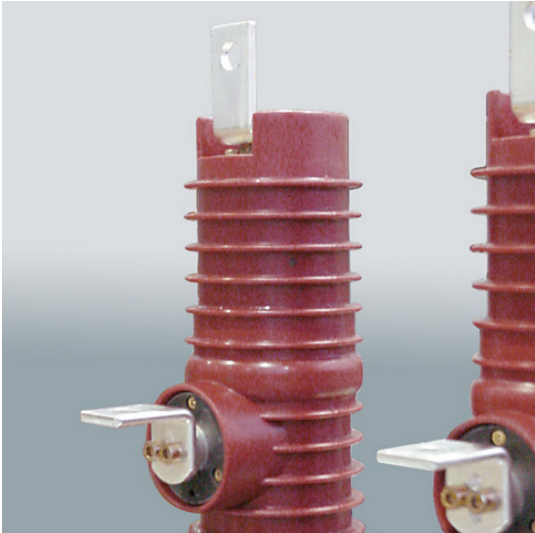
Voltages available	
Un	F
30 V~	-
48 V~	-
60 V~	-
110 V~	-
125 V~	-
220 V~	-
48 V~	50 Hz
110 V~	50 Hz
127 V~	50 Hz
220 V~	50 Hz
110 V~	60 Hz
127 V~	60 Hz
220 V~	60 Hz
240 V~	60 Hz

20. Connection terminals

The set includes the set of upper and lower terminals.
The terminals allow the fixed circuit breaker to be connected to the power circuit.

Currents available	
Kit	In
14A	630 A
14B	1250 A

The connection terminals are not available for the 24 kV P 230 mm versions



Specific characteristics of the product



Vibration resistance

HD4/R circuit breakers are not affected by mechanically or electromagnetically generated vibrations.



Tropicalization

HD4/R circuit breakers are made in compliance with the most stringent specifications concerning their use in hot-humidsaline climates.

All the more important metal parts are treated against corrosive substances corresponding to environment C, in accordance with UNI 12500 Standards.

The galvanizing treatment is applied in compliance with Standard UNI ISO 2081, classification code Fe/Zn 12, thickness 12×10^{-6} m, protected by a conversion layer formed mainly by chromates, in accordance with Standard UNI ISO 4520.

Such characteristics ensure that the HD4/R series complies with climatogram 8 of Standards IEC 60721-2-1 and IEC 60068-2-2 (Test B: DRY HEAT) / IEC 60068-2-30 (Test Db: DAMP HEAT, CYCLIC).

Electromagnetic compatibility

HD4/R circuit breakers equipped with REF601 microprocessor-type solid-state relay guarantee operation without accidental tripping even in the presence of interference caused by electronic equipment, atmospheric disturbance or electrical discharge.

They are also unable to create interference with other, already existing electronic equipment near the installation.

All this in accordance with Standards EN 50081-2, 50082-2, 62271-1, as well as European Directive EEC 89/336 and successive directives concerning electromagnetic compatibility (EMC), in compliance with which the releases bear CE marking.

Altitude

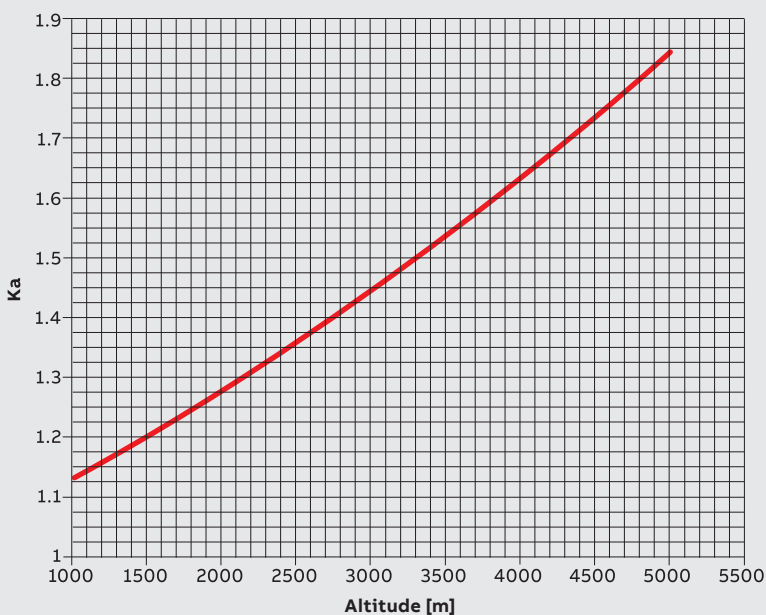
It is known that the insulating property of air diminishes as the altitude increases.

This phenomenon must always be considered when the insulating components of equipment that must be installed at more than 1000 m above sea level are designed. In this case, one must consider a correction coefficient that can be taken from the following graph created in accordance with the indications provided by Standards IEC 62271-100.

The example below gives a clear interpretation of the indications above.



Graph for determining the Ka correction factor according to the altitude, Example (IEC):



Ka = $e^{mH/8150}$ with $m=1$
H = altitude in metres
m = value referred to industrial frequency and the atmospheric impulse withstand voltages and those between phase and phase. Defined value for $m = 1$

- Installation altitude: 2000 m
- Service at a rated voltage of 7 kV
- Withstand voltage at power frequency 20 kV rms
- Impulse withstand voltage 60 kVp
- Ka Factor = 1.28 (see graph).

Taking the above parameters into consideration, the apparatus will have to withstand the following values (under test at zero altitude i.e. at sea level):

- withstand voltage at power frequency equal to:
 $20 \times 1.28 = 25.6 \text{ kVrms}$
- impulse withstand voltage equal to:
 $60 \times 1.28 = 76.8 \text{ kVp}$.

From the above, it can be deduced that for installations at an altitude of 2000 m above sea level, with a service voltage of 7 kV, apparatus with a rated voltage of 17 kV characterized by insulation levels at power frequency of 38 kV rms and with 95 kVp impulse withstand voltage must be provided.

Specific characteristics of the product

Environmental protection program

HD4/R circuit breakers are manufactured in accordance with ISO 14000 Standards (Guidelines for environmental management).

The manufacturing processes are implemented in accordance with the environmental protection standards when it comes to reducing both energy consumption and the production of waste. All this is thanks to the environmental management system, certified by RINA, applied in the manufacturing facility where the medium voltage apparatus is made.

Assessment of the environmental impact during the life cycle of the product (LCA - Life Cycle Assessment) obtained by reducing the overall energy consumption and use of raw materials for the product to the minimum, is put into effect during the design engineering phase through an accurate choice of materials, processes and packaging.

Production techniques that allow the products to be easily disassembled and their components easily separated are implemented when the circuit breakers are manufactured.

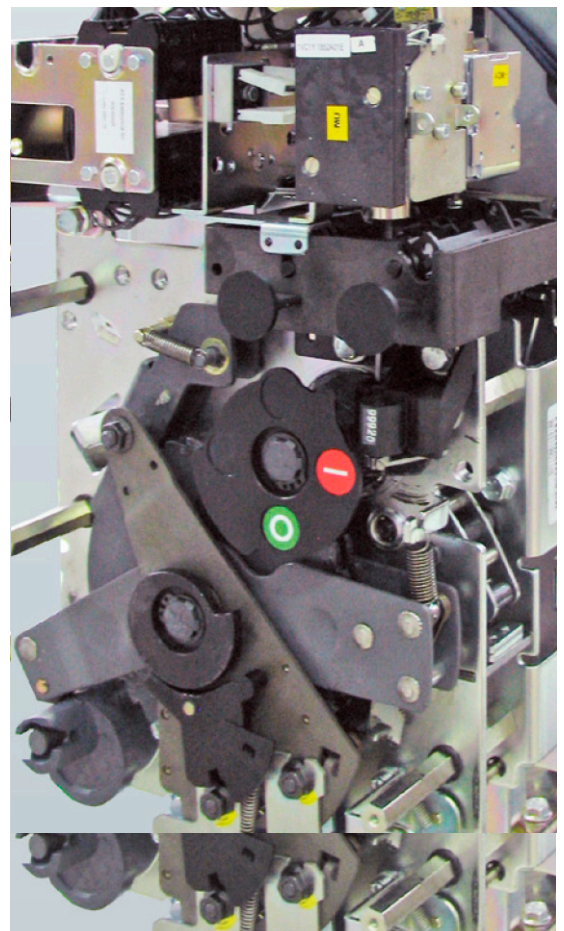
This to allow the products and components to be recycled to the utmost degree at the end of their life cycle.

Spare parts

- Opening spring(*)
- Closing spring(*)
- Complete pole(*)
- Basic operating mechanism(*)
- Gearmotor
- Shunt opening release
- Additional shunt opening release
- Closing release
- Circuit breaker locking device complete with signalling lamps
- Key lock
- Gearmotor limit contact
- KA1 instantaneous relay
- KA2 instantaneous relay
- Opening pushbutton
- Closing pushbutton

Ordering: please contact ABB and specify the serial number of the circuit breaker when ordering spare parts.

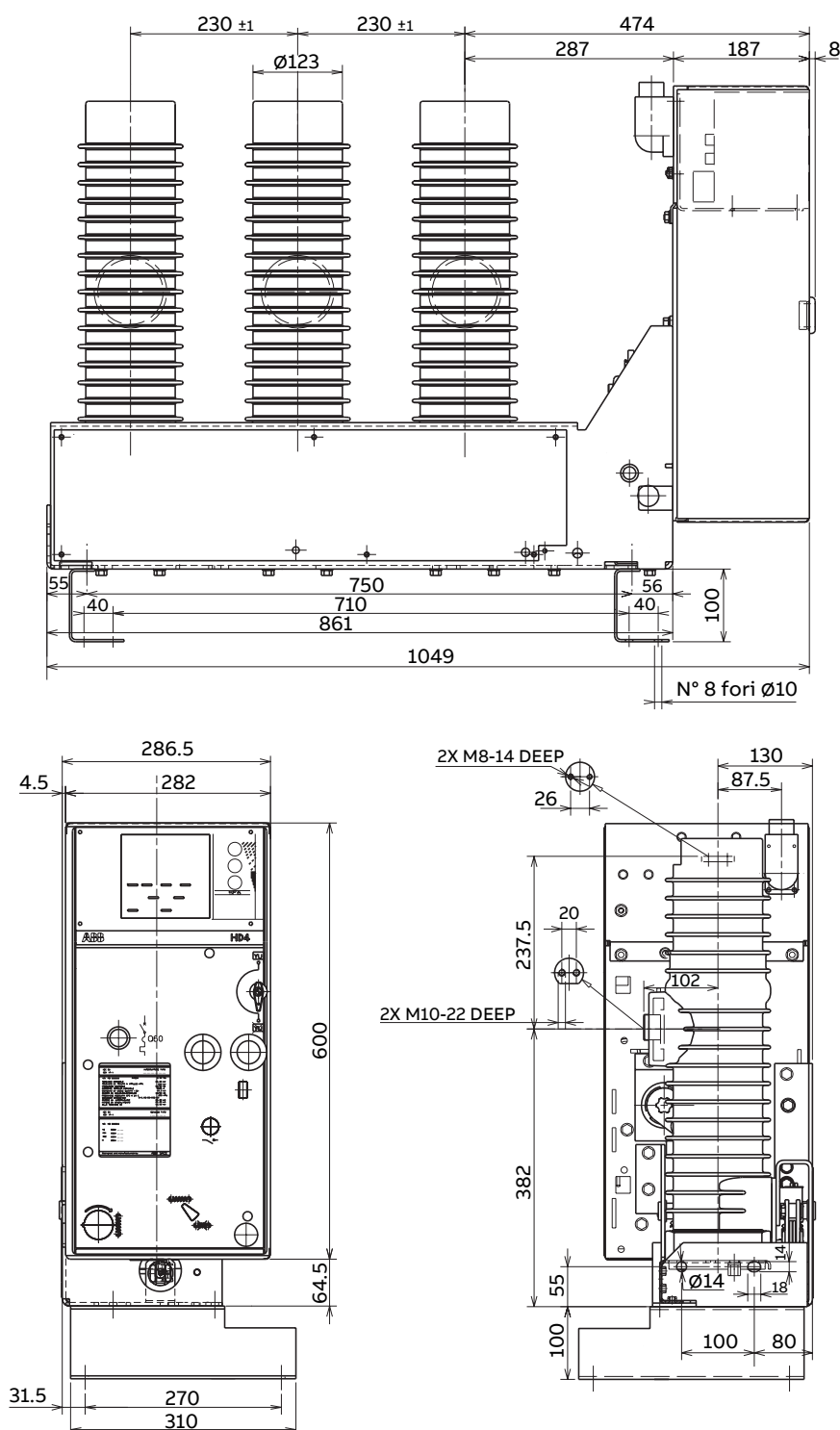
(*) Can only be replaced by trained personnel and/or in our repair shops.



Overall dimensions

Fixed circuit breaker HD4/R with rh lateral operating mechanism
- 12-17.5-24 kV pole center-distance P = 230 mm

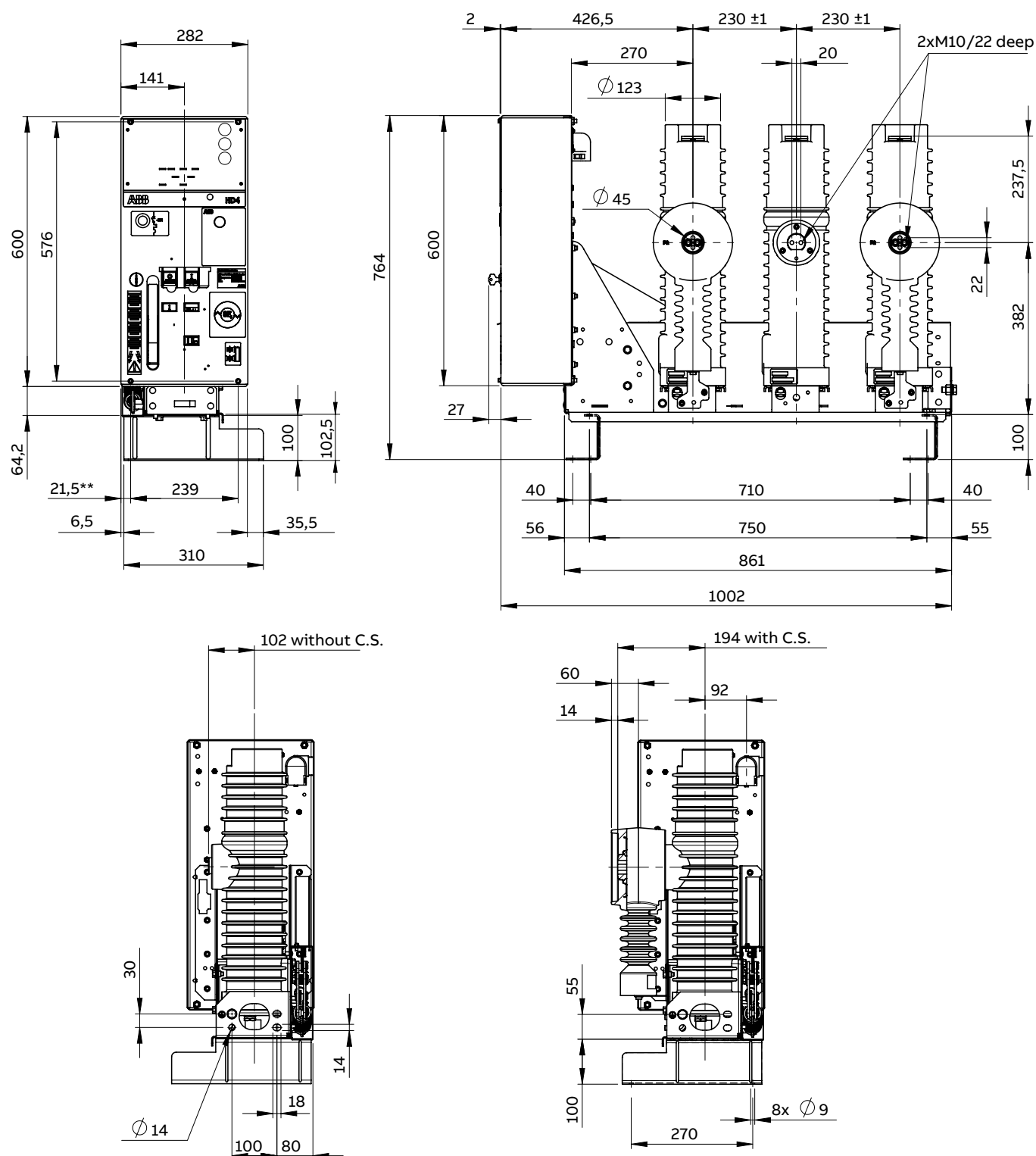
TN 7237



Overall dimensions

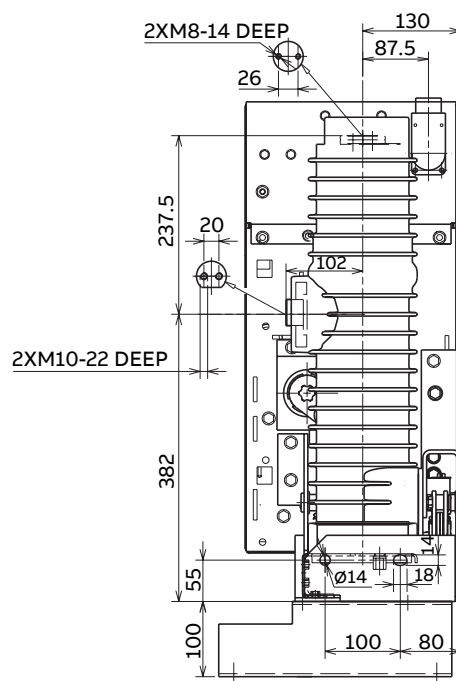
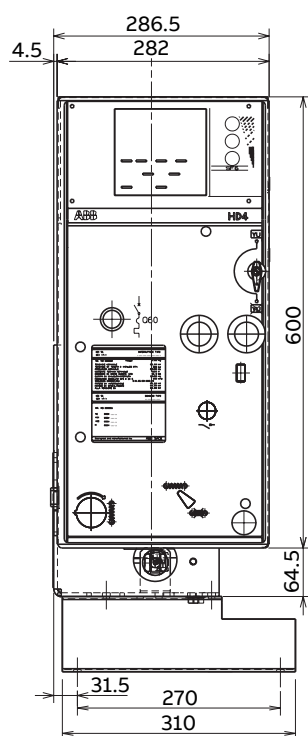
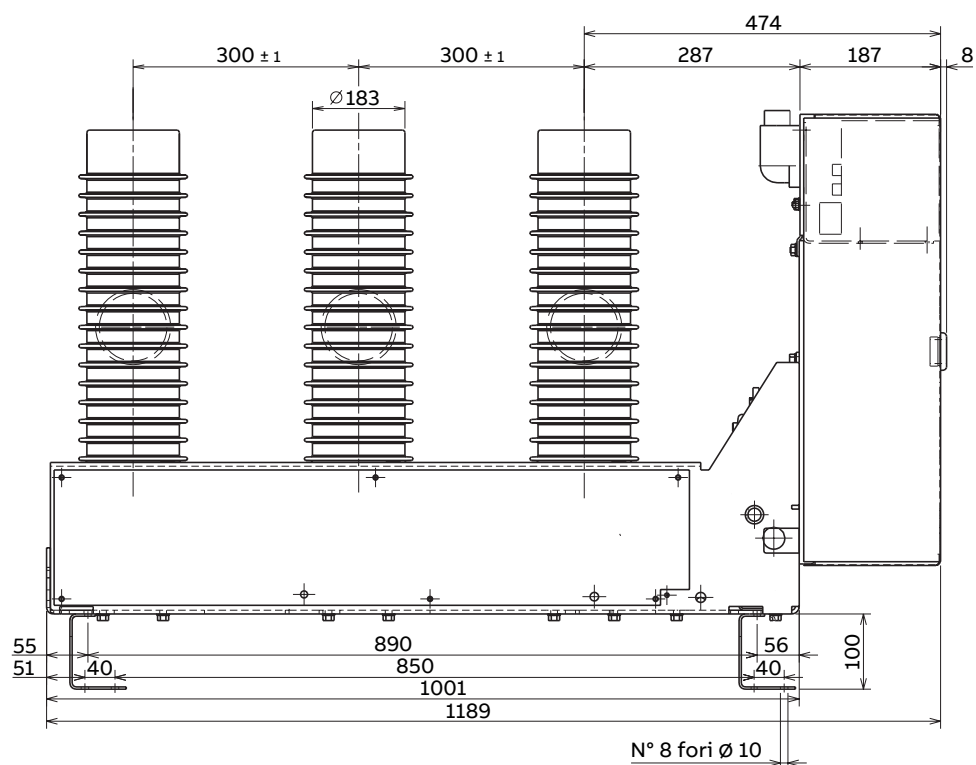
Fixed circuit breaker HD4/RE with rh lateral operating mechanism
- 12-17.5-24 kV pole center-distance P = 230 mm

1VCD000207



Fixed circuit breaker HD4/R with rh lateral operating mechanism
- 12-17.5-24 kV pole center-distance P = 300 mm

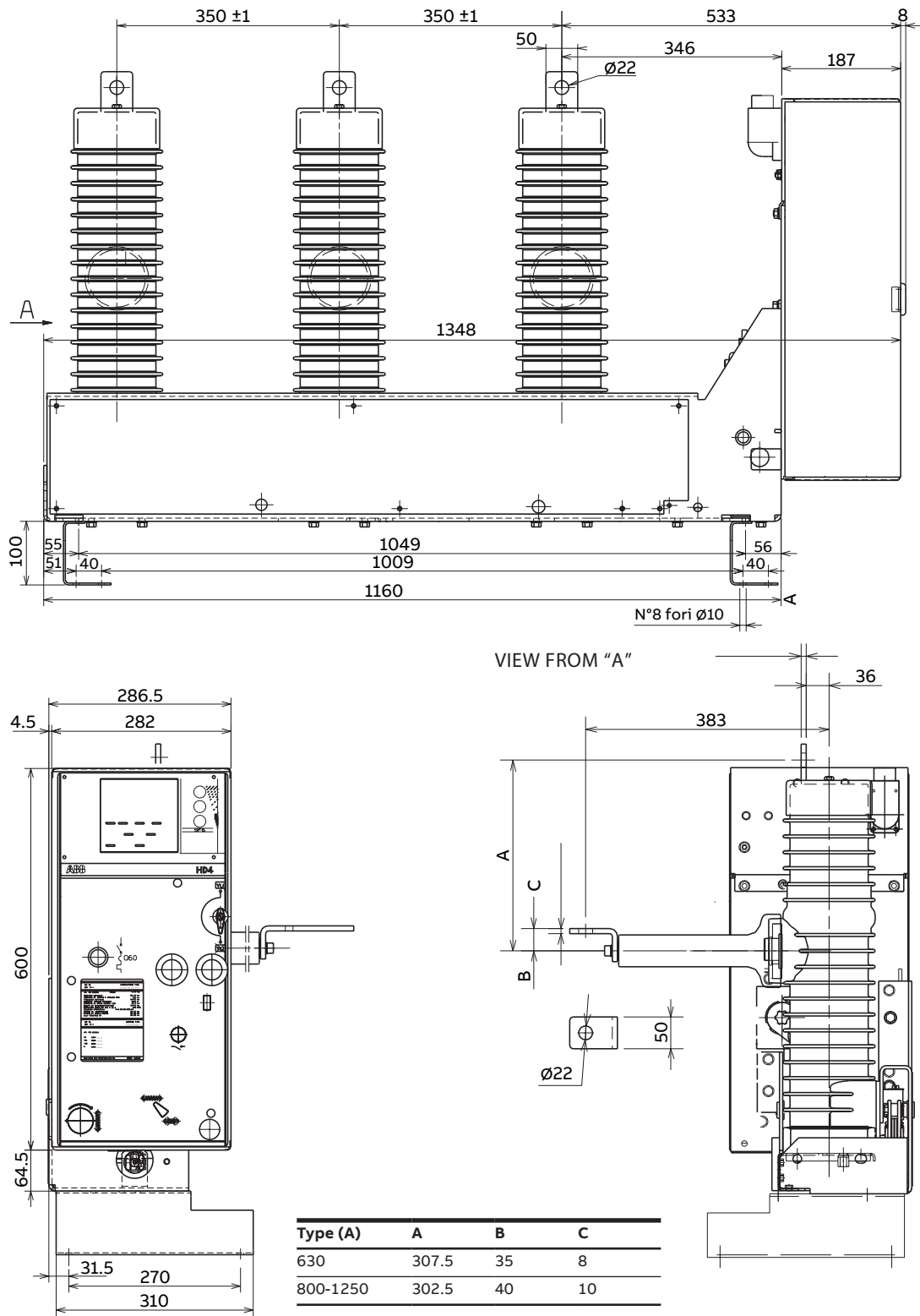
TN 7234



Overall dimensions

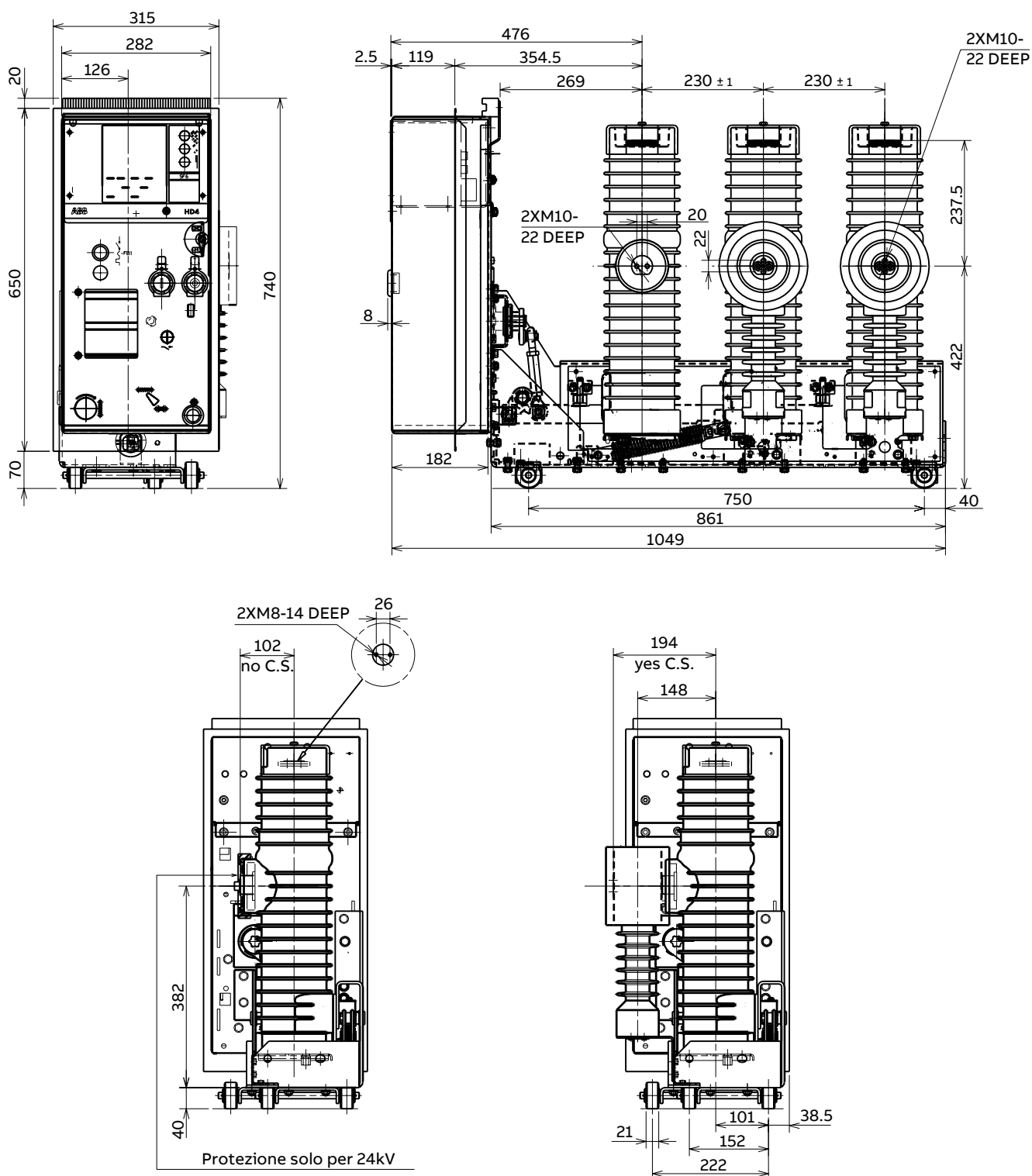
Fixed circuit breaker HD4/R with rh lateral operating mechanism
- 36 kV pole center-distance P = 350 mm

TN 7238



Fixed circuit breaker HD4/R-SEC for UniSec switchgear - rh lateral operating mechanism
- 12-17.5-24 kV pole center-distance P = 230 mm

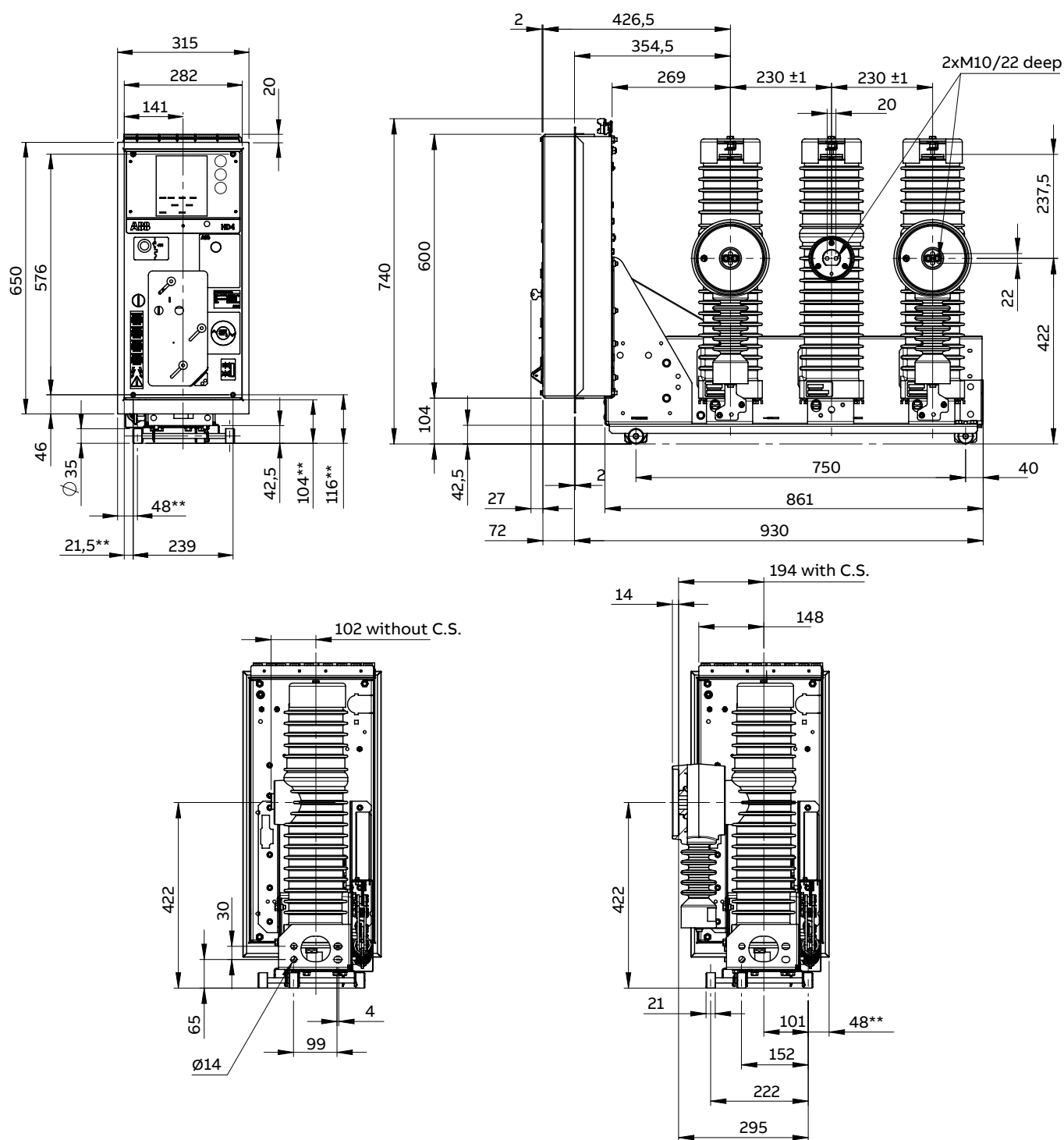
1VCD003536



Overall dimensions

Fixed circuit breaker HD4/RE-SEC for UniSec switchgear - rh lateral operating mechanism
- 12-17.5-24 kV pole center-distance P = 230 mm

1VCD000196





Per maggiori informazioni sul prodotto:

abb.com/mediumvoltage

Centro di contatto:

abb.com/contactcenters

Per maggiori informazioni sul service:

abb.com/service

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