



Medium voltage products

# HD4/R

## MV gas circuit-breakers for secondary distribution



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# 1. Description

- 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<sup>(1)</sup>
- Breaking up to 30% of rated breaking capacity even with SF<sub>6</sub> gas at zero relative pressure<sup>(1)</sup>
- Limited maintenance
- Remote control
- Suitable for installation in prefabricated substations and switchgear
- Application (on request) of current sensors and the PR521 self-supplied protection device
- Application (on request) of current sensors and the REF601 protection device (version with IEC curves or version conforming to CEI 0-16)

<sup>(1)</sup> Up to 24 kV rated voltage



HD4/R circuit-breaker with ESH operating mechanism



HD4/RE circuit-breaker with EL operating mechanism

## General information

HD4 series medium voltage circuit-breakers with lateral operating mechanism for indoor installation use sulphur hexafluoride (SF<sub>6</sub>) 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 operations independent of the operator. The operating mechanism for HD4/RE is the EL trip-free stored energy type with opening and closing 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 dossier 7642).

## Available versions

HD4 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 rh lateral operating mechanism and 300 mm pole center-distance
- plug-in, with rh lateral operating mechanism, version for UniSwitch switchgear, 210 mm pole center-distance
- plug-in, with rh lateral operating mechanism, version for UniMix switchgear, 230 mm pole center-distance
- plug-in, with rh lateral operating mechanism, version for UniAir switchgear, 300 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 PR521 series or REF 601 series device for protection against overcurrents.

**NOTE.** Series PR521 and REF 601 protection devices against overcurrents cannot be installed on the 24 kV UniSwitch version with 210 mm pole center-distance. The PR 521 protection device against overcurrents at can be installed on 24 kV versions with 230 mm pole center-distance if supplied with just 2 current sensors (installed on the lateral poles).

## 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.

Thanks to installation (on request) of the self-supplied PR521 microprocessor-based overcurrent release, HD4/R circuit-breakers are suitable for use in unmanned MV/LV transformer substations without auxiliary power supply.

## PR521 protection device

With the exception of the version for 24 kV UniSec switchgear and UniSec switchgear, HD4/R circuit-breakers with rated voltage up to 24 kV can be equipped on request with the self-supplied PR521 microprocessor-based overcurrent relay, which is available in the following versions:

- **PR521 (50-51):** protects against overloads (51) and against instantaneous and delayed short-circuits (50);
- **PR521 (50-51-51N):** protects against overloads (51), instantaneous and delayed short-circuits (50) and against earth faults (51N).

The current sensors of the releases are available with four rated current values and cover all the circuit-breaker's application ranges (consult chap. 3 for the protection ranges).

**NOTE.** Only two current sensors can be installed (on the lateral poles) in 24 kV versions with 230 mm pole center distance.

Other important features of the PR521 releases are:

- precise interventions
- wide setting ranges
- operation also assured with single-phase power supply
- fade-free specifications and reliable operation even in places with a high degree of pollution
- single and contemporaneous adjustment of the three phases
- no limits to the rated breaking capacity of the circuit-breaker's short-time withstand current even for rated currents lower than the relay.

Consult chapter 3 for further details.



# 1. Description

## REF 601 protection device

On request, HD4 circuit-breakers with lateral operating mechanisms and rated voltage up to 24 kV can be equipped with the REF 601 protection device. The HD4 version for UniSec switchgear can be equipped on request with the REF 601 protection device only. Unlike PR521, which is a self-supplied relay, 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 three-phase 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 short-circuits (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 circuit-breakers with 630 A rated current and for circuit-breakers with rated current values that are higher than 630 A.

Consult chap. 3 for the protection ranges.

Besides the characteristics already described for PR521, REF 601 also possesses other important 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 A.C./D.C. 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 dossier 7642 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.

## Accessories

HD4/R circuit-breakers come with a full range of accessories able to meet all installation requirements.

The same type of ESH operating mechanism is used for the entire HD4/R series and there is a standard range of accessories and spare parts that are simple to identify and order. The HD4/RE series comes with the EL operating mechanism.

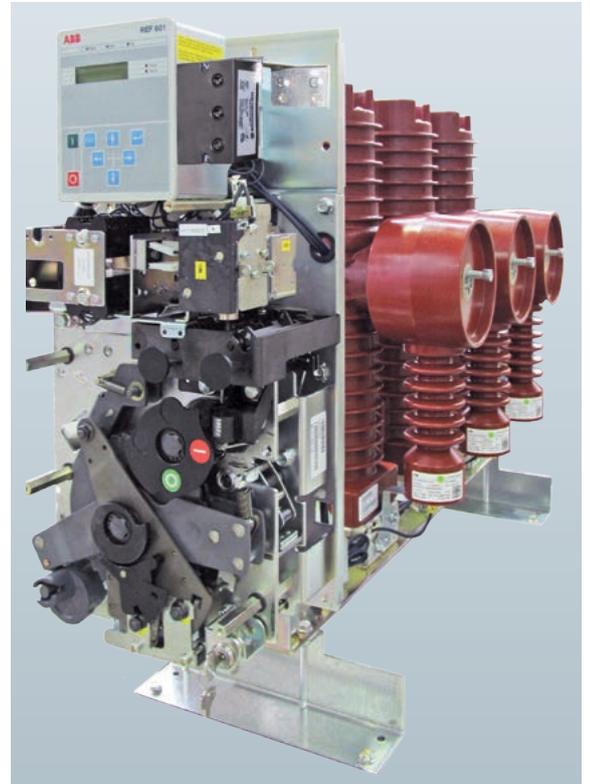
The equipment is easy to operate and manage and requires a limited use of resources.

## ESH operating mechanism

- The same one is used for the entire HD4/R series.
- The same accessories are available for all types of circuit-breaker.
- Fixed strikers make the accessories easy to assemble or replace.
- Accessories wired with sockets and plugs.

## EL operating mechanism

- Used for the HD4/RE series.
- The same accessories are available for all types of circuit-breaker.
- Fixed strikers make the accessories easy to assemble or replace.
- Accessories wired with sockets and plugs.



SF<sub>6</sub> gas pressure status signalling device (on request)



Nameplate with circuit-breaker specifications on front panel



SF<sub>6</sub> gas detector (available on request)



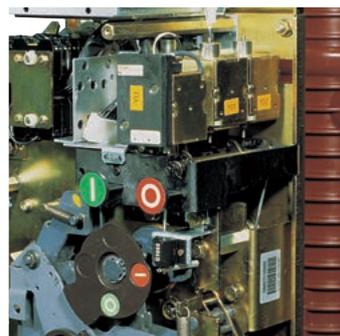
Electrical accessories with simplified assembly



REF 601 relay coordinated with circuit-breaker and with the current sensors



Current sensors (on request), easily replaced

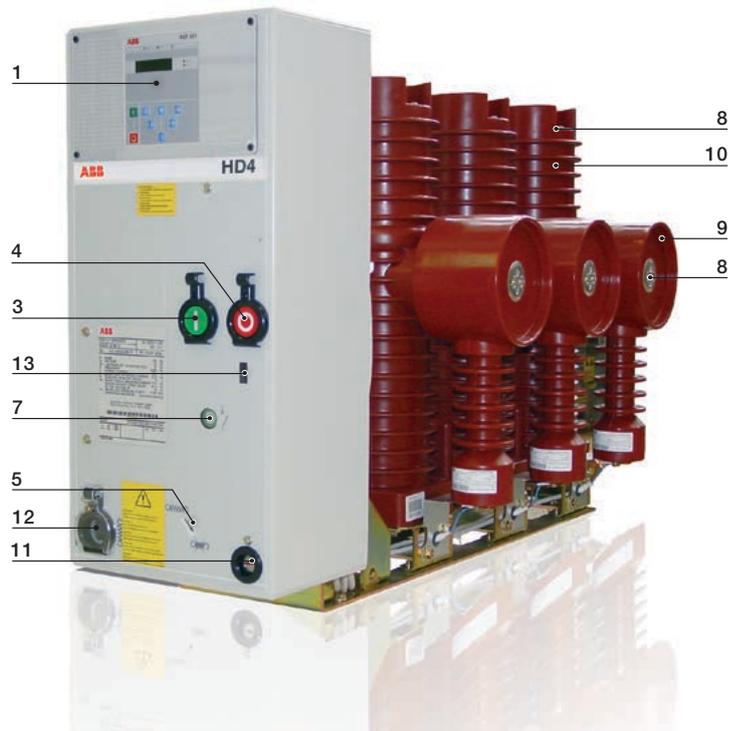


Mechanical anti-pumping device



EL operating mechanism

# 1. Description



- 1 PR521/REF 601 protection relay (on request)
- 2 Manual loading of the closing springs
- 3 Closing pushbutton
- 4 Opening pushbutton
- 5 Indicator for closing springs loaded (yellow) and discharged (white)
- 6 Operation counter
- 7 Circuit-breaker open/closed indicator

- 8 Medium voltage terminals
- 9 Current sensor (for PR521 release/for REF 601 release - if applicable)
- 10 Circuit-breaker pole
- 11 Key lock
- 12 Shaft for loading closing springs in the manual mode
- 13 SF<sub>6</sub> gas pressure status locking and signalling device (applied on request only to circuit-breakers with pressure switch)

## Electrical characteristics

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 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:

- UniAir switchgear Cat. 1VCP000065
- UniMix switchgear Cat. 1VCP000008
- REF542 Plus units Cat. 1VTA000001
- UniSwitch switchgear Cat. UNISS
- UniSec switchgear Cat. 1VFM200001
- REF601 Cat. YN1MDB07212-YN

## Quality Assurance System

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

## Environmental Management System

Conforms to ISO 14001 Standards, certified by an independent third party.

## Health and Safety Management System

Conforms to OHSAS 18001 Standards, certified by an independent third party.

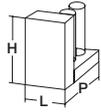
## Test laboratory

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

# 2. How to choose and order the circuit-breakers



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

Circuit-breaker		HD4/R 12			HD4/R 17			HD4/R 24			HD4/R 36			
Standards	IEC 62271-100	●			●			●			●			
	CEI EN 62271-100 (dossier 7642)	●			●			●			●			
Rated voltage	Ur [kV]	12			17.5			24			36			
Rated insulation voltage	Us [kV]	12			17.5			24			36			
Withstand voltage at 50 Hz	Ud (1 min) [kV]	28			38			50			70			
Impulse withstand voltage	Up [kV]	75			95			125			170			
Rated frequency	fr [Hz]	50-60			50-60			50-60			50-60			
Rated thermal current (40°C)	Ir [A]	630	800	1250	630	800	1250	630	800	1250	630	800	1250	
Rated breaking capacity (symmetrical rated short-circuit current)	Isc [kA]	12.5	–	–	12.5	–	–	12.5	–	–	12.5	12.5	12.5	
		16	16	16	16	16	16	16	16	16	16	16	16	
		20	20	20	20	20	20	20	20	20	–	–	–	
		25	25	25	25	25	25	–	–	–	–	–	–	
Rated admissible short-time current (3 s)	Ik [kA]	12.5	–	–	12.5	–	–	12.5	–	–	12.5	12.5	12.5	
		16	16	16	16	16	16	16	16	16	16	16	16	
		20	20	20	20	20	20	20	20	20	–	–	–	
		25	25	25	25	25	25	–	–	–	–	–	–	
Making capacity	Ip [kA]	31.5	–	–	31.5	–	–	31.5	–	–	31.5	31.5	31.5	
		40	40	40	40	40	40	40	40	40	40	40	40	
		50	50	50	50	50	50	50	50	50	–	–	–	
		63	63	63	63	63	63	–	–	–	–	–	–	
Sequence of operations	[O - 0.3s - CO - 15s - CO]	●			●			●			●			
Opening time	[ms]	45			45			45			45			
Arcing time	[ms]	10...15			10...15			10...15			10...15			
Total break-time	[ms]	55...60			55...60			55...60			55...60			
Closing time	[ms]	80			80			80			80			
Overall dimensions (maximum)		H [mm]	764.5			764.5			764.5			810		
		L [mm]	321			321			321			409		
		D [mm]	1049 <sup>(1)</sup> / 1189 <sup>(2)</sup>			1049 <sup>(1)</sup> / 1189 <sup>(2)</sup>			1049 <sup>(1)</sup> / 1189 <sup>(2)</sup>			1348		
		Pole center-distance [mm]	230 / 300			230 / 300			230 / 300			350		
Weight <sup>(3)</sup>	[kg]	103 <sup>(1)</sup> - 105 <sup>(2)</sup>			103 <sup>(1)</sup> - 105 <sup>(2)</sup>			103 <sup>(1)</sup> - 105 <sup>(2)</sup>			110			
Absolute gas pressure (nominal duty value)	[kPa]	380			380			380			380			
Application of PR521 protection device	In [A]	40-80-250-1250 <sup>(4)</sup>			40-80-250-1250 <sup>(4)</sup>			40-80-250-1250 <sup>(4)</sup>			–			
Application of REF 601 protection device <sup>(6)</sup>		● <sup>(5)</sup>			● <sup>(5)</sup>			● <sup>(5)</sup>			–			
Standardized dimensions table		TN 7237 <sup>(1)</sup>			TN 7237 <sup>(1)</sup>			TN 7237 <sup>(1)</sup>			TN 7238			
		TN 7234 <sup>(2)</sup>			TN 7234 <sup>(2)</sup>			TN 7234 <sup>(2)</sup>			–			
Circuit diagram	without protection device installed	1VCD400017			1VCD400017			1VCD400017			1VCD400017			
	with PR521	1VCD400017			1VCD400017			1VCD400017			–			
	with REF 601	1VCD400114			1VCD400114			1VCD400114			–			
Operating temperature	[°C]	- 5 ... + 40			- 5 ... + 40			- 5 ... + 40			- 5 ... + 40			
Tropicalization	IEC: 60068-2-30, 60721-2-1	●			●			●			●			
Electromagnetic compatibility	IEC 62271-1	●			●			●			●			

<sup>(1)</sup> 230 mm pole center distance

<sup>(2)</sup> 300 mm pole center-distance

<sup>(3)</sup> increase the indicated weight by 20 kg for circuit-breakers with PR521 / REF 601 devices and 3 current sensors (15 kg only with 2 current sensors)

<sup>(4)</sup> rated current of the current sensors (the PR521 device and the current sensors are available on request); at 24 kV, only 2 current sensors for PR521 (installed on the circuit-breaker's lateral poles) can be used with 230 mm center-distance between poles

<sup>(5)</sup> 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 -MU undervoltage release for relay-controlled opening

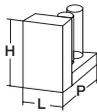
<sup>(6)</sup> at 12 and 17.5 kV and at 630 A rated current, the rated short-time withstand current is 20 kA for 1 second

# 2. How to choose and order the circuit-breakers



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

Circuit-breaker		HD4/RE 12	HD4/RE 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 thermal current (40°C)	Ir [A]	630	630	630
Rated breaking capacity (rated symmetrical short-circuit current)	Isc [kA]	12.5	12.5	12.5
Rated admissible short-time current (1 s)	I <sub>k</sub> [kA]	12.5	12.5	12.5
		16	16	16
Making capacity	I <sub>p</sub> [kA]	31.5	31.5	31.5
		40	40	40
Sequence of operations	[O - 3m - CO - 3m - CO]	●	●	●
Opening time	[ms]	77	77	77
Arcing time	[ms]	10...15	10...15	10...15
Total break-time	[ms]	87...92	87...92	87...92
Closing time	[ms]	50	50	50
Overall dimensions (maximum)	H [mm]	764.5	764.5	764.5
	L [mm]	321	321	321
	P [mm]	1049	1049	1049
	Pole center-distance [mm]	230	230	230
Weight <sup>(2)</sup>	[kg]	103	103	103
Absolute gas pressure (nominal duty value)	[kPa]	380	380	380
Application of PR521 protection device	I <sub>n</sub> [A]		application not available	
Application of REF 601 protection device	I <sub>n</sub> [A]	● <sup>(1)</sup>	● <sup>(1)</sup>	● <sup>(1)</sup>
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	●	●	●

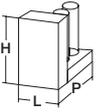


<sup>(1)</sup> the REF 601 and current sensors are available on request; the rated current of the REF 601 device must be set in the relay in accordance with the circuit-breaker's rated current

<sup>(2)</sup> 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 UniSwitch switchgear (12 - 17.5 - 24 kV)



Circuit-breaker		HD4/S 12			HD4/S 17			HD4/S 24			
Standards	IEC 62271-100	●			●			●			
	CEI EN 62271-100 (dossier 7642)	●			●			●			
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 thermal current (40°C)	Ir [A]	630	800	1250	630	800	1250	630	800	1250	
Rated breaking capacity (rated symmetrical short-circuit current)	Isc [kA]	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	
		16	16	16	16	16	16	16	16	16	
		20	20	20	20	20	20	20	20	20	
		25	25	25	-	-	-	-	-	-	
Rated admissible short-time current (1 s)	Ik [kA]	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	
		16	16	16	16	16	16	16	16	16	
		20 <sup>(5)</sup>	20	20	20 <sup>(5)</sup>	20	20	20	20	20	
		25 <sup>(6)</sup>	25 <sup>(6)</sup>	25 <sup>(6)</sup>	-	-	-	-	-	-	
Making capacity	Ip [kA]	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	
		50	50	50	50	50	50	50	50	50	
		63	63	63	-	-	-	-	-	-	
Sequence of operations	[O - 0.3s - CO - 15s - CO]	●			●			●			
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]	710			710			710		
		L [mm]	286.5			286.5			286.5		
		D [mm]	1009			1009			1009		
		Pole center-distance [mm]	210			210			210		
Weight <sup>(1)</sup>	[kg]	90			90			90			
Absolute gas pressure (nominal duty value)	[kPa]	380			380			380			
Application of PR521 protection device	In [A]	40-80-250-1250 <sup>(2)</sup>			40-80-250-1250 <sup>(2)</sup>			-			
Application of REF 601 protection device		● <sup>(3)</sup>			● <sup>(3)</sup>			-			
Application of PR512 protection device		see note <sup>(4)</sup>			see note <sup>(4)</sup>			-			
Standardized dimensions table		TN 7236			TN 7236			TN 7236			
Circuit diagram	without protection device installed	1VCD400018			1VCD400018			1VCD400018			
	with PR521	1VCD400018			1VCD400018			-			
	with REF 601	1VCD400116			1VCD400116			-			
Operating temperature	[°C]	- 5 ... + 40			- 5 ... + 40			- 5 ... + 40			
Tropicalization	IEC: 60068-2-30, 60721-2-1	●			●			●			
Electromagnetic compatibility	IEC 62271-1	●			●			●			

<sup>(1)</sup> increase the indicated weight by 20 kg for circuit-breakers with PR 521 / PR 512 / REF 601 devices and 3 current sensors (15 kg only with 2 current sensors)

<sup>(2)</sup> rated current of the current sensors (the PR521 device and the current sensors are available on request)

<sup>(3)</sup> 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 -MU undervoltage release for relay-controlled opening

<sup>(4)</sup> special version with curves "β = 1" or "β = 1, RI" for the Belgian market: ask ABB for the availability, delivery lead times and wiring diagram

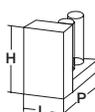
<sup>(5)</sup> at 12 and 17.5 kV and at 630 A rated current, the rated short-time withstand current is 20 kA for 1 second

<sup>(6)</sup> at 12 and with 25 kA breaking capacity, the rated short-time withstand current is 25 kA for 2 seconds

# 2. How to choose and order the circuit-breakers



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

Circuit-breaker		HD4/UniMix 12	HD4/UniMix 17	HD4/UniMix 24	
Standards	IEC 62271-100	•	•	•	
	CEI EN 62271-100 (dossier 7642)	•	•	•	
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 thermal current (40°C)	Ir [A]	630	630	630	
Rated breaking capacity (rated symmetrical short-circuit current)	Isc [kA]	12.5	12.5	12.5	
		16	16	16	
		20	20	20	
		25 <sup>(5)</sup>	-	-	
Rated admissible short-time current (3 s)	Ik [kA]	12.5	12.5	12.5	
		16	16	16	
		20 <sup>(6)</sup>	20 <sup>(6)</sup>	20	
		25	-	-	
Making capacity	Ip [kA]	31.5	31.5	31.5	
		40	40	40	
		50	50	50	
		63	-	-	
Sequence of operations	[O - 0.3s - CO - 15s - CO]	•	•	•	
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]	734.5	734.5	734.5
		L [mm]	393.5	393.5	393.5
		D [mm]	1049	1049	1049
		Pole center-distance [mm]	230	230	230
Weight <sup>(1)</sup>	[kg]	103	103	103	
Absolute gas pressure (nominal duty value)	[kPa]	380	380	380	
Application of PR521 protection device	In [A]	40-80-250-1250 <sup>(2)</sup>	40-80-250-1250 <sup>(2)</sup>	40-80-250-1250 <sup>(2)</sup>	
Application of REF 601 protection device		• <sup>(3)</sup>	• <sup>(3)</sup>	• <sup>(3)</sup>	
Standardized dimensions table		TN 7366 <sup>(4)</sup>	TN 7366 <sup>(4)</sup>	TN 7366 <sup>(4)</sup>	
		1VCD003396 <sup>(5)</sup>	1VCD003396 <sup>(5)</sup>	1VCD003396 <sup>(5)</sup>	
Circuit diagram	without relay / with PR521	1VCD400017 <sup>(4)</sup>	1VCD400017 <sup>(4)</sup>	1VCD400017 <sup>(4)</sup>	
		1VCD400018 <sup>(5)</sup>	1VCD400018 <sup>(5)</sup>	1VCD400018 <sup>(5)</sup>	
	with REF 601	1VCD400114 <sup>(4)</sup>	1VCD400114 <sup>(4)</sup>	1VCD400114 <sup>(4)</sup>	
		1VCD400116 <sup>(5)</sup>	1VCD400116 <sup>(5)</sup>	1VCD400116 <sup>(5)</sup>	
Operating temperature	[°C]	- 5 ... + 40	- 5 ... + 40	- 5 ... + 40	
Tropicalization	IEC: 60068-2-30, 60721-2-1	•	•	•	
Electromagnetic compatibility	IEC 62271-1	•	•	•	

<sup>(1)</sup> increase the indicated weight by 20 kg for circuit-breakers with PR521 / REF 601 devices and 3 current sensors (15 kg only with 2 current sensors)

<sup>(2)</sup> rated current of the current sensors (the PR521 device and the current sensors are available on request)

<sup>(3)</sup> 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 -MU undervoltage release for relay-controlled opening

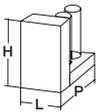
<sup>(4)</sup> HD4/UniMix-F for Unit P1/F (fixed circuit-breaker without wheels and wiring in terminal box)

<sup>(5)</sup> HD4/UniMix-R for Unit P1/F (fixed circuit-breaker with wheels and plug connection)

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

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



Circuit-breaker		HD4/UniAir 12	HD4/UniAir 17	HD4/UniAir 24	
Standards	IEC 62271-100	•	•	•	
	CEI EN 62271-100 (dossier 7642)	•	•	•	
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 thermal current (40°C)	Ir [A]	630 800 1250	630 800 1250	630 800 1250	
Rated breaking capacity (rated symmetrical short-circuit current)	Isc [kA]	12.5 – –	12.5 – –	12.5 – –	
		16 16 16	16 16 16	16 16 16	
		20 20 20	20 20 20	20 20 20	
		25 25 25	– – –	– – –	
Rated admissible short-time current (3 s)	Ik [kA]	12.5 – –	12.5 – –	12.5 – –	
		16 16 16	16 16 16	16 16 16	
		20 <sup>(6)</sup> 20 20	20 <sup>(6)</sup> 20 20	20 20 20	
		25 25 25	– – –	– – –	
Making capacity	Ip [kA]	31.5 – –	31.5 – –	31.5 – –	
		40 40 40	40 40 40	40 40 40	
		50 50 50	50 50 50	50 50 50	
		63 63 63	– – –	– – –	
Sequence of operations	[O - 0.3s - CO - 15s - CO]	•	•	•	
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]	748 <sup>(4)</sup> -735 <sup>(5)</sup> -704.5 <sup>(7)</sup>	748 <sup>(4)</sup> -735 <sup>(5)</sup> -704.5 <sup>(7)</sup>	748 <sup>(4)</sup> -735 <sup>(5)</sup> -704.5 <sup>(7)</sup>
		L [mm]	374 <sup>(4)</sup> -464 <sup>(5)</sup> -286.5 <sup>(7)</sup>	374 <sup>(4)</sup> -464 <sup>(5)</sup> -286.5 <sup>(7)</sup>	374 <sup>(4)</sup> -464 <sup>(5)</sup> -286.5 <sup>(7)</sup>
		D [mm]	1189	1189	1189
		Pole center-distance [mm]	300	300	300
Weight <sup>(1)</sup>	[kg]	108 <sup>(4)</sup> -110 <sup>(5)</sup> -103 <sup>(7)</sup>	108 <sup>(4)</sup> -110 <sup>(5)</sup> -103 <sup>(7)</sup>	108 <sup>(4)</sup> -110 <sup>(5)</sup> -103 <sup>(7)</sup>	
Absolute gas pressure (nominal duty value)	[kPa]	380	380	380	
Application of PR521 protection device	In [A]	40-80-250-1250 <sup>(2)</sup>	40-80-250-1250 <sup>(2)</sup>	40-80-250-1250 <sup>(2)</sup>	
Application of REF 601 protection device		• <sup>(3)</sup>	• <sup>(3)</sup>	• <sup>(3)</sup>	
Standardized dimensions table		TN 7235 <sup>(4)</sup>	1VCD000102 <sup>(4)</sup>	1VCD000102 <sup>(4)</sup>	
		TN 7274 <sup>(5)</sup>	1VCD000103 <sup>(5)</sup>	1VCD000103 <sup>(5)</sup>	
		TN 7273 <sup>(6)</sup>	1VCD000104 <sup>(6)</sup>	1VCD000104 <sup>(6)</sup>	
		TN 7275 <sup>(7)</sup>	1VCD000104 <sup>(6)</sup>	1VCD000104 <sup>(6)</sup>	
Circuit diagram	without relay / with PR521	1VCD400018 <sup>(4)</sup> <sup>(5)</sup> <sup>(6)</sup>	1VCD400018 <sup>(4)</sup> <sup>(5)</sup> <sup>(6)</sup>	1VCD400018 <sup>(4)</sup> <sup>(5)</sup> <sup>(6)</sup>	
		1VCD400017 <sup>(7)</sup>	1VCD400017 <sup>(7)</sup>	1VCD400017 <sup>(7)</sup>	
	with REF 601	1VCD400116 <sup>(4)</sup> <sup>(5)</sup> <sup>(6)</sup>	1VCD400116 <sup>(4)</sup> <sup>(5)</sup> <sup>(6)</sup>	1VCD400116 <sup>(4)</sup> <sup>(5)</sup> <sup>(6)</sup>	
		1VCD400114 <sup>(7)</sup>	1VCD400114 <sup>(7)</sup>	1VCD400114 <sup>(7)</sup>	
Operating temperature	[°C]	- 5 ... + 40	- 5 ... + 40	- 5 ... + 40	
Tropicalization	IEC: 60068-2-30, 60721-2-1	•	•	•	
Electromagnetic compatibility	IEC 62271-1	•	•	•	

<sup>(1)</sup> increase the indicated weight by 20 kg for circuit-breakers with PR521 / REF 601 devices and 3 current sensors (15 kg only with 2 current sensors)

<sup>(2)</sup> rated current of the current sensors (the PR521 device and the current sensors are available on request)

<sup>(3)</sup> 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 -MU undervoltage release for relay-controlled opening

<sup>(4)</sup> HD4/UniAir for Unit P1/F (unit with plug-in circuit-breaker)

<sup>(5)</sup> HD4/UniAir-2R for Unit P1E/2R (unit with plug-in circuit-breaker on the supply and load sides)

<sup>(6)</sup> HD4/UniAir-A for Unit P1/A (unit with fixed "upside-down" circuit-breaker)

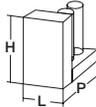
<sup>(7)</sup> HD4/UniAir-F for P1/F Unit (unit with fixed circuit-breaker without wheels and cabled to terminal box); the 12-17.5-24 kV types available are 630 A, 12.5 and 16 kA only

<sup>(8)</sup> at 12 and 17.5 kV and at 630 A rated current, the rated short-time withstand current is 20 kA for 1 second

# 2. How to choose and order the circuit-breakers



## 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 (dossier 7642)	•	•	•		
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 thermal current (40°C)	Ir [A]	630	800	630		
Rated 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 <sup>(5)</sup>	20 <sup>(5)</sup>	20
		25	25	–	–	–
Rated admissible short-time current (3 s)	Ik [kA]	12.5	12.5	12.5	–	12.5
		16	16	16	16	16
		20 <sup>(3)</sup>	20	20 <sup>(5)</sup>	20 <sup>(5)</sup>	20
		25 <sup>(4)</sup>	25 <sup>(4)</sup>	–	–	–
Making capacity	Ip [kA]	31.5	31.5	31.5	–	31.5
		40	40	40	40	40
		50	50	50	50	50
		63	63	–	–	–
Sequence of operations	[O - 0.3s - CO - 15s - CO]	•	•	•		
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	
		L [mm]	315	315	315	
		D [mm]	1049	1049	1049	
		Pole center-distance [mm]	230	230	230	
Weight <sup>(1)</sup>	[kg]	103	103	103		
Absolute gas pressure (nominal duty value)	[kPa]	380	380	380		
Application of PR521 protection device	In [A]	application not available				
Application of REF 601 protection device		• <sup>(2)</sup>	• <sup>(2)</sup>	• <sup>(2)</sup>		
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	•	•	•		

<sup>(1)</sup> 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)

<sup>(2)</sup> 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 -MU undervoltage release for relay-controlled opening

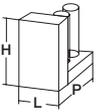
<sup>(3)</sup> at 12 and 17.5 kV and at 630 A rated current, the rated short-time withstand current is 20 kA for 1 second

<sup>(4)</sup> at 12, the rated short-time withstand current is 25 kA for 2 seconds

<sup>(5)</sup> at 17.5 kV, the breaking capacity is 21 kA and the rated short-time withstand current is 21 kA for 3 seconds

## 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 (dossier 7642)	•	•	•	
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 thermal current (40°C)	Ir [A]	630	630	630	
Rated breaking capacity (rated symmetrical short-circuit current)	Isc [kA]	12.5	12.5	12.5	
		16	16	16	
Rated admissible short-time current (1 s)	Ik [kA]	12.5	12.5	12.5	
		16	16	16	
Making capacity	Ip [kA]	31.5	31.5	31.5	
		40	40	40	
Sequence of operations	[O - 3m - CO - 3m - CO]	•	•	•	
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	740
		L [mm]	315	315	315
		D [mm]	1049	1049	1049
		Pole center-distance [mm]	230	230	230
Weight <sup>(1)</sup>	[kg]	103	103	103	
Absolute gas pressure (nominal duty value)	[kPa]	380	380	380	
Application of REF 601 protection device	In [A]	• <sup>(2)</sup>	• <sup>(2)</sup>	• <sup>(2)</sup>	
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	•	•	•	

<sup>(1)</sup> 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)

<sup>(2)</sup> 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 -MU undervoltage release for relay-controlled opening

# 2. How to choose and order the circuit-breakers

## Standard equipment

### 1. Fixed circuit-breakers with rh lateral operating mechanism (230 or 300 mm distance between centers)

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 operation counter
- 4 circuit-breaker open/closed indicator
- 5 housing for the manual springs loading handle
- 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 pages 23-24):

**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 UniSwitch switchgear with rh lateral operating mechanisms (210 mm distance between centers)

The basic coded version of the HD4/S circuit-breakers for UniSwitch switchgear is the same as that of the fixed circuit-breakers with the following exceptions and specific fittings:

- base with wheels to make the UniSwitch switchgear easier to move and rack-in to the compartment
- upper and lower terminals pre-engineered for connection to the busbars of the UniSwitch switchgear
- insulating caps to install in the upper part of the poles (after the busbars have been connected to the upper terminals)
- a dedicated connector (58-pole bayonet connection plug) fixed to the right-hand side of the operating mechanism's enclosure. The connector has a lock that inhibits manual operation unless the relative plug with insulating release pin is inserted.
- insulating release pin to insert into the plug (female with 58 poles) and disable the lock that inhibits manual operation unless the plug is plugged into the socket on the operating mechanism.

A set of 12 auxiliary contacts is available on request, with a surcharge, as an alternative to the open/closed group of 5 auxiliary contacts. The shunt opening device uses an NO auxiliary contact to shut off its power supply after the circuit-breaker has been opened. This means that there is an unavailable NO auxiliary contact for every shunt opening release installed.

### 3. Circuit-breakers for UniMix switchgear with rh lateral operating mechanisms (230 mm distance between centers)

The coded basic version of the circuit-breakers for UniMix switchgear is the same as that of the fixed circuit-breakers. The operating mechanism's enclosure is equipped with a specific side frame for the UniMix unit into which the circuit-breaker must be inserted. In detail:

- type HD4/UniMix-F has the top and bottom terminals pre-engineered for connection to the busbars of the UniMix switchgear P1/F unit. Alternatively and with a surcharge, 10 auxiliary contacts are available as an alternative to the group of 5 open/closed auxiliary contacts. Each shunt opening release uses one NO auxiliary contact to de-energize after the circuit-breaker has opened, thus there is one NO auxiliary contact less available for each shunt opening release installed
- type HD4/UniMix-R has a base fitted with wheels to facilitate handling and racking into the switchgear compartment, a power cord with 58-pole plug for the auxiliary circuits, and the top and bottom terminals prepared for connection to the busbars of the UniMix switchgear P1/F

unit. 12 auxiliary contacts are available as an alternative to the group of 5 auxiliary open/closed contacts, subject to a surcharge. Each shunt opening release uses one NO auxiliary contact to deenergise after having carried out circuit-breaker opening, therefore for each shunt opening release installed there is one NO auxiliary contact less available.

#### **4. Circuit-breakers for UniAir switchgear with rh lateral operating mechanisms (300 mm distance between centers)**

The coded basic version of the circuit-breakers for UniAir switchgear is the same as that of the fixed circuit-breakers. The operating mechanism's dustproof enclosure is equipped with a specific side frame for the UniAir unit into which the circuit-breaker must be inserted. In detail:

- the HD4/UniAir type has a base with wheels to make the switchgear easier to move and rack-in to the compartment, a connection with 58-pole plug for the auxiliary circuits, upper and lower terminals pre-engineered with jaw contact for connection to the isolator on the supply side and to the busbars (or TA DIN) on the load side of the P1/E unit UniAir switchgear, and the release lever that keeps the circuit-breaker locked in the cubicle. 12 auxiliary contacts are available as an alternative, with a surcharge. An NO auxiliary contact is used to shut off the shunt opening release's power supply after the circuit-breaker has been opened. This means that there is an unavailable NO auxiliary contact for every shunt opening release installed.
- the HD4/UniAir-2R type has a base with wheels to make the switchgear easier to move and rack-in to the compartment, a connection with 58-pole plug for the auxiliary circuits, upper and lower terminals pre-engineered with jaw contact for connection to the isolator on the supply side and to the busbars (or TA DIN) on the load side of the P1E/2R unit UniAir switchgear, and the release lever that keeps the circuit-breaker locked in the cubicle. 12 auxiliary contacts are available as an alternative, with a surcharge. An NO auxiliary contact is used to shut off the shunt opening release's power supply after the circuit-breaker has been opened. This means that there is an unavailable NO auxiliary contact for every shunt opening release installed.
- the HD4/UniAir-2R type has a base with wheels to make the switchgear easier to move and rack-in to the compartment, a connection with 58-pole plug for the auxiliary circuits, upper and lower terminals pre-engineered

with jaw contact for connection to the isolator on the supply side and to the busbars (or TA DIN) on the load side of the P1/A unit UniAir switchgear, and the release lever that keeps the circuit-breaker locked in the cubicle. 12 auxiliary contacts are available as an alternative, with a surcharge. An NO auxiliary contact is used to shut off the shunt opening release's power supply after the circuit-breaker has been opened. This means that there is an unavailable NO auxiliary contact for every shunt opening release installed.

- the HD4/UniAir-F type is equipped with wheels and loose connection while only the upper terminals are pre-engineered with jaw contacts for connection to the isolator on the supply side while the fixed lower terminals are pre-engineered for connection to the busbars/TA on the supply side of the P1/F unit UniAir switchboard. 10 auxiliary contacts are available. An NO auxiliary contact to shut off the shunt opening release's power supply after the circuit-breaker has been opened. This means that there is an unavailable NO auxiliary contact for every opening release installed.

#### **5. Circuit-breakers for UniSec switchgear with rh lateral operating mechanisms (230 mm distance between centers)**

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 circuit-breaker 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 PR 521 protection device cannot be supplied for the UniSec HD4 version. The HD4/RE-Sec circuit-breaker is only available in conjunction with the REF 601 protection device.

## 2. 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 center distance			Circuit diagram		
				230 mm TN 7237	300 mm TN 7234	300 mm TN 7238			
12	630	12.5	HD4/R 12.06.12	•	•		without relay 1VCD400017		
		16	HD4/R 12.06.16	•	•				
		20 <sup>(1)</sup>	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	•	•				
		20	HD4/R 12.12.20	•	•				
		25	HD4/R 12.12.25	•	•				
	17.5	630	12.5	HD4/R 17.06.12	•	•			with relay PR521 1VCD400017
			16	HD4/R 17.06.16	•	•			
20 <sup>(1)</sup>			HD4/R 17.06.20	•	•				
800		16	HD4/R 17.08.16	•	•				
		20	HD4/R 17.08.20	•	•				
1250		16	HD4/R 17.12.16	•	•				
		20	HD4/R 17.12.20	•	•				
		25	HD4/R 17.12.25	•	•				
24	630	12.5	HD4/R 24.06.12	•	•		with relay REF 601 1VCD400114		
		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	•	•				
		20	HD4/R 24.12.20	•	•				
	36 <sup>(2)</sup>	630	12.5	HD4/R 36.06.12				•	without relay 1VCD400017
			16	HD4/R 36.06.16				•	
		800	12.5	HD4/R 36.08.12				•	
16			HD4/R 36.08.16			•			
1250		12.5	HD4/R 36.12.12			•			
		16	HD4/R 36.12.16			•			

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

<sup>(2)</sup> 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 center 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/S 12-17-24 (right lateral operating mechanism; version for UniSwitch switchgear)

U [kV]	In [A]	Isc [kA]	Description	Pole center distance 210 mm	Maximum	Circuit diagram	
12	630	12.5	HD4/S 12.06.12	•	TN 7236	without relay / with relay PR521 1VCD400018	
		16	HD4/S 12.06.16	•			
		20 <sup>(1)</sup>	HD4/S 12.06.20	•			
		25 <sup>(2)</sup>	HD4/S 12.06.25	•			
	800	800	12.5	HD4/S 12.08.12			•
			16	HD4/S 12.08.16			•
			20	HD4/S 12.08.20			•
			25 <sup>(2)</sup>	HD4/S 12.08.25			•
	1250	1250	12.5	HD4/S 12.12.12			•
			16	HD4/S 12.12.16			•
			20	HD4/S 12.12.20			•
			25 <sup>(2)</sup>	HD4/S 12.12.25			•
17.5	630	12.5	HD4/S 17.06.12	•	TN 7236	with relay REF 601 1VCD400116	
		16	HD4/S 17.06.16	•			
		20 <sup>(1)</sup>	HD4/S 17.06.20	•			
		25 <sup>(2)</sup>	HD4/S 17.06.25	•			
	800	800	12.5	HD4/S 17.08.12			•
			16	HD4/S 17.08.16			•
			20	HD4/S 17.08.20			•
			25 <sup>(2)</sup>	HD4/S 17.08.25			•
	1250	1250	12.5	HD4/S 17.12.12			•
			16	HD4/S 17.12.16			•
			20	HD4/S 17.12.20			•
			25 <sup>(2)</sup>	HD4/S 17.12.25			•
24	630	12.5	HD4/S 24.06.12	•	TN 7236	with relay REF 601 1VCD400116	
		16	HD4/S 24.06.16	•			
		20	HD4/S 24.06.20	•			
		25 <sup>(2)</sup>	HD4/S 24.06.25	•			
	800	800	12.5	HD4/S 24.08.12			•
			16	HD4/S 24.08.16			•
			20	HD4/S 24.08.20			•
			25 <sup>(2)</sup>	HD4/S 24.08.25			•
	1250	1250	12.5	HD4/S 24.12.12			•
			16	HD4/S 24.12.16			•
			20	HD4/S 24.12.20			•
			25 <sup>(2)</sup>	HD4/S 24.12.25			•

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

<sup>(2)</sup> the rated short-time withstand current is 25 kA for 2 seconds

## 2. How to choose and order the circuit-breakers

### HD4/UniMix-F 12-17-24

(right lateral operating mechanism, version for P1/F unit UniMix switchgear; circuit-breaker without wheels and wiring in terminal box)

U [kV]	In [A]	Isc [kA]	Description	Pole center distance 230 mm	Maximum	Circuit diagram
12	630	12.5	HD4/UNIMIX-F 12.06.12	•	TN 7366	without relay / with relay PR521 1VCD400017
		16	HD4/UNIMIX-F 12.06.16	•		
		20 <sup>(1)</sup>	HD4/UNIMIX-F 12.06.20	•		
17,5	630	12.5	HD4/UNIMIX-F 17.06.12	•		
		16	HD4/UNIMIX-F 17.06.16	•		
		20 <sup>(1)</sup>	HD4/UNIMIX-F 17.06.20	•		
24	630	12.5	HD4/UNIMIX-F 24.06.12	•		with relay REF 601 1VCD400114
		16	HD4/UNIMIX-F 24.06.16	•		
		20	HD4/UNIMIX-F 24.06.20	•		

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

### HD4/UniMix-R 12-17-24

(right lateral operating mechanism, version for UniMix switchgear, P1/F unit; circuit-breaker with wheels and connection with 64-pin plug)

U [kV]	In [A]	Isc [kA]	Description	Pole center distance 230 mm	Maximum	Circuit diagram
12	630	12.5	HD4/UNIMIX-R 12.06.12	•	1VCD003396	without relay / with relay PR521 1VCD400018
		16	HD4/UNIMIX-R 12.06.16	•		
		20 <sup>(1)</sup>	HD4/UNIMIX-R 12.06.20	•		
17.5	630	12.5	HD4/UNIMIX-R 17.06.12	•		
		16	HD4/UNIMIX-R 17.06.16	•		
		20 <sup>(1)</sup>	HD4/UNIMIX-R 17.06.20	•		
24	630	12.5	HD4/UNIMIX-R 24.06.12	•		with relay REF 601 1VCD400116
		16	HD4/UNIMIX-R 24.06.16	•		
		20	HD4/UNIMIX-R 24.06.20	•		

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

## HD4/UniAir 12-17-24

(right lateral operating mechanism; version for UniAir switchgear, P1/E unit, unit with circuit-breaker isolatable on the supply side)

U [kV]	In [A]	Isc [kA]	Description	Pole center distance 300 mm	Maximum	Circuit diagram			
12	630	12.5	HD4/UNIAIR 12.06.12	•	TN 7235	senza relè / with relay PR521 1VCD400018			
		16	HD4/UNIAIR 12.06.16	•					
		20 <sup>(1)</sup>	HD4/UNIAIR 12.06.20	•					
		25	HD4/UNIAIR 12.06.25	•					
	800	16	HD4/UNIAIR 12.08.16	•					
		20	HD4/UNIAIR 12.08.20	•					
		25	HD4/UNIAIR 12.08.25	•					
	1250	16	HD4/UNIAIR 12.12.16	•					
		20	HD4/UNIAIR 12.12.20	•					
		25	HD4/UNIAIR 12.12.25	•					
	17.5	630	12.5	HD4/UNIAIR 17.06.12			•	TN 7235	with relay REF 601 1VCD400116
			16	HD4/UNIAIR 17.06.16			•		
20 <sup>(1)</sup>			HD4/UNIAIR 17.06.20	•					
800		16	HD4/UNIAIR 17.08.16	•					
		20	HD4/UNIAIR 17.08.20	•					
1250		16	HD4/UNIAIR 17.12.16	•					
		20	HD4/UNIAIR 17.12.20	•					
24		630	12.5	HD4/UNIAIR 24.06.12	•	TN 7235	with relay REF 601 1VCD400116		
			16	HD4/UNIAIR 24.06.16	•				
	20		HD4/UNIAIR 24.06.20	•					
	800	16	HD4/UNIAIR 24.08.16	•					
		20	HD4/UNIAIR 24.08.20	•					
	1250	16	HD4/UNIAIR 24.12.16	•					
		20	HD4/UNIAIR 24.12.20	•					

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

## 2. How to choose and order the circuit-breakers

### HD4/UniAir-2R 12-17-24

(right lateral operating mechanism; version for UniAir switchgear, P1E/2R unit, unit with circuit-breaker isolatable on the supply and load sides)

U [kV]	In [A]	Isc [kA]	Description	Pole center distance 300 mm	Maximum	Circuit diagram			
12	630	12.5	HD4/UNIAIR-2R 12.06.12	•	TN 7274	without relay / with relay PR521 1VCD400018			
		16	HD4/UNIAIR-2R 12.06.16	•					
		20 <sup>(1)</sup>	HD4/UNIAIR-2R 12.06.20	•					
		25	HD4/UNIAIR-2R 12.06.25	•					
	800	16	HD4/UNIAIR-2R 12.08.16	•					
		20	HD4/UNIAIR-2R 12.08.20	•					
		25	HD4/UNIAIR-2R 12.08.25	•					
	1250	16	HD4/UNIAIR-2R 12.12.16	•					
		20	HD4/UNIAIR-2R 12.12.20	•					
		25	HD4/UNIAIR-2R 12.12.25	•					
	17.5	630	12.5	HD4/UNIAIR-2R 17.06.12			•	TN 7274	with relay REF 601 1VCD400116
			16	HD4/UNIAIR-2R 17.06.16			•		
20 <sup>(1)</sup>			HD4/UNIAIR-2R 17.06.20	•					
800		16	HD4/UNIAIR-2R 17.08.16	•					
		20	HD4/UNIAIR-2R 17.08.20	•					
1250		16	HD4/UNIAIR-2R 17.12.16	•					
		20	HD4/UNIAIR-2R 17.12.20	•					
24		630	12.5	HD4/UNIAIR-2R 24.06.12	•	TN 7274	with relay REF 601 1VCD400116		
	16		HD4/UNIAIR-2R 24.06.16	•					
	20		HD4/UNIAIR-2R 24.06.20	•					
	800	16	HD4/UNIAIR-2R 24.08.16	•					
		20	HD4/UNIAIR-2R 24.08.20	•					
	1250	16	HD4/UNIAIR-2R 24.12.16	•					
		20	HD4/UNIAIR-2R 24.12.20	•					

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

## HD4/UniAir-A 12-17-24

(right lateral operating mechanism; version for UniAir switchgear, P1/A unit, “overturned” unit with circuit-breaker isolatable on the load side)

U [kV]	In [A]	Isc [kA]	Description	Pole center distance 300 mm	Maximum	Circuit diagram	
12	630	12.5	HD4/UNIAIR-A 12.06.12	•	TN 7273	without relay / with relay PR521 1VCD400018	
		16	HD4/UNIAIR-A 12.06.16	•			
		20 <sup>(1)</sup>	HD4/UNIAIR-A 12.06.20	•			
		25	HD4/UNIAIR-A 12.06.25	•			
	800	16	HD4/UNIAIR-A 12.08.16	•			
		20	HD4/UNIAIR-A 12.08.20	•			
		25	HD4/UNIAIR-A 12.08.25	•			
	1250	16	HD4/UNIAIR-A 12.12.16	•			
		20	HD4/UNIAIR-A 12.12.20	•			
25		HD4/UNIAIR-A 12.12.25	•				
17.5	630	12.5	HD4/UNIAIR-A 17.06.12	•			
		16	HD4/UNIAIR-A 17.06.16	•			
		20 <sup>(1)</sup>	HD4/UNIAIR-A 17.06.20	•			
	800	16	HD4/UNIAIR-A 17.08.16	•			
		20	HD4/UNIAIR-A 17.08.20	•			
	1250	16	HD4/UNIAIR-A 17.12.16	•			
		20	HD4/UNIAIR-A 17.12.20	•			
	24	630	12.5	HD4/UNIAIR-A 24.06.12			•
			16	HD4/UNIAIR-A 24.06.16	•		
20			HD4/UNIAIR-A 24.06.20	•			
800		16	HD4/UNIAIR-A 24.08.16	•			
		20	HD4/UNIAIR-A 24.08.20	•			
1250		16	HD4/UNIAIR-A 24.12.16	•			
		20	HD4/UNIAIR-A 24.12.20	•			
with relay REF 601 1VCD400116							

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

## HD4/UniAir-F 12-17-24

(right lateral operating mechanism, version for UniAir switchgear, P1/F unit; unit with fixed circuit-breaker without wheels and wiring in terminal box)

U [kV]	In [A]	Isc [kA]	Description	Pole center distance 300 mm	Maximum	Circuit diagram
12	630	12.5	HD4/UNIAIR-F 12.06.12	•	TN 7275	without relay / with relay PR521 1VCD400017
		16	HD4/UNIAIR-F 12.06.16	•		
17.5	630	12.5	HD4/UNIAIR-F 17.06.12	•		
		16	HD4/UNIAIR-F 17.06.16	•		
24	630	12.5	HD4/UNIAIR-F 24.06.12	•		
		16	HD4/UNIAIR-F 24.06.16	•		
with relay REF 601 1VCD400114						

## 2. How to choose and order the circuit-breakers

### HD4/R-SEC 12-17-24

(right lateral operating mechanism, version for UniSec switchgear)

U [kV]	In [A]	Isc [kA]	Description	Pole center distance 230 mm	Maximum	Circuit diagram
12	630	12.5	HD4/R-SEC 12.06.12	•	1VCD003536	without relay / with relay REF 601 1VCD400119 <sup>(3)</sup>
		16	HD4/R-SEC 12.06.16	•		
		20	HD4/R-SEC 12.06.20	•		
		25 <sup>(2)</sup>	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 <sup>(2)</sup>	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 <sup>(1)</sup>	HD4/R-SEC 17.06.20	•		
	800	12.5	HD4/R-SEC 17.08.12	•		
		16	HD4/R-SEC 17.08.16	•		
		20 <sup>(1)</sup>	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	•		

<sup>(1)</sup> the breaking capacity is 21 kA and the admissible rated short-time withstand current is 21 kA for 3 seconds

<sup>(2)</sup> the breaking capacity is 25 kA and the admissible rated short-time withstand current is 25 kA for 2 seconds

<sup>(3)</sup> HD4/R-SEC cannot be fitted with the PR521 relay and the relative current transformers. Accessories included in the standard equipment

### HD4/RE-SEC 12-17-24

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

U [kV]	In [A]	Isc [kA]	Description	Pole center 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	•		

## Accessories included for the HD4/R series

### KIT 1

#### Open/closed signalling contacts (-BB1...-BB3)



Electrical specifications of the contacts			
Un	Icu	cosφ	T
400 V~	15 A	0,4	-
220 V-	1,5 A	-	10 ms

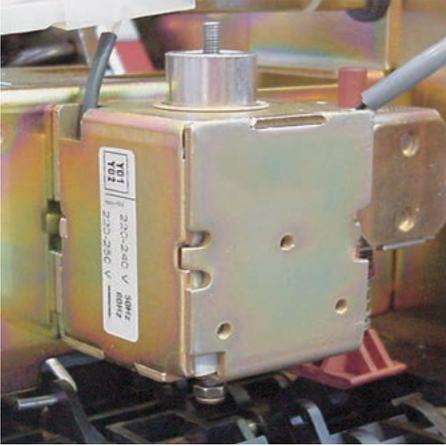
The auxiliary contacts (**available on request and subject to a surcharge**) supplied as alternatives to the standard set of five contacts, vary depending on the version:

Number of auxiliary contacts <sup>(1)</sup>		without relay	with PR521	with REF 601
HD4/R	diagram	1VCD400017	1VCD400017	1VCD400114
HD4/UniMix-F	5 auxiliary contacts	standard equipment	standard equipment	standard equipment
HD4/UniAir-F	10 auxiliary contacts	alternative	alternative	alternative
HD4/S	diagram	1VCD400018	1VCD400018	1VCD400116
HD4/UniMix-R	5 auxiliary contacts	standard equipment	standard equipment	standard equipment
HD4/UniAir	12 auxiliary contacts	alternative	alternative	alternative
HD4/UniAir-2R				
HD4/UniAir-A				
HD4/R-SEC	diagram	1VCD400119	not available	1VCD400119
	5 auxiliary contacts	standard equipment	-	standard equipment
	9 auxiliary contacts	alternative	-	alternative

<sup>(1)</sup> 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

## 2. How to choose and order the circuit-breakers

### KIT 2 Instantaneous opening release (-MO1)



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.

### KIT 3 Open position key lock



Specify the type of lock required:

- 3A** Lock with different keys
- 3B** Lock with the same keys.

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#### Electrical characteristics

Inrush power	125 VA/W
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#### Voltages available

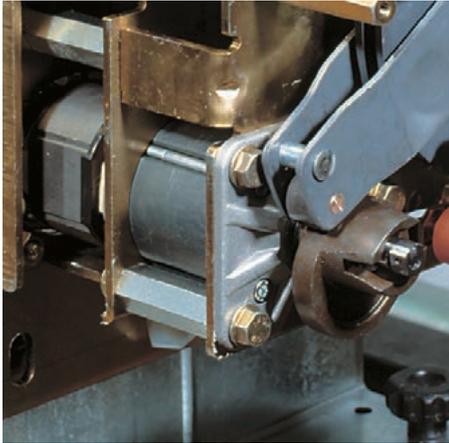
24-30-48-60-110-125-132-220-250 V-
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48-110-120-127-220-230-240 V 50 Hz
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110-120-127-220-230-240 V 60 Hz
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## Optional accessories for the HD4/R series

### 1. Spring-loading gearmotor (-MS)



Automatically loads the springs of the operating mechanism after the closing operation.  
The 24 V D.C. 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 (-MC)



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

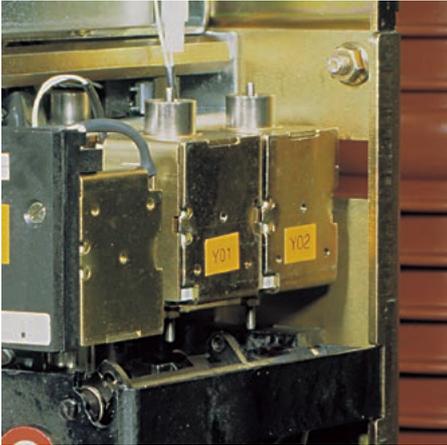
**NOTE.** If a circuit-breaker with pressure switch and locking circuit is ordered in the case of insufficient gas pressure, the supply voltage of the shunt opening release, the shunt closing release and the lamps (if installed) must always be the same.

#### 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

## 2. How to choose and order the circuit-breakers

### 3. Additional shunt opening release (-MO2)



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 PR521 protection relay or with the -MO3 opening solenoid.

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

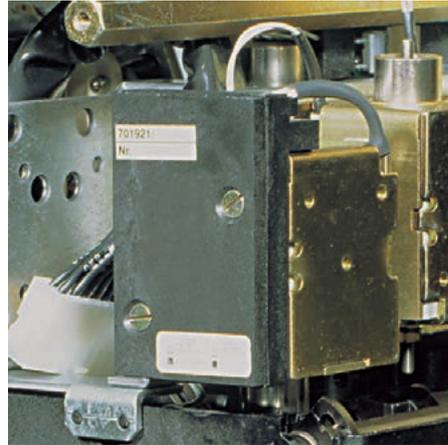
#### Electrical characteristics

Inrush power	125 VA / W
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#### 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 (-MU)



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 circuit-breaker in the open position for insufficient gas pressure.
- The undervoltage release can be used in conjunction with the electronic time delay device (see accessory 16).
- 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

**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. It is always fitted with electrical signalling of release excluded.

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

**Electrical specifications of the contact**

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

## 2. How to choose and order the circuit-breakers

### 7. Signalling contact for closing springs loaded or discharged (-BS2)



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 contact

<b>Un</b>	<b>In</b>	<b>cosφ</b>	<b>T</b>
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 state of SF<sub>6</sub> 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 SF<sub>6</sub> gas pressure for tripping due to insufficient pressure with circuit-breaker locking in the position in which it is found is ordered.

## 9. PR521 protection device (-BR51)



Controls circuit-breaker tripping due to:

- overload (51)
- short-circuit (50)
- earth fault (51N).

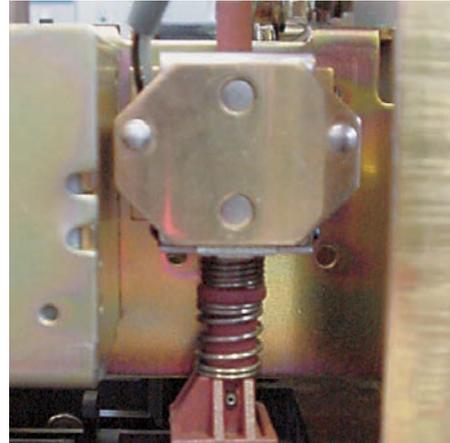
It is available in the following versions:

- 9A** PR521 with protection 51-50
- 9B** PR521 with protection 51-50-51N

### Notes

- Application of the PR521 relay does not allow application of the locking circuit for circuit-breaker in the state in which it is to be found owing to insufficient pressure. It is only possible to obtain the automatic circuit-breaker opening circuit for insufficient gas pressure.
- The PR521 relay cannot be installed for 36 kV circuit-breakers.
- The transparent tamperproof protection is always supplied with the PR521 relay.
- Consult chapter 3 for the technical and tripping specifications of the PR521 relay.
- To enable the relay to function, the circuit-breaker must be equipped with:
  - opening solenoid (-MO3) (accessory 10);
  - two or three BSC1...BSC2 current sensors (accessory 11).Three sensors are required in order to perform function 51N for the vector sum of the phase currents. Just two current sensors can be installed if function 51N is performed with an external toroidal current transformer.  
**Only two current sensors can be installed (on the lateral poles) in 24 kV versions with 230 mm pole center distance.**  
For the adjustable minimum threshold values of function 51N with three sensors or with external toroidal transformer.

## 10. Opening solenoid (-MO3)



Makes the circuit-breaker open if the PR521 overcurrent release installed on the circuit-breaker or the trips.

**NOTE.** The opening solenoid can only be used in conjunction with an ABB PR521 series device.

## 2. How to choose and order the circuit-breakers

### 11. Current sensors for protection device PR521 (-BC1...-BC3)



The current sensors transmit the current signal to the relay for processing and provide the energy to power the relay and opening solenoid if tripping occurs.

The kit includes all the accessories for assembling the sensors, with the exception of the wiring that connects the relay.

**NOTE.** Only two current sensors can be installed (on the lateral poles) in 24 kV versions with 230 mm pole center distance.

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#### Available types

##### In

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2 sensors In = 40 A

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3 sensors In = 40 A

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2 sensors In = 80 A

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3 sensors In = 80 A

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2 sensors In = 250 A

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3 sensors In = 250 A

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2 sensors In = 1250 A

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3 sensors In = 1250 A

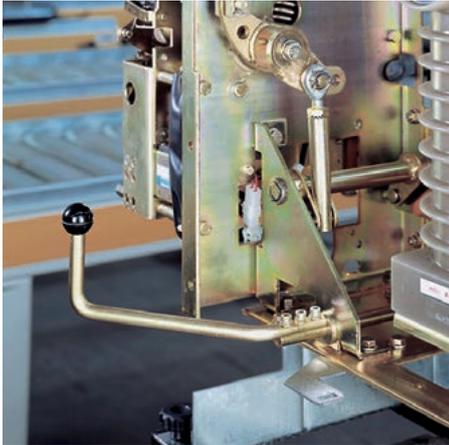
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### 12. Test unit TT2



This is a portable device that allows the operation of “release chain” PR521 and the opening solenoid to be checked. It also allows the bistable alarm signalling device of the PR521 relay to be reset.

### 13. 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.

### 14. Special accessories for HD4/S circuit-breakers



A 1.5 m length standard dedicated cord with wired socket for connecting the control circuits in UniSwitch switchgear to the auxiliary circuits of the circuit-breaker is available for HD4/S circuit-breakers on request. The customer can make his own version by using an Amphenol type socket (52 + 2 poles) if this cord is not ordered. The socket must be completed with the relative plug provided with the accessories supplied with the circuit-breaker. Omission of this plug in the socket will prevent the circuit-breaker from operating even when the plug has been correctly plugged into the socket alongside the operating mechanism.

## 2. How to choose and order the circuit-breakers

### Accessories included in the standard equipment for HD4/RE

#### KIT 1

#### Open/closed signalling contacts (-BGB1)



The standard equipment includes a set of five auxiliary contacts. Other additional sets of auxiliary contacts are available on request, with a surcharge. Their number depends on the version of the device. See summary of the total quantities that can be supplied.

#### Summary of the total quantity of auxiliary contacts available<sup>(1)</sup>

	Standard equipment	On request
HD4/RE	6	10
HD4/RE-SEC	5	9

<sup>(1)</sup> 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 - 50/60Hz
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 <sup>2</sup>

#### Additional requirements (IEC 60947)

Rated voltage Un		Breaking capacity (10,000 breaks)
220 V AC	cosφ = 0.70	20 A
220 V AC	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)**

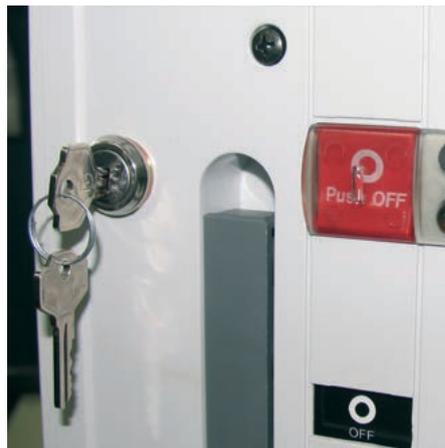


Allows the device to be opened by remote control.  
 The release operates with both direct and alternate current.  
 This release is suitable for both instantaneous and permanent duty. However, an auxiliary contact shuts off the power supplied to the opening release after the circuit-breaker has been 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 9, 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.

**Caratteristiche**

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)

**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.

## 2. 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 D.C. gearmotor is always supplied with the protecting thermal magnetic circuit-breaker (accessory 15).

#### 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.

#### Characteristics

Un	24...30 - 48...60 - 110...130 - 220...250 V~
Un	100...130 - 220...250 V~ 50/60 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)

### 3. Additional shunt opening release (-MBO2)

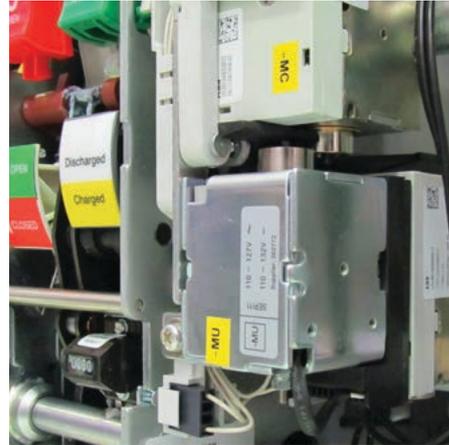


Similarly to shunt opening release -MBO1, this allows the opening command of the apparatus to be transmitted in the remote mode and can be energized by a circuit that is completely separate from release -MBO1. The release operates with both direct and alternating current. This release is suitable for 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 9, 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)



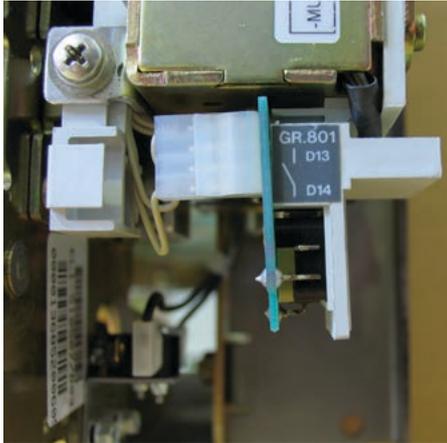
The undervoltage release opens the circuit-breaker when there is a sensitive reduction or lack of the voltage that powers it. It can be used for remote release (by means of a pushbutton of the normally closed type), for locking on closing or for monitoring the voltage in auxiliary circuits. The circuit-breaker 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)

## 2. How to choose and order the circuit-breakers

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

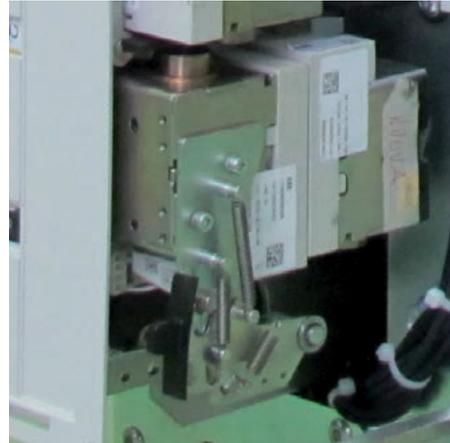


The undervoltage release can be equipped with a contact (normally closed or open, as required) that signals when the undervoltage release is energized or de-energized, so as to signal the status of the release in the remote mode.

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 under-voltage override is always equipped with an electrical device for signalling when the under-voltage 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.

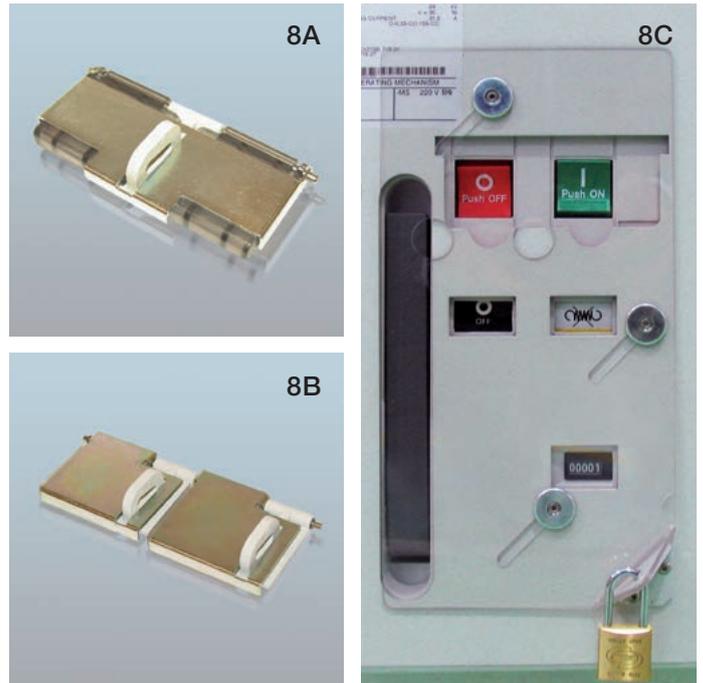
The temporary mechanical override cannot be supplied when the CEI 0-16 version REF 601 protection device is required.

## 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:

- 8A** Locking of both pushbuttons without distinction
- 8B** Separate locking of the opening and/or closing pushbuttons
- 8C** Locking for HD4/RE-Sec. circuit-breakers without distinction

**NOTE.** Lock 8A prevents closing by remote control; lock 8B does not prevent closing by remote control.

## 2. 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
- -MO/-MC 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

### 15. 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:

- 15A** Protecting thermal magnetic circuit-breaker with circuit-breaker closed signalling contact
- 15B** 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 contact

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

### 16. 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 circuit-breaker 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

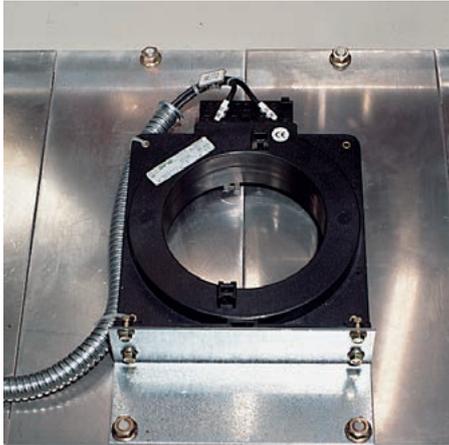
24/60 V-
48 V- 48 V 50-60 Hz
60 V- 60 V 50-60 Hz
110/127 V- 110/127 V 50-60 Hz
220/240 V- 220/240 V 50-60 Hz

**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.

## 2. How to choose and order the circuit-breakers

### 17. 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):

- 17A** with closed core and 110 mm internal diameter (in the photograph)
- 17B** with openable core and 110 mm internal diameter
- 17C** 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).

### 18. REF 601 protection device (-BR51)



This protection device is an alternative to the similar PR521. Unlike PR521, which is self-supplied, REF 601 needs auxiliary voltage in order to function. On request, it can be equipped with all the HD4 series circuit-breakers with lateral operating mechanisms. It is the only protection device that can be installed on the HD4/R-Sec and HD4/L-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:

- 18A** 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)
- 18B** REF 601 version IEC as 16A with RS485 serial communication, MODBUS RTU protocol
- 18C** REF 601 version CEI 0-16 (tripping curves in compliance with CEI 0-16)
- 18D** REF 601 version CEI 0-16 as 16C with RS485 serial communication, MODBUS RTU , FULL DUPLEX protocol.

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 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, which are different from those supplied for the PR 521 device. 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 19), and with the external toroidal transformer for homopolar protection -BN (accessory 17).

### 19. 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

- 19A** 2 (three) KEVCR 24 OC2 R 0101 sensors with 630 A internal feed-through
- 19B** 3 (three) KEVCR 24 OC2 R 0101 sensors with 630 A internal feed-through
- 19C** 2 (two) KEVCR 24 AC2 R 0102 sensors with 1250 A internal feed-through
- 19D** 3 (three) KEVCR 24 AC2 R 0102 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 center-distance: 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 center-distance: 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.

## 2. How to choose and order the circuit-breakers

### 20. 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.

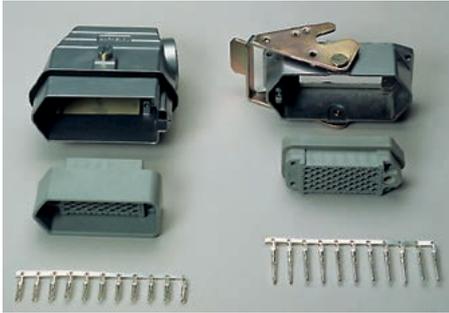
### 21. Set of wheels (12 - 17 - 24 kV)



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.

## 22. 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.

## 23. 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.

## 2. How to choose and order the circuit-breakers

### 24. Circuit-breaker locking device (with/without lamps) for insufficient SF<sub>6</sub> gas pressure



This device can only be supplied for circuit-breakers provided with a pressure switch (accessory 23).

The locking circuit is an optional application and can only be installed by ABB.

The following configurations are available:

- 24A** 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**.
- 24B** 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**.
- 23C** 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**.
- 23D** 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
24 V~	–
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
240 V~	50 Hz
110 V~	60 Hz
127 V~	60 Hz
220 V~	60 Hz
240 V~	60 Hz

## 25. 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.

**NOTE.** The terminals are part of the standard fittings for 36 kV circuit-breakers.

### Currents available

Kit	In
14A	630 A
14B	1250 A

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

# 3. Specific characteristics of the product

## Vibration resistance

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

## Electromagnetic compatibility

HD4/R circuit-breakers equipped with REF601 and PR521 microprocessor-type solid-state relays 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.

## Tropicalization

HD4/R circuit-breakers are made in compliance with the most stringent specifications concerning their use in hot-humid-saline 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  $12 \times 10^{-6}$  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).

## Altitude

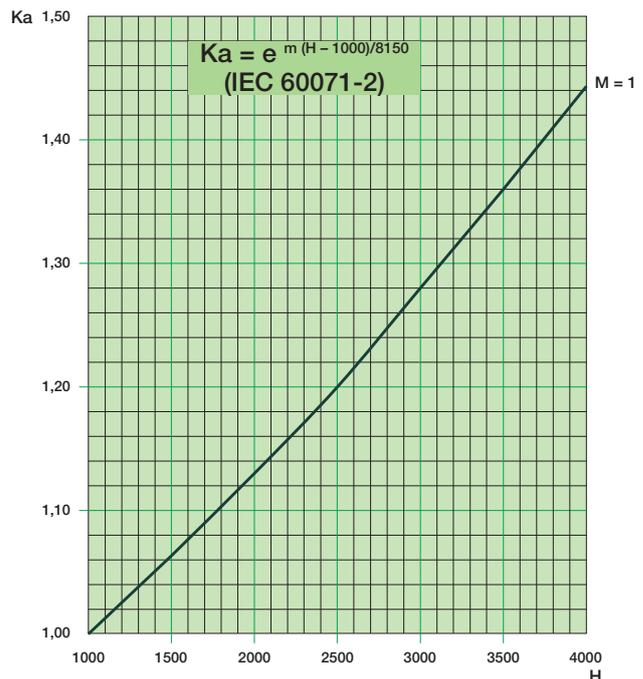
It is well-known that the insulating properties of air diminish as the altitude increases. The phenomenon must always be considered when the insulating components of equipment that must be installed at more than 1000 m above sea level are designed.

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 62271-1. The example below gives a clear interpretation of the indications above.



### Graph for establishing correction factor Ka depending on the altitude

**H** = altitude in meters;  
**m** = value with reference to power frequency and atmospheric impulse withstand and line-to-line voltages.



## 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.

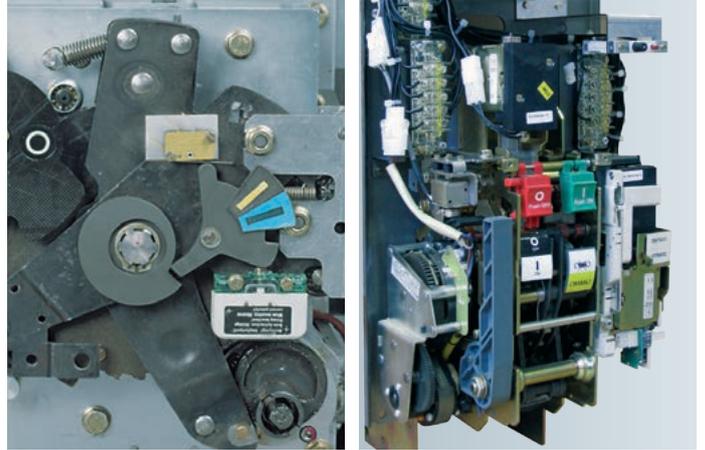
Assessment of the environmental impact during the life cycle of the product (LCA - Life Cycle Assessment) obtained by reducing the overall energy consumption and use of raw materials for the product to the minimum, is put into effect during the design engineering phase through an accurate choice of materials,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

## Anti-pumping device

The ESH or EL operating mechanisms of HD4/R circuit-breakers (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.



## Spare parts

- Opening spring<sup>(1)</sup>
- Closing spring<sup>(1)</sup>
- Complete pole<sup>(1)</sup>
- Basic operating mechanism<sup>(1)</sup>
- 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.

<sup>(1)</sup> Can only be replaced by trained personnel and/or in our repair shops.

# 3. Specific characteristics of the product

## PR521 protection device

Unit PR521 provides the following functions:

- **PR521 - LSI:** two-phase or three-phase overcurrent protection (code ANSI 50-51), depending on whether two or three current sensors are connected;
- **PR521 - LSIG:** same as PR521-LSI plus earth fault protection (code ANSI 51N) (by means of the internal vector sum of the three phase sensors or by means of the external earth fault toroid and two or three current sensors).

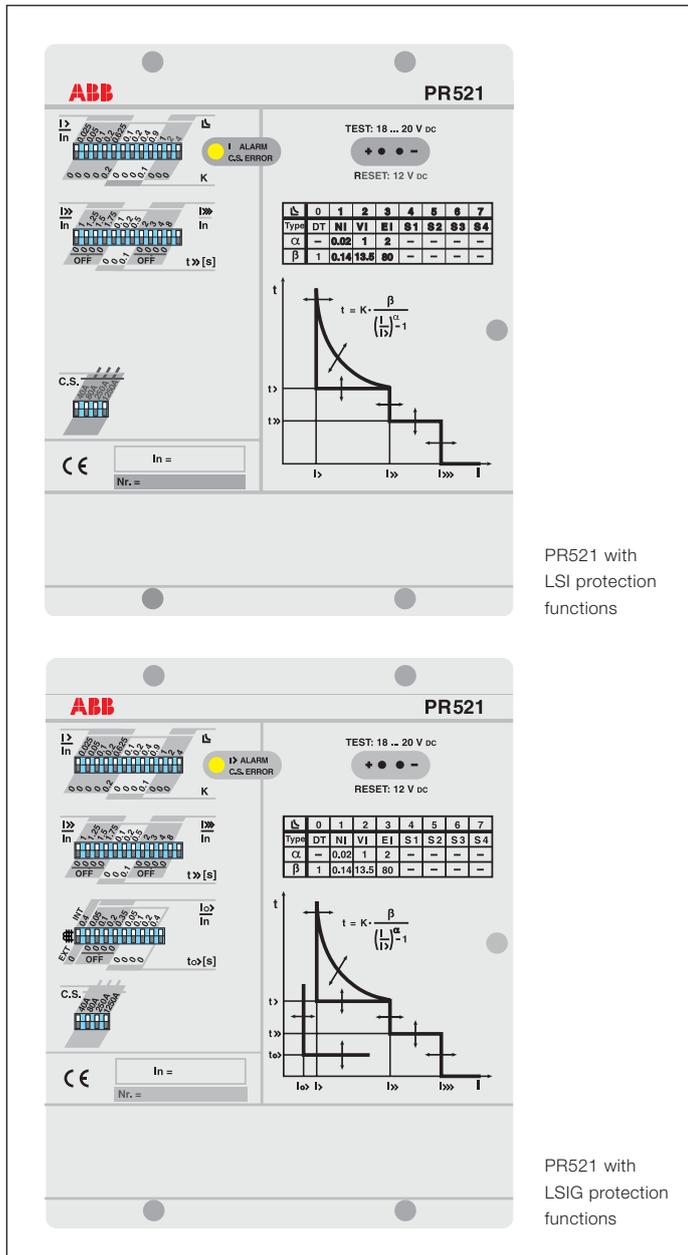
Besides providing the current signal, the current sensors also supply the energy required for operating the unit. The unit is self-supplied and guarantees correct operation when the current is 20% of the rated value or more on at least one of the phases equipped with current sensor ( $0.2 \times I_n$ ). This device features digital microprocessor technology. The unit opens the circuit-breaker in which it is installed by means of an opening solenoid (-MBO3 see accessory kit N° 13), which acts directly on the operating mechanism of the device.

## Current sensors (C.S.)

PR521 can be used with ABB current sensors possessing the following specifications:

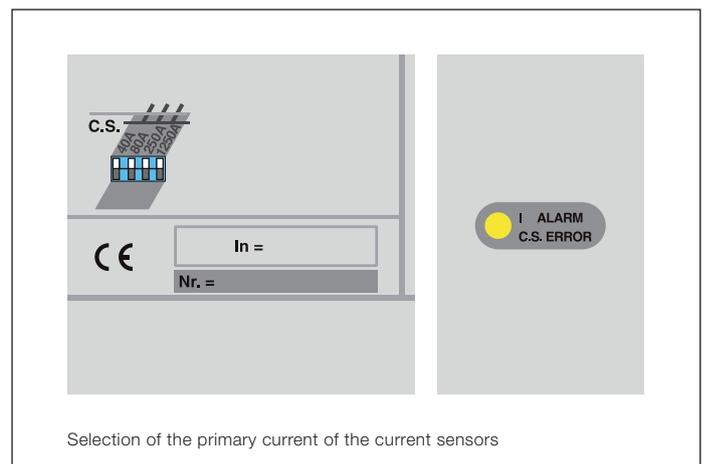
Primary rated current	In = 40 A
	In = 80 A
	In = 250 A
	In = 1250 A
Secondary rated current	In = 1 A

Activate the corresponding dip-switch in order to select the sensor. If more than one sensor is selected by accident, the alarm LED will flash to indicate that an error has occurred. The current sensors can be installed on HD4/R circuit-breakers with up to 24 kV rated voltage. Only two current sensors can be installed on 24 kV circuit-breaker versions with 230 mm pole center-distance.



PR521 with LSI protection functions

PR521 with LSIG protection functions



Selection of the primary current of the current sensors

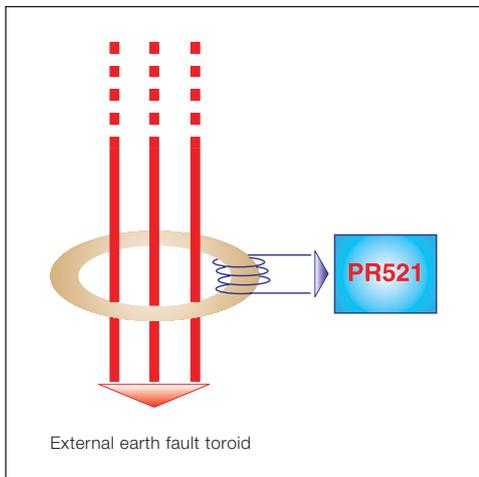
## External earth fault toroid

PR521 can be used with any external toroid for detecting earth fault current, so long as it possess the following specifications:

Primary rated current	any
Secondary rated current	1 A
Performance	1 VA
Precision class, ultimate precision factor	Cl. 3 or higher

It is advisable to use the external toroids for detecting earth fault current when very low values of the 51N threshold must be regulated (less than 0.45 times the rated current -  $I_n$  - of the current sensors).

Use of the above-mentioned toroid is obligatory when protection 51N must be provided with 24 kV circuit-breakers and 230 mm pole center distance.



## Release actuator

The PR521 release unit releases the operating mechanism by means of an opening solenoid if the protection functions trip.

## Self-supply

PR521 operation is guaranteed by the self-supply circuit. The minimum phase current value required for operation is  $0.2 \times I_n$ . This circuit is able to withstand:

- overload: continuative  $1.5 \times I_n$
- overload:  $6 \times I_n$  for 200 s
- overload: 25 kA for 1 s (circuit-breaker's maximum short-time withstand current).

## MTBF

A 15-year MTBF has been envisaged at an operating temperature of 40 °C.

### Environmental conditions

Ambient temperature	- 5 °C ... +40 °C
Storage temperature	- 40 °C ... +90 °C
Relative humidity without condensation	90%
Protection class (assembled on circuit-breaker and with front protection)	IP42

## Operating frequency

From 45 Hz to 66 Hz.

# 3. Specific characteristics of the product

## Inputs

### Analog inputs

- Inputs for current sensors.  
The current sensors that supply the proportional signals to the current circulating in the phases and the energy required for self-powering the device, are connected to the PR521 unit by means of these three inputs.
- External earth fault toroid input.  
The external earth fault toroid, the signal of which is directly proportional to the earth fault current, is connected to the PR521 unit by means of this input. This transformer does not supply electricity for relay operation in the self-supply mode. This input must be made with a twin-core screened cable, the braided wire of which must be earthed on the metal housing of the PR521 unit (refer to the wiring diagram enclosed with the circuit-breaker).  
If there are EMC problems, the earth connection of the braided wire must be as solid and short as possible.

### Binary input for the monitoring function

- Input for remote controlled circuit-breaker opening command.  
This input allows the circuit-breaker to be opened by remote control, using the energy supplied by the current sensors if available.  
This input must be made with a twin-core screened cable, the braided wire of which must be earthed on the metal housing of the PR521 unit (refer to the wiring diagram enclosed with the circuit-breaker).  
By connecting a potential-free external contact (e.g. the contact of a Buchholz relay) to the relative input connector, circuit-breaker opening can be remote controlled through the PR521 release when the primary current exceeds the value of  $0.2 \times I_n$  in at least one phase without current sensor.

## Outputs

### Power output

This output controls the specific opening solenoid for PR521 (MBO3 - see accessories kit N° 10).

### Signalling output with closing contact

There is an output obtained by means of a bistable relay (maintains the status even in a power failure and until the RESET operation) with potential-free closing contacts, through which the relay tripped signal is transmitted. After the protection has tripped and the circuit-breaker has opened, this contact can be reset in two different ways:

- resetting occurs automatically when the circuit-breaker recloses with a phase current of more than  $0.2 \times I_n$ ;
- with a phase current of less than  $0.2 \times I_n$  and the protection unit off (even when the circuit-breaker is open), resetting occurs by means of the front bushings for the RESET function, as described in the “Test and reset function” chapter.

**NOTE.** The signalling contact is not activated if circuit-breaker opening or the release function Test are conducted by remote control.

Function	Protection tripped
Type	Bistable
Maximum change-over power	150 W / 1250 VA (resistive load)
Maximum change-over voltage	220 V~ / 250 V~
Maximum change-over current	5 A
Breaking capacity (UL/CSA):	
– at 30 V DC (resistive load)	5 A
– at 250 V DC (resistive load)	5 A
– at 250 V AC ( $\cos\phi = 1.0$ )	5 A
– at 250 V AC ( $\cos\phi = 0.4$ )	3 A
Mechanical life (with 180 operations/minute)	$5 \times 10^7$
Electrical life	$1 \times 10^5$
Insulation:	
– between open contacts	1000 Veff (50 Hz / 1 min)
– between contact and coil	3000 Veff (50 Hz / 1 min)

## Protection functions

Unit PR521 provides the following protections:

- **PR521 - LSI**: phase overcurrent protection (instantaneous, with adjustable delay, with inverse and fixed time delay)
- **PR521 - LSIG**: the same as PR521-LSI, plus earth fault overcurrent protection (with adjustable delay).

The tripping times and thresholds can be selected by setting the Dip Switches on the front part of the unit.

The tripping time for the fixed time protection is given by the following relation.

$$t = K \times \beta$$

The relation between tripping time and overcurrent for the inverse time protection, is given by the following formula.

$$t = K \times \frac{\beta}{\left[ \frac{I}{I>} \right]^{-1}}$$

### Key

- t** = tripping time
- k** = parameter that can be set by the user in order to select the desired tripping curve
- α, β** = pair of parameters that depends on the type of protection that can be selected by the user
- I** = fault current
- I>** = tripping threshold that can be selected by the user.

## Fixed time overcurrent protection

A family of protection curves known as “Fixed time with adjustable delay DT” is available (in accordance with Standard IEC 60255-3).

The following settings can be obtained:

• 32 threshold correct values (I>) <sup>(1)</sup>				
0.200	0.225	0.250	0.275	
0.300	0.325	0.350	0.375	
0.400	0.425	0.450	0.475	
0.500	0.525	0.550	0.575	
–	0.625	0.650	0.675	
0.700	0.725	0.750	0.775	
0.800	0.825	0.850	0.875	
0.900	0.925	0.950	0.975	
1.000	–	–	–	x I <sub>n</sub>

- 16 tripping times (t>), (with b = 1, K = 0.1...1.6 with 0.1 steps)<sup>(2)</sup>

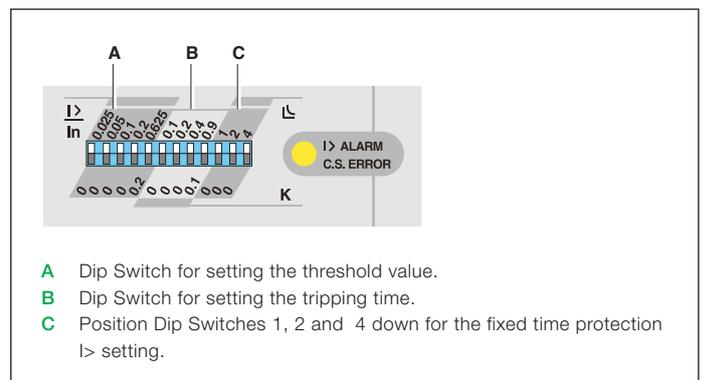
0.1	0.2	0.3	0.4	0.5	–
0.6	0.7	0.8	0.9	1.0	–
1.1	1.2	1.3	1.4	1.5	1.6 s

<sup>(1)</sup> The unit guarantees non-access to the threshold for current values of less than 1.05 x I> set and guarantees access to the threshold for current values of more than 1.30 x I> set.

<sup>(2)</sup> The tolerance on tripping times with three-phase power is ±15% or ±30 ms.

The protection **cannot be excluded**.

I> protection for the DT curve processes the peak value for the entire range 0.2 ... 20 x I<sub>n</sub>.



# 3. Specific characteristics of the product

## Inverse time overcurrent protection

Three different families of protection curves are available (in accordance with Standard IEC 60255-3), namely:

- Normally inverse time NI
- Very inverse time VI
- Extremely inverse time EI

The following settings can be obtained:

• **32 threshold correct values (I<sub>></sub>)<sup>(1)</sup>**

0.200	0.225	0.250	0.275
0.300	0.325	0.350	0.375
0.400	0.425	0.450	0.475
0.500	0.525	0.550	0.575
–	0.625	0.650	0.675
0.700	0.725	0.750	0.775
0.800	0.825	0.850	0.875
0.900	0.925	0.950	0.975
1.000	–	–	–

**x I<sub>n</sub>**

• **16 tripping curves for each family, thus defined<sup>(2)</sup>**

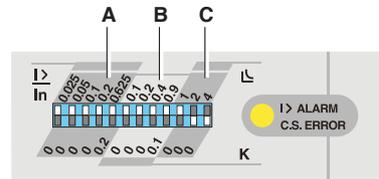
- Normally inverse time curves  
(with  $\alpha = 0.02$ ,  $\beta = 0.14$ ,  $K = 0.1 \dots 1.6$  with 0.1 steps)
- Very inverse time curves  
(with  $\alpha = 1$ ,  $\beta = 13.5$ ,  $K = 0.1 \dots 1.6$  with 0.1 steps)
- Extremely inverse time curves  
(with  $\alpha = 2$ ,  $\beta = 80$ ,  $K = 0.1 \dots 1.6$  with 0.1 steps)

<sup>(1)</sup> The unit guarantees non-access to the threshold for current values of less than  $1.05 \times I_{>}$  set and guarantees access to the threshold for current values of more than  $1.30 \times I_{>}$  set.

<sup>(2)</sup> The tolerance on tripping times is  $\pm 20\%$  or  $\pm 150$  ms.

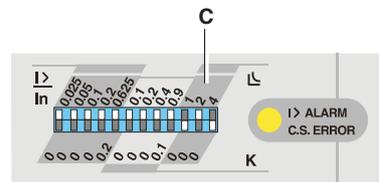
The protection **cannot be excluded**. The tripping curves change as the current thresholds vary.

Protection I<sub>></sub> for curves NI, VI and EI processes the true effective value of the phase current.



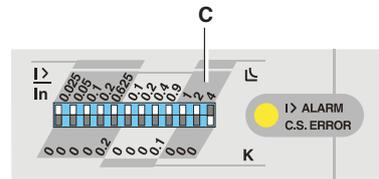
**Normally inverse time curves**

- A Dip Switch for setting the threshold value.
- B Dip Switch for setting the tripping curve.
- C Position Dip Switch 1 up and Dip Switches 2 and 4 down for the normally inverse time protection I<sub>></sub> setting.



**Very inverse time curves**

- C Position Dip Switches 1 and 4 down and Dip Switch 2 up for the very inverse time protection I<sub>></sub> setting.



**Extremely inverse time curves**

- C Position both Dip Switches 1 and 2 up and Dip Switch 4 down for the extremely inverse time protection I<sub>></sub> setting.

## Overcurrent protection with adjustable delay

The following settings can be obtained:

- 14 threshold current values ( $I_{>>}$ )<sup>(1)</sup>

1.00	1.25	1.50	1.75	
–	2.25	2.50	2.75	
3.00	3.25	–	3.75	
4.00	4.25	4.50	–	
–	–	5.50	–	x $I_n$

- 8 tripping times ( $t_{>>}$ )<sup>(2)</sup>

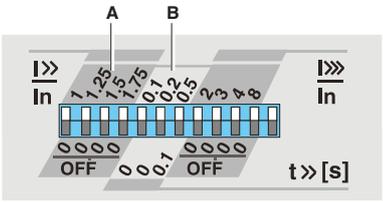
0.10	0.20	0.30	0.40	
0.50	0.60	0.70	0.80	s

<sup>(1)</sup> The tolerance on the threshold values is  $\pm 10\%$ .

<sup>(2)</sup> The tolerance on tripping times is  $\pm 15\%$  or  $\pm 30$  ms.

The protection **can be excluded**.

Protection  $I_{>>}$  processes the peak value for the entire range  $1 \dots 20 \times I_n$ .



**A** Position all the Dip Switches down to cut-out the protection. The tripping threshold setting is made by positioning the Dip Switches in the appropriate way.

**B** Dip Switch for setting the tripping time.

## Instantaneous overcurrent protection

The following settings can be obtained:

- 15 threshold current values ( $I_{>>>}$ )<sup>(1)</sup>

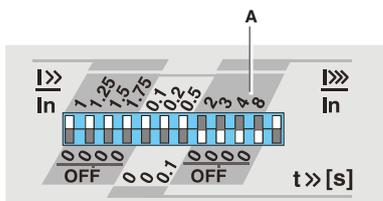
2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17 x  $I_n$

- Instantaneous non-adjustable tripping time (curve with null intentional additional delay)

<sup>(1)</sup> The tolerance of the threshold values is  $\pm 20\%$ .

The protection **can be excluded**.

Protection  $I_{>>>}$  processes the peak value for the entire range  $2 \dots 20 \times I_n$ .



**A** Position all the Dip Switches down to cut-out the protection. The tripping threshold setting is made by positioning the Dip Switches in the appropriate way.

# 3. Specific characteristics of the product

## Earth fault overcurrent protection with adjustable delay (internal vector sum).

The earth fault current is calculated as the vector sum of the three phase current values, thus the device must be equipped with three current sensors (this solution is not possible for 24 kV circuit-breakers with 230 mm pole center distance). This sum is obtained by means of an internal toroid (which processes the secondary phase currents of the correct sensors). This mode is selected by means of the front Dip Switches.

The following settings can be obtained:

- 14 threshold current values ( $I_{o>}$ )<sup>(1)</sup>

0.45	0.50	0.55	0.60	
0.65	0.70	0.75	0.80	
0.85	0.90	0.95	1.00	
1.05	1.10			x $I_n$

- 16 tripping times ( $t_{o>}$ )<sup>(2)</sup>

0.00 <sup>(3)</sup>	0.05	0.10	0.15	
0.20	0.25	0.30	0.35	
0.40	0.45	0.50	0.55	
0.60	0.65	0.70	0.75	s

<sup>(1)</sup> The tolerance on the threshold values is  $\pm 20\%$ .

<sup>(2)</sup> The tolerance on tripping times is  $\pm 20\%$  or  $\pm 30$  ms.

<sup>(3)</sup> Curve with null intentional additional delay.

The protection **can be excluded**. Protection  $I_{o>}$  processes the peak value of the earth fault current for the entire range 0... 2.5 x  $I_n$ .

## Earth fault overcurrent protection with adjustable delay (External Toroid).

The earth fault current is calculated as the vector sum of the three primary phase currents.

This sum is obtained by means of an external toroid (which processes the primary phase currents) installed on the power cables. Thus, only two current sensors can be installed on the device (with network with isolated neutral). This solution is obligatory for 24 kV circuit-breakers with 230 mm pole center distance. This mode is selected by means of the front Dip Switches.

The following settings can be obtained:

- 14 threshold current values ( $I_{o>}$ )<sup>(1)</sup>

0.05	0.10	0.15	0.20	
0.25	0.30	0.35	0.40	
0.45	0.50	0.55	0.60	
0.65	0.70			x $I_n$

- 16 tripping times ( $t_{o>}$ )<sup>(2)</sup>

0.00 <sup>(3)</sup>	0.05	0.10	0.15	
0.20	0.25	0.30	0.35	
0.40	0.45	0.50	0.55	
0.60	0.65	0.70	0.75	s

<sup>(1)</sup>The tolerance on the threshold values is  $\pm 15\%$ .

<sup>(2)</sup> The tolerance on tripping times is  $\pm 20\%$  or  $\pm 30$  ms.

<sup>(3)</sup> Curve with null intentional additional delay.

The protection **can be excluded**. Protection  $I_{o>}$  processes the peak value of the earth fault current for the entire operating range.

**A** Position the Dip Switch up to select the internal toroid. This setting defines a tripping threshold of  $0.4 +$  the threshold setting (see note B).

**B** Position all the Dip Switches down to cut-out the protection. The tripping threshold setting is made by positioning the Dip Switches in the appropriate way.

**C** Dip Switch for setting the tripping time.

**NOTE.** The  $I_{o>}$  protection function is activated if the current exceeds the value of  $0.2 \times I_n$  in at least two phases, or the value of  $0.4 \times I_n$  in the single-phase mode, while it is automatically cut out when the phase overcurrent exceeds the value of  $2.5 \times I_n$ .

**A** Position the Dip Switch down to select the external toroid. This setting defines a tripping threshold of  $0 +$  the threshold setting (see note B).

**B** Position all the Dip Switches down to cut-out the protection. The tripping threshold setting is made by positioning the Dip Switches in the appropriate way.

**C** Dip Switch for setting the tripping time.

**NOTE.** The  $I_{o>}$  protection function is activated if the current exceeds the value of  $0.2 \times I_n$  in at least two phases of the value of  $0.4 \times I_n$  in the single-phase mode.

## Fixed time fail-safe operation curve

We can supply a fail-safe operation curve for the electronic relay that trips with a 1 s fixed time at  $20 \times I_n$ . The fail-safe operation processes the peak value of the phase current. No type of regulation can be made and the protection **cannot**

**be cut out.** This allows fail-safe operation to be achieved for the unit when the phase current exceeds  $20 \times I_n$  without limiting the circuit-breaker's breaking capacity (1 short-time current).

## Rated currents for settings

Current sensor	Protection function				
$I_n$ [A]	$I>$ (0.2...1x $I_n$ ) [A]	$I>>$ (1...5.5x $I_n$ ) [A]	$I>>>$ (2...17x $I_n$ ) [A]	$I_o>$ (0.05...0.7x $I_n$ ) [A] External toroid <sup>0)</sup>	$I_o>$ (0.45...1.1x $I_n$ ) [A] Internal toroid
40	8 ... 40	40 ... 220	80 ... 680	2.5 ... 35	18 ... 44
80	16 ... 80	80 ... 440	160 ... 1360	2.5 ... 35	36 ... 88
250	50 ... 250	250 ... 1375	500 ... 4250	2.5 ... 35	112.5 ... 275
1250	250 ... 1250	1250 ... 6875	2500 ... 21250	2.5 ... 35	562.5 ... 1375

$I_n$  = rated current of the current sensor  
 $I>$  = setting value of the overload current (51)  
 $I>>$  = setting value of the short-circuit current (50)

$I>>>$  = setting value of the instantaneous short-circuit current (50)  
 $I_o>$  = setting value of the earth fault current (51N)  
<sup>0)</sup> = if the external toroid is used (accessory 12) with  $I_n = 50/1$  A

## Optical signalling function with LED

The release is fitted with an indicator on the front (operates from  $0.22 \times I_n$  of phase onwards) that signals the events given in the table.

Current sensor setting error	Protection $I>$ in delay mode	LED
No	No	Off
No	Yes	On
Yes	No	Flashing
Yes	Yes	Flashing

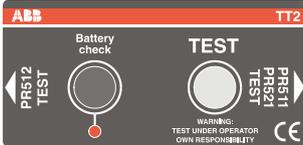
**NOTE.** A current sensor setting error is made when 2 or more models are selected at the same time.

## TEST and RESET function

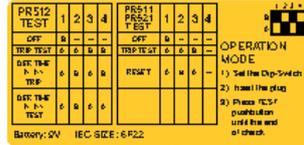
The overall TEST of the relay release function (electronic part and opening solenoid MBO3) can be performed and the "release tripped owing to overcurrent signalling contact" RESET by means of the TT2 accessory (Test Unit supplied on request). The RESET function is only active when the protection unit is completely off.

## Autoreset

The release tripped signal autoreset function occurs when the circuit-breaker recloses with  $0.2 \times 2$  primary current or more on at least one phase equipped with current sensor.



Front view of Test Unit TT2.

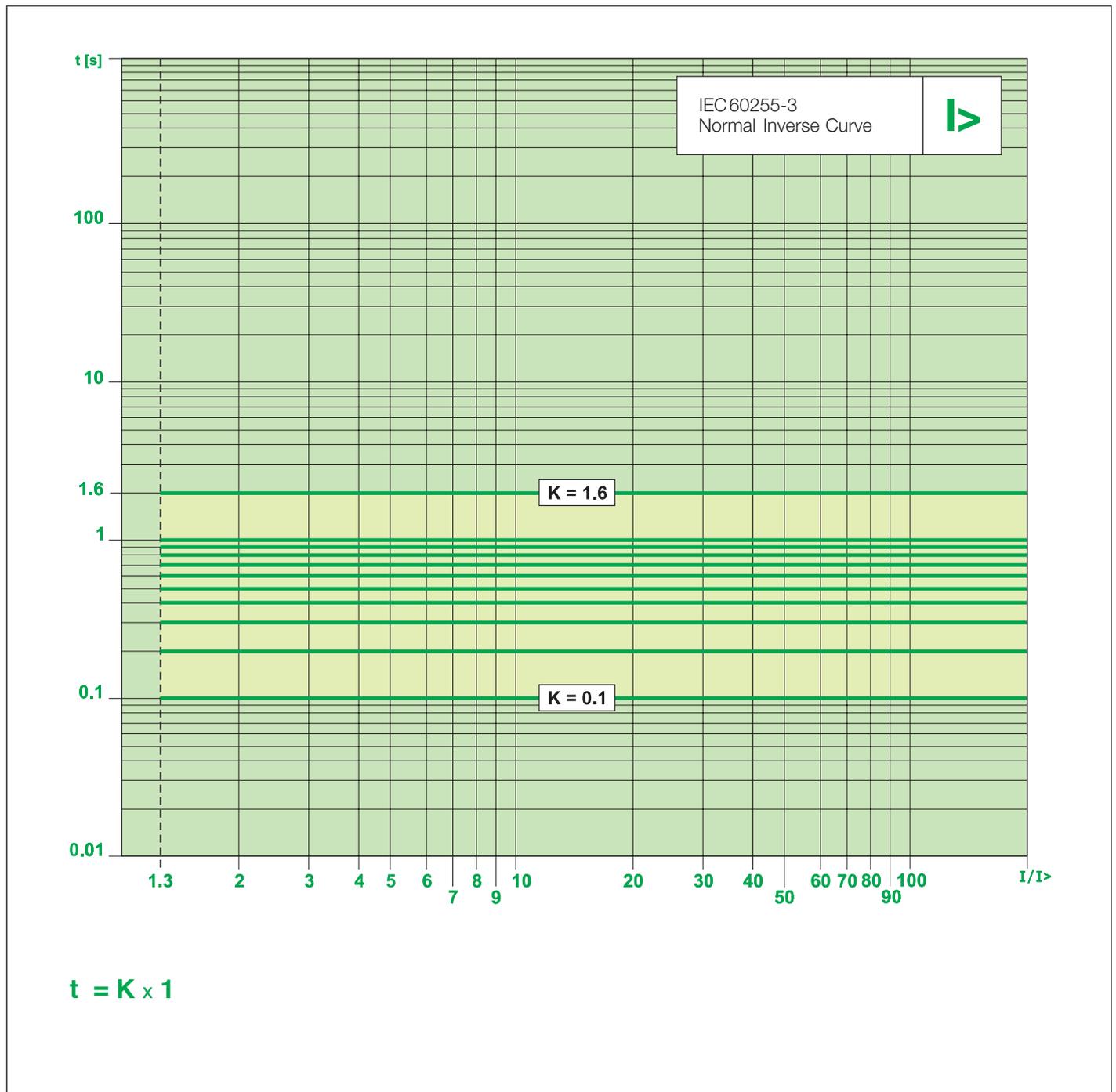


Rear view of Test Unit TT2.

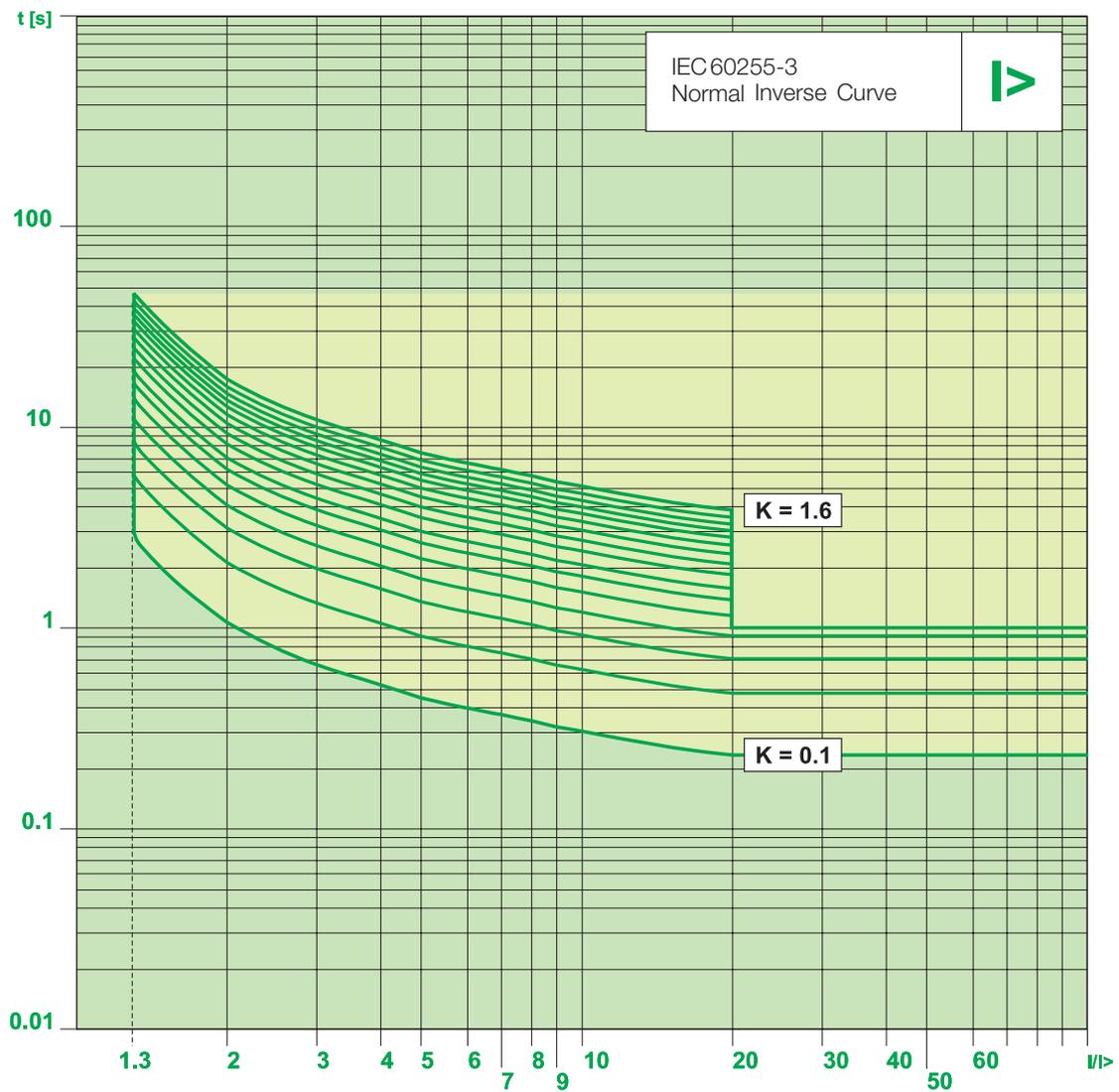
- The TT2 unit activates when Dip Switch 1 is set in position A (Battery Check can be performed).
- When Dip Switches 1 and 2 are set to position A and Dip switch 3 to position B, the TT2 unit conducts the circuit-breaker opening test by means of opening solenoid -YO3.
- When Dip Switches 1 and 3 are set to position A and Dip switch 2 to position B, the TT2 unit resets the alarm (internal signalling relay).

# 3. Specific characteristics of the product

Fixed time trip curve (DT) for overcurrent protection



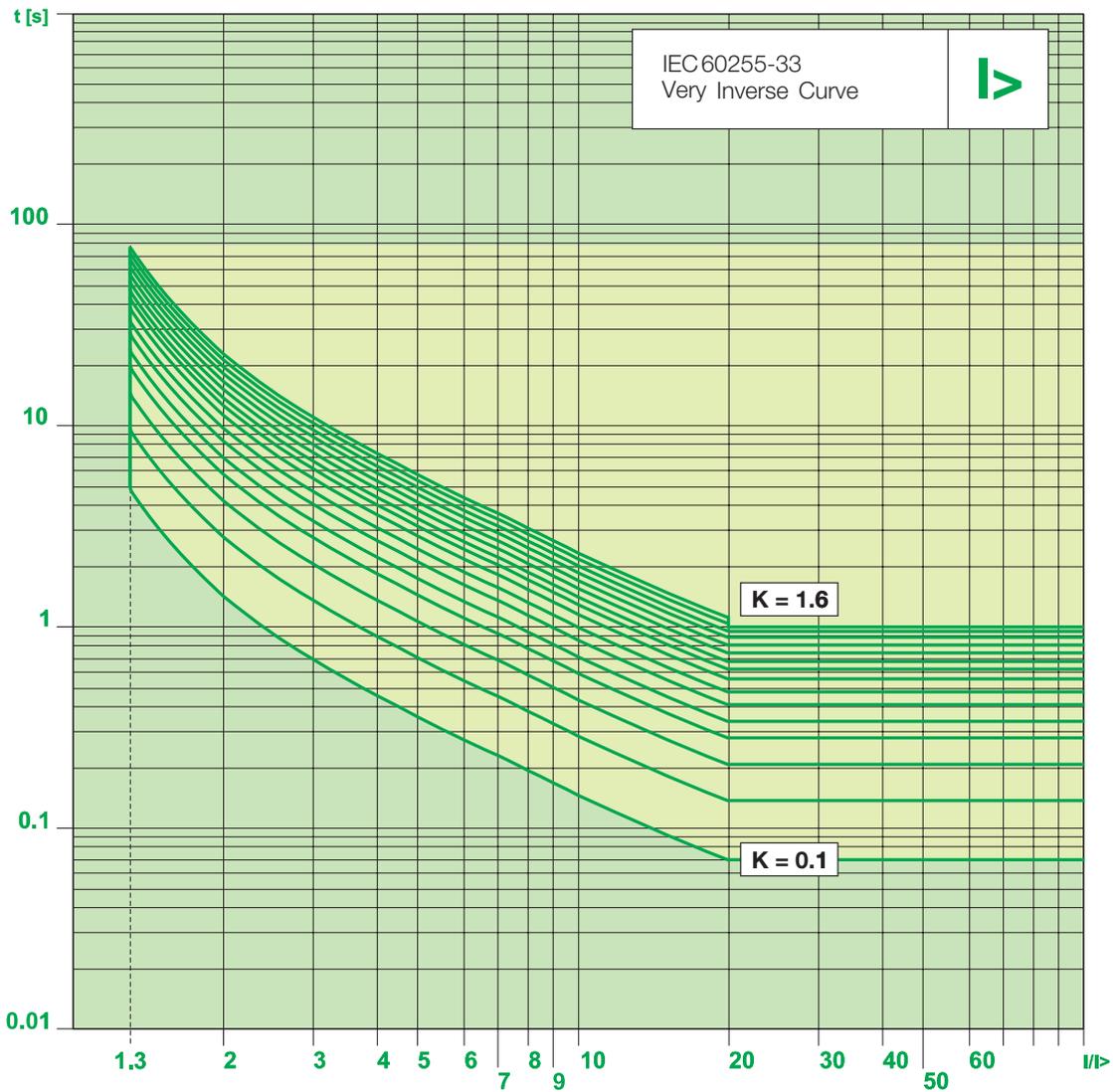
## Normally inverse time trip curve (NI) for overcurrent protection



$$t = K \times \frac{0.14}{\left[ \frac{I}{I_n} \right]^{0.02} - 1}$$

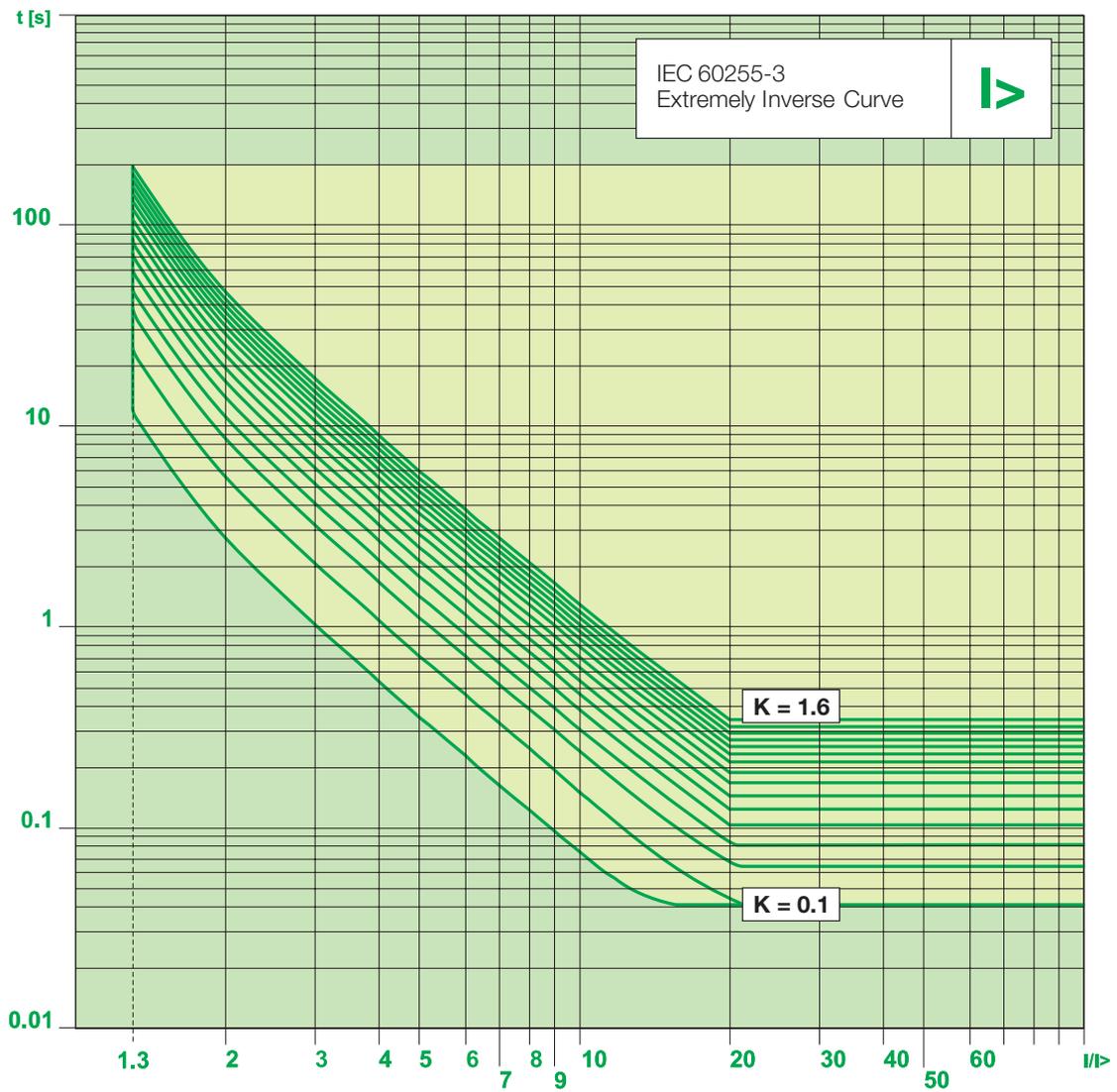
# 3. Specific characteristics of the product

Very inverse time tripping curve (VI) for overcurrent protection



$$t = K \times \frac{13.5}{\left[ \frac{I}{I>} \right] - 1}$$

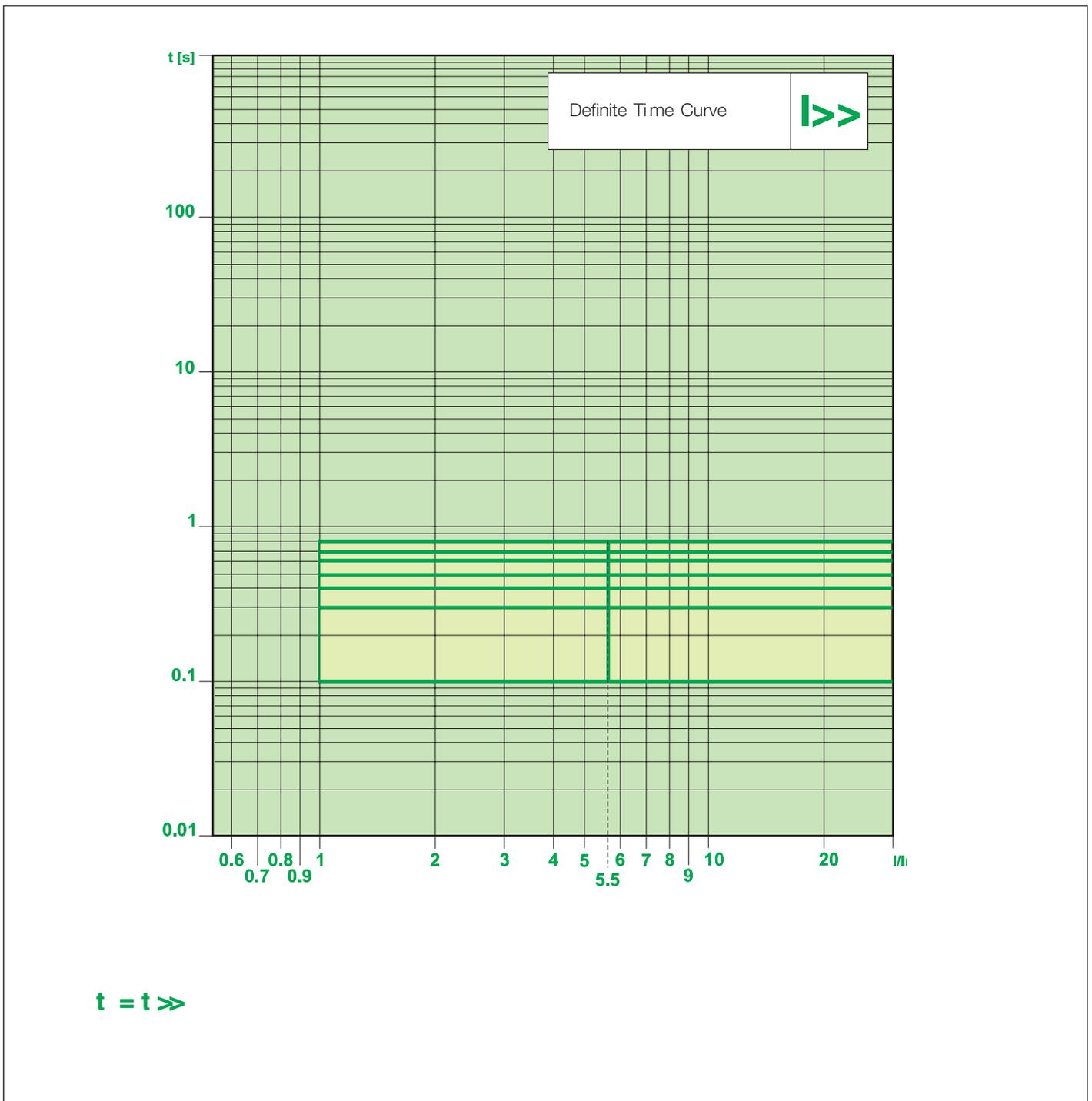
## Extremely inverse time tripping curve (EI) for overcurrent protection



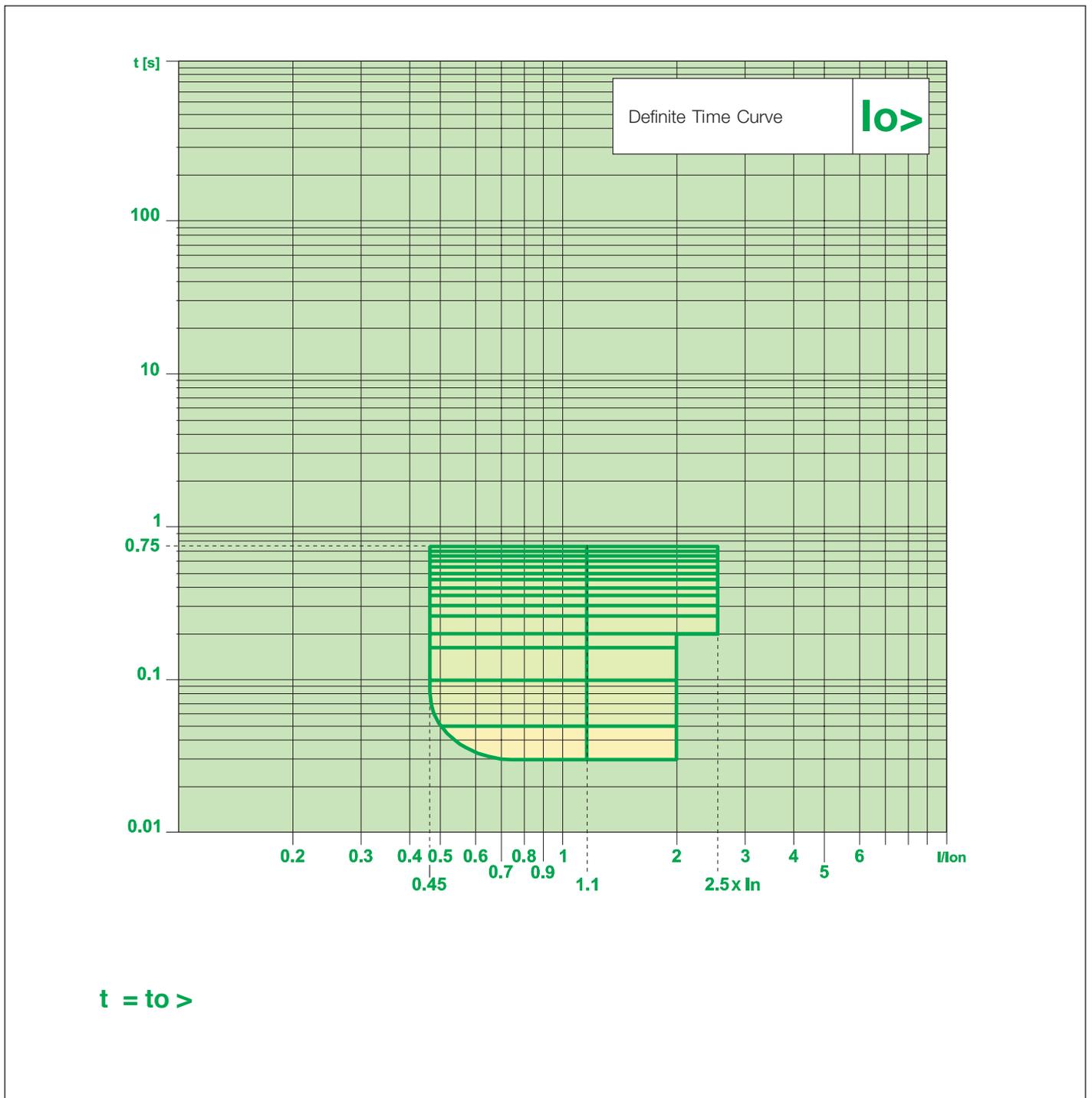
$$t = K \times \frac{80}{\left[ \frac{I}{I>} \right]^2 - 1}$$

# 3. Specific characteristics of the product

Fixed time trip curve for short-circuit protection with adjustable delay

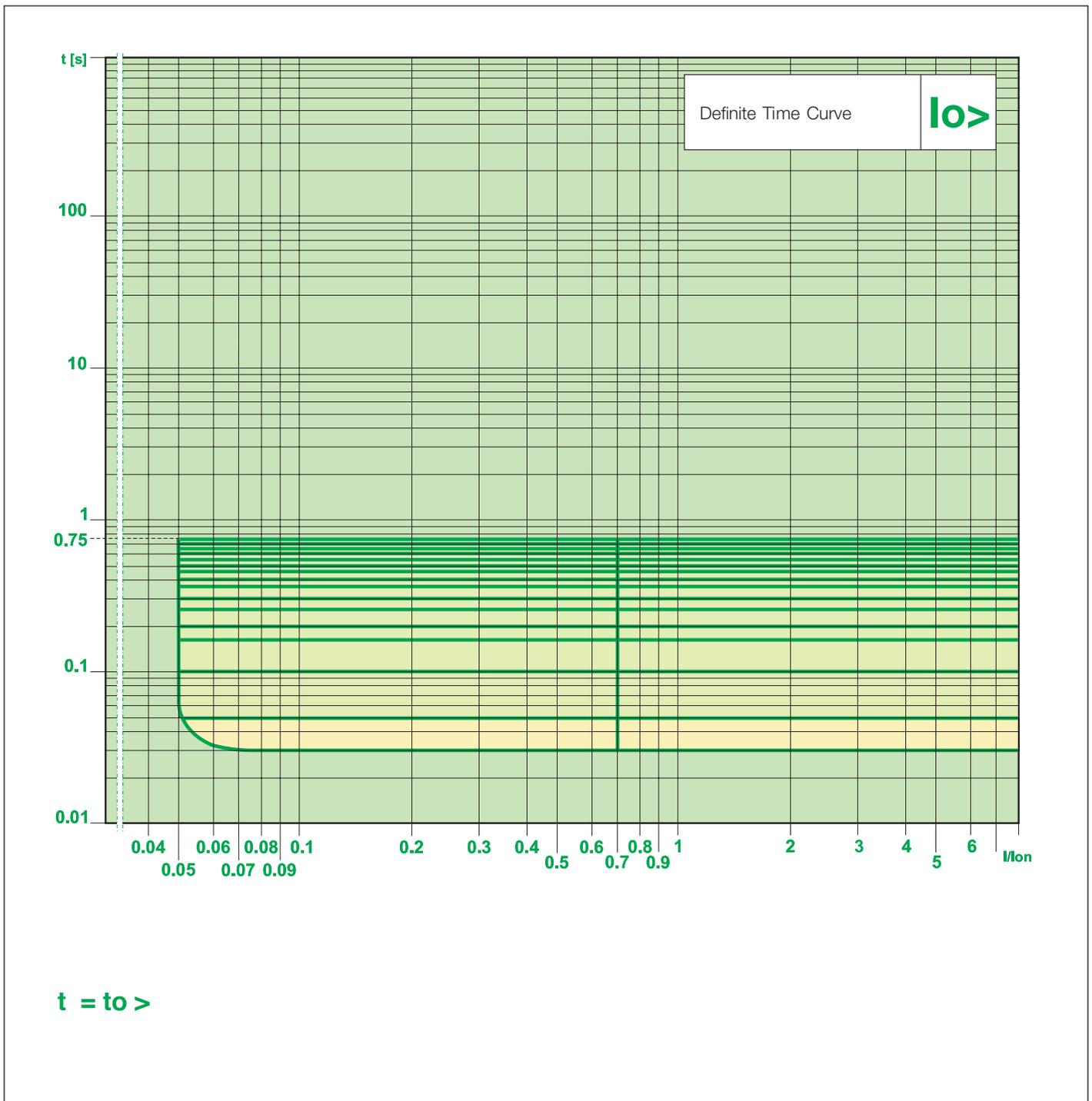


## Fixed time tripping curve for earth fault protection via internal toroid



# 3. Specific characteristics of the product

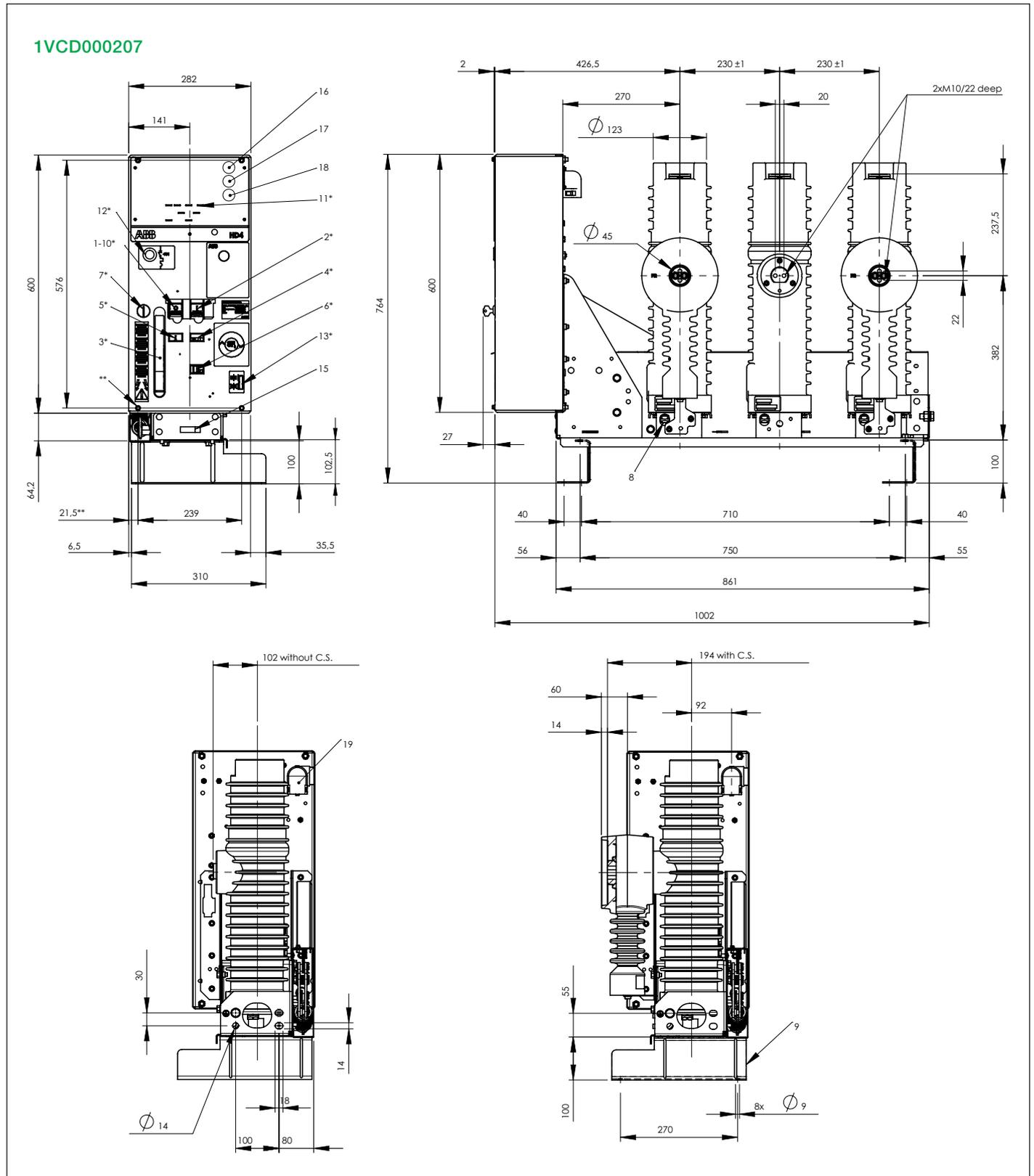
Fixed time tripping curve for earth fault protection via external toroid





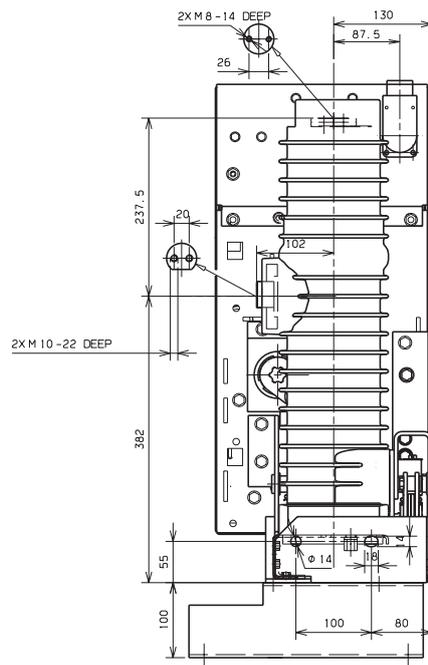
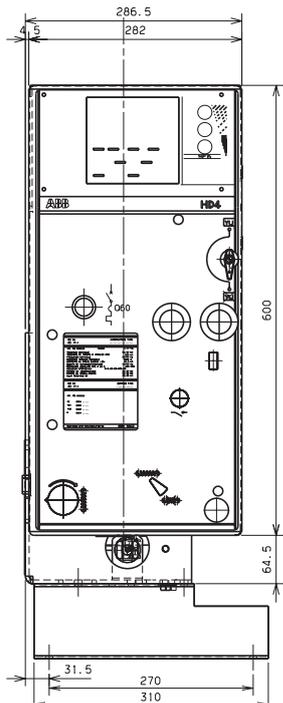
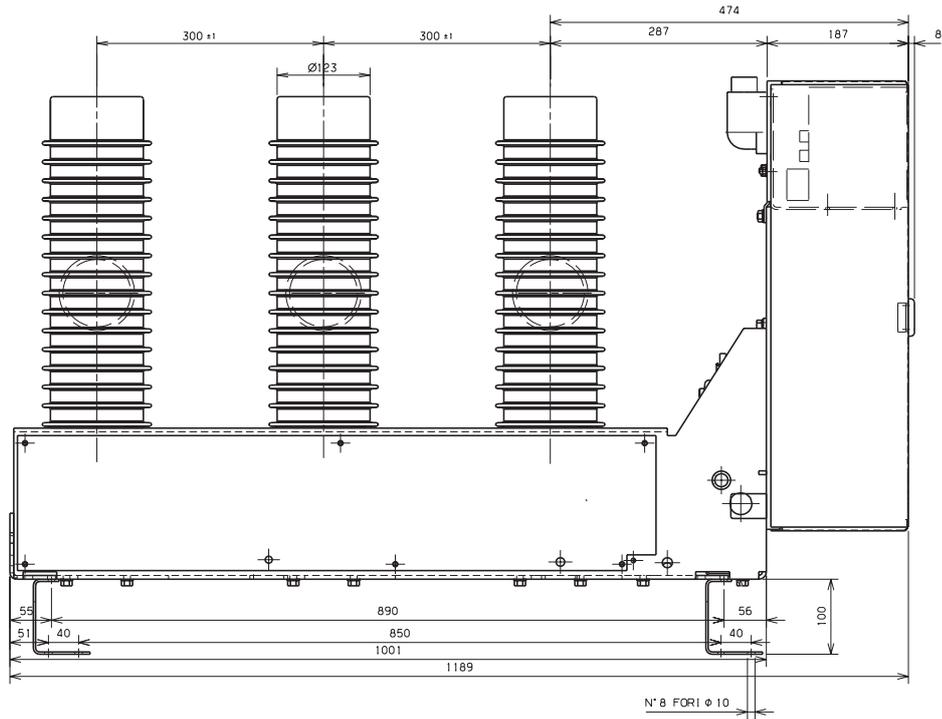
# 4. Overall dimensions

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



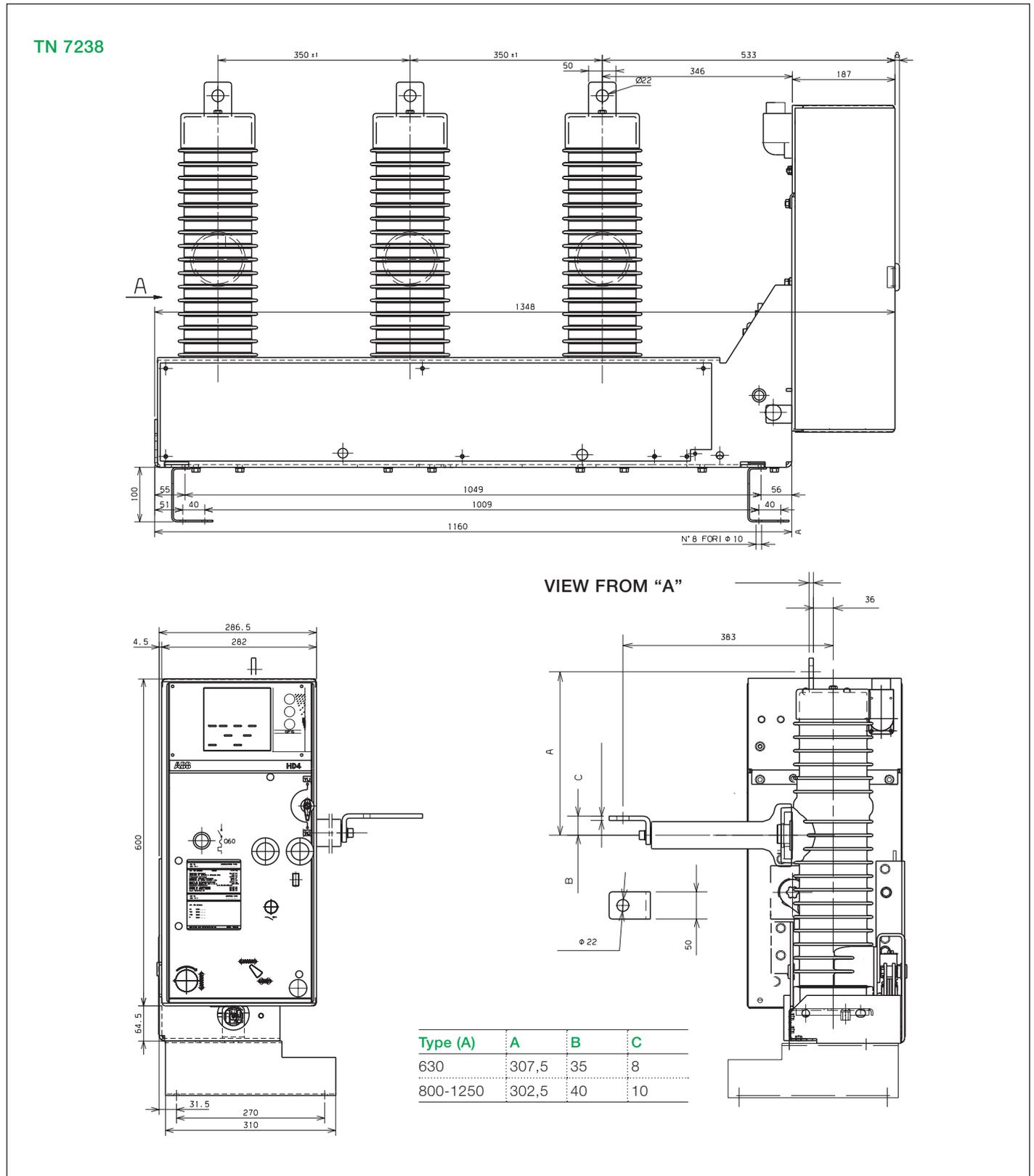
Fixed circuit-breaker HD4/R with rh lateral operating mechanism - 12-17.5-24 kV pole center-distance P = 300 mm

TN 7234



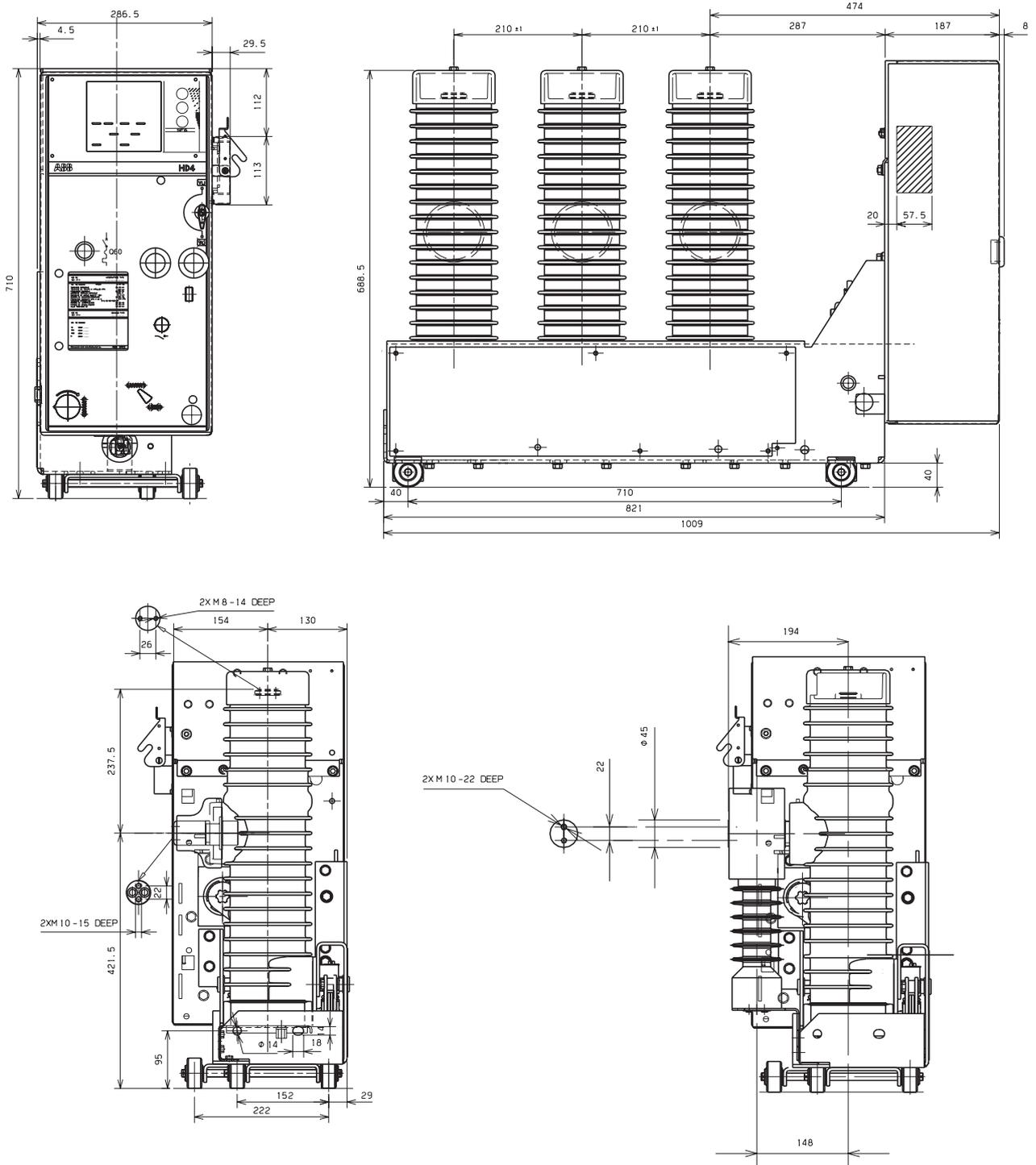
# 4. Overall dimensions

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



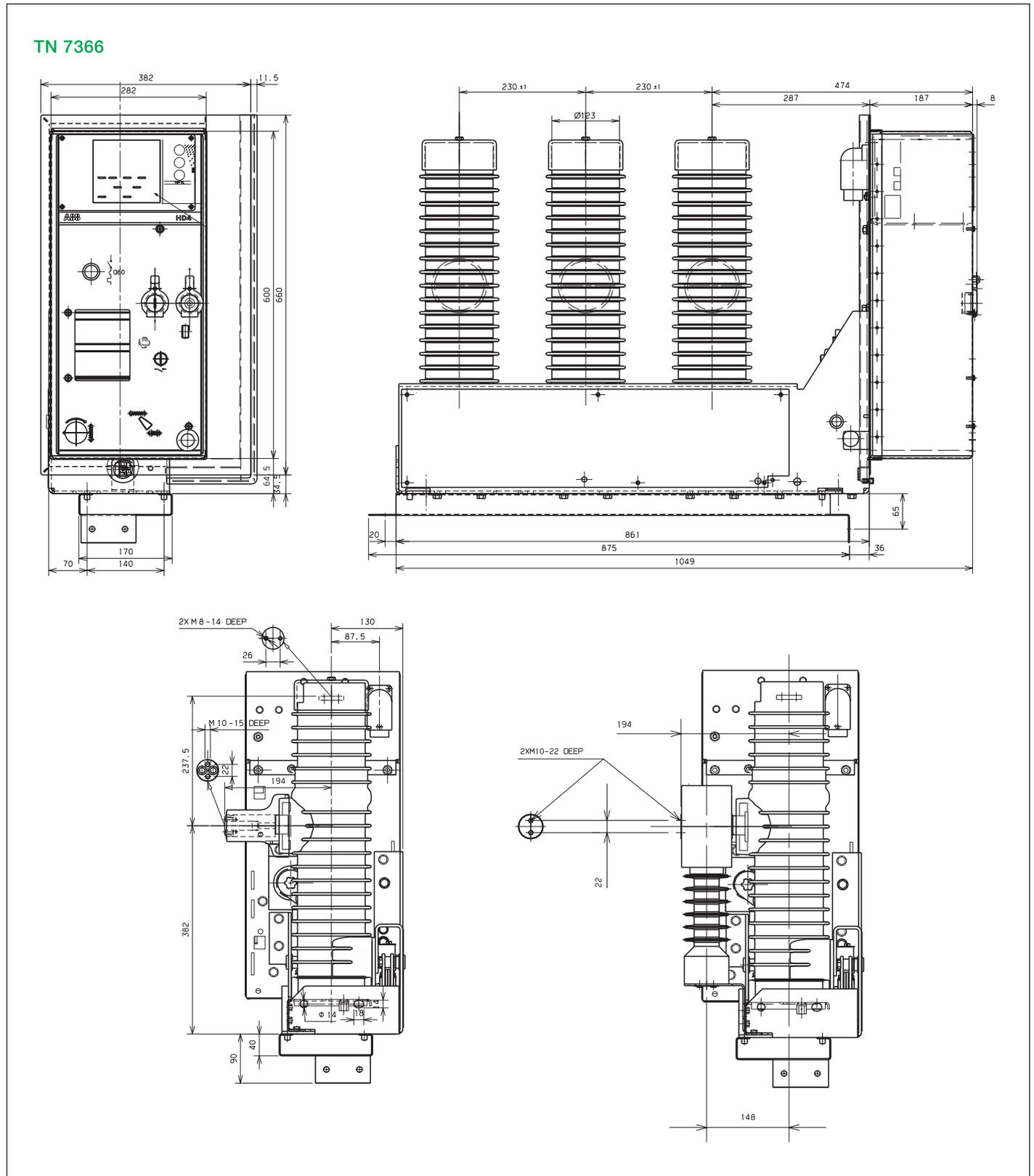
Fixed circuit-breaker HD4/S for UniSwitch switchgear - rh lateral operating mechanism - 12-17.5-24 kV  
pole center-distance P = 210 mm

TN 7236



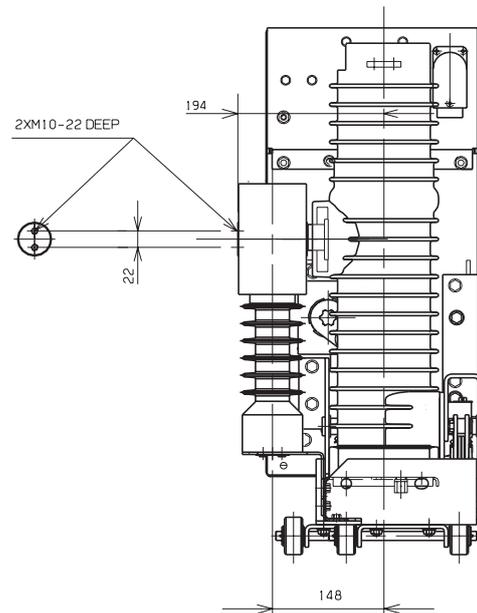
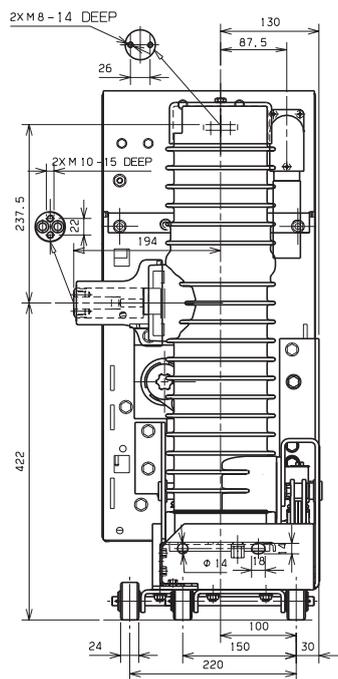
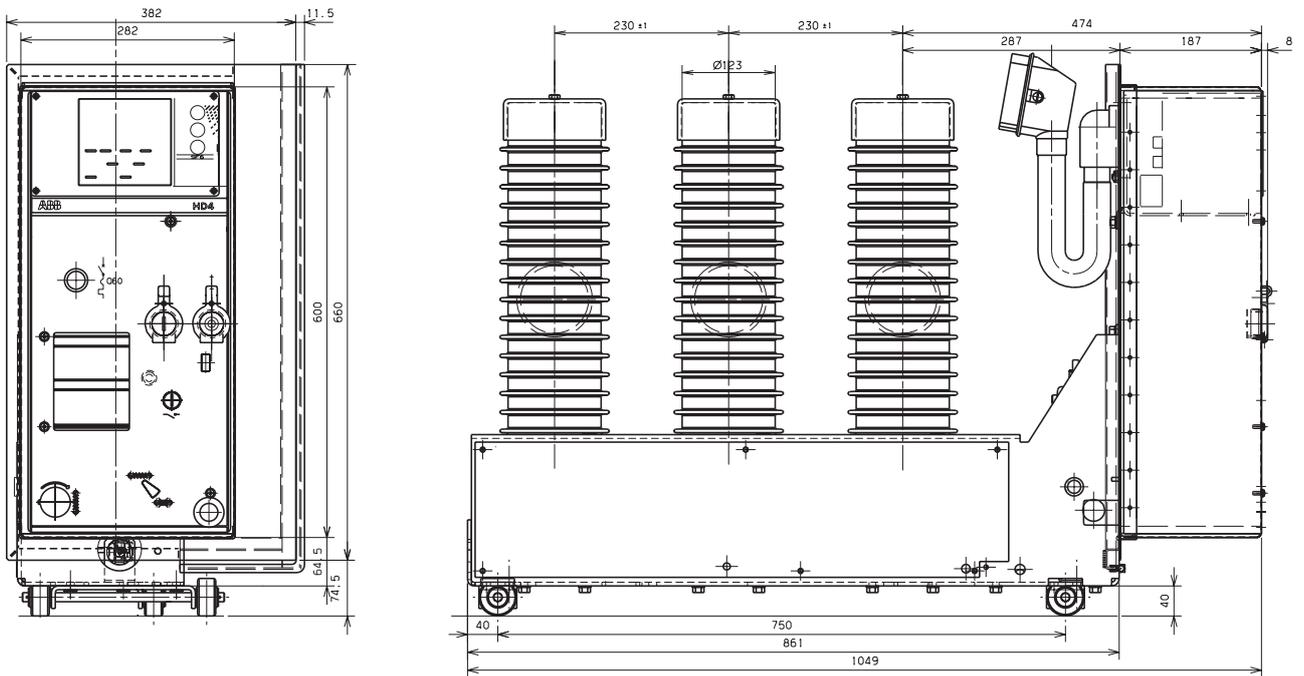
# 4. Overall dimensions

Fixed circuit-breaker HD4-Unimix-F for UniMix switchgear- rh lateral operating mechanism - 12-17.5-24 kV  
pole center-distance P = 230 mm



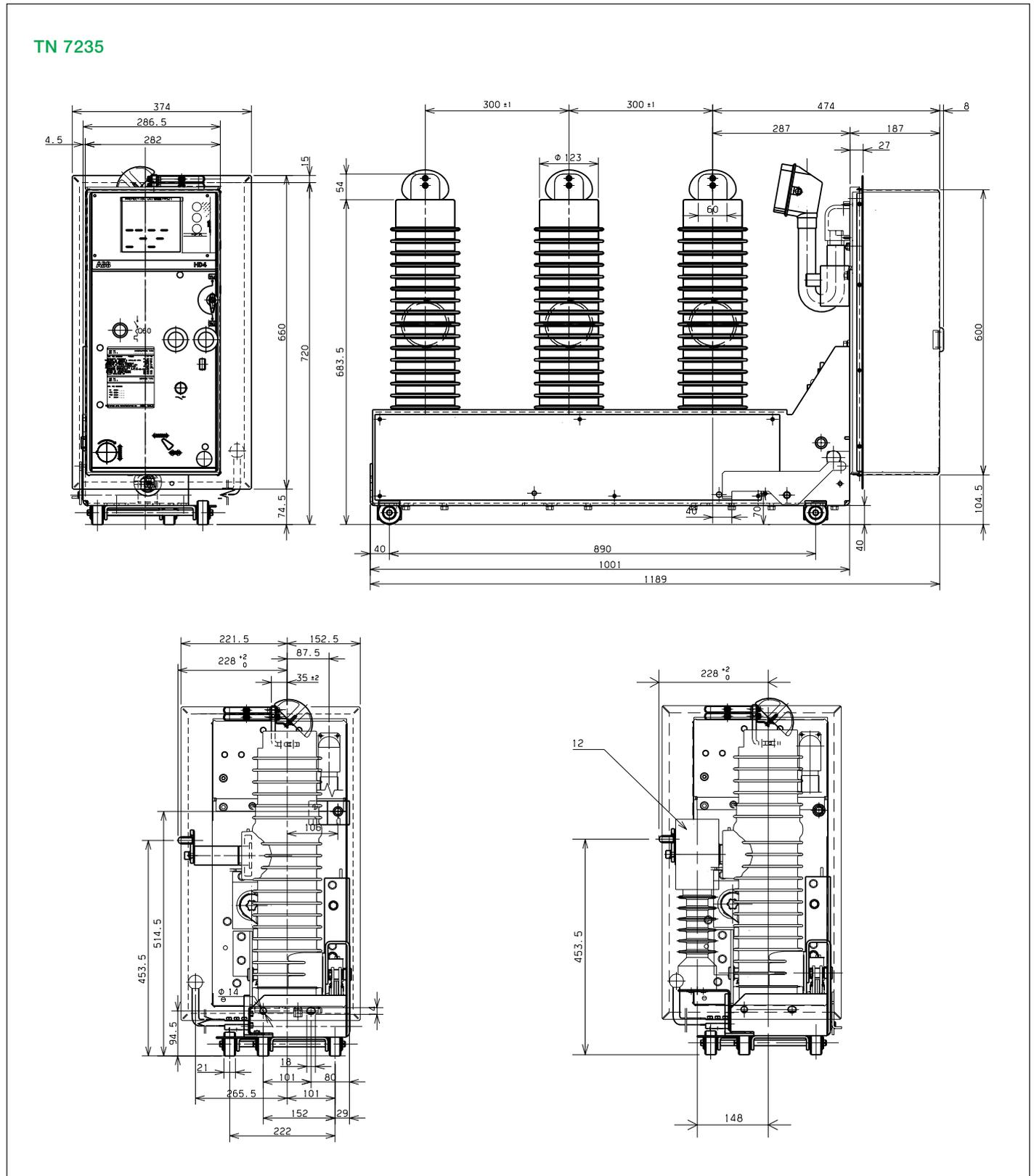
Fixed circuit-breaker HD4-Unimix-R for UniMix switchgear - Unit P1/F - rh lateral operating mechanism - 12-17.5-24 kV pole center-distance P = 230 mm

1VCD003396



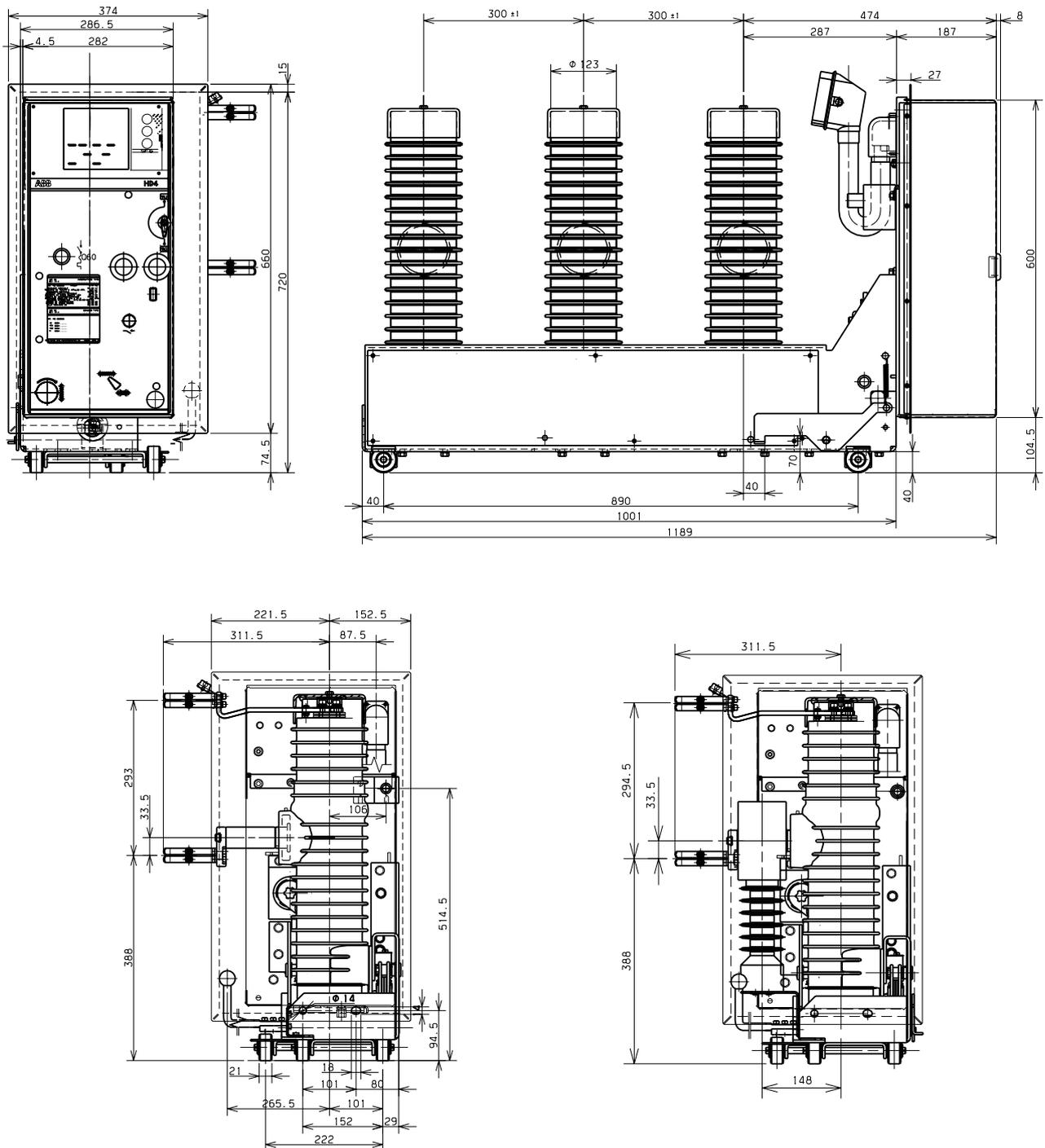
# 4. Overall dimensions

Fixed circuit-breaker HD4/UniAir for UniAir switchgear - P1/E unit - rh lateral operating mechanism - 12-17.5-24 kV  
pole center-distance P = 300 mm



Fixed circuit-breaker HD4/UniAir-2R for UniAir4 switchgear - Unit P1E/2R - rh lateral operating mechanism - 12-17.5-24 kV pole center-distance P = 300 mm

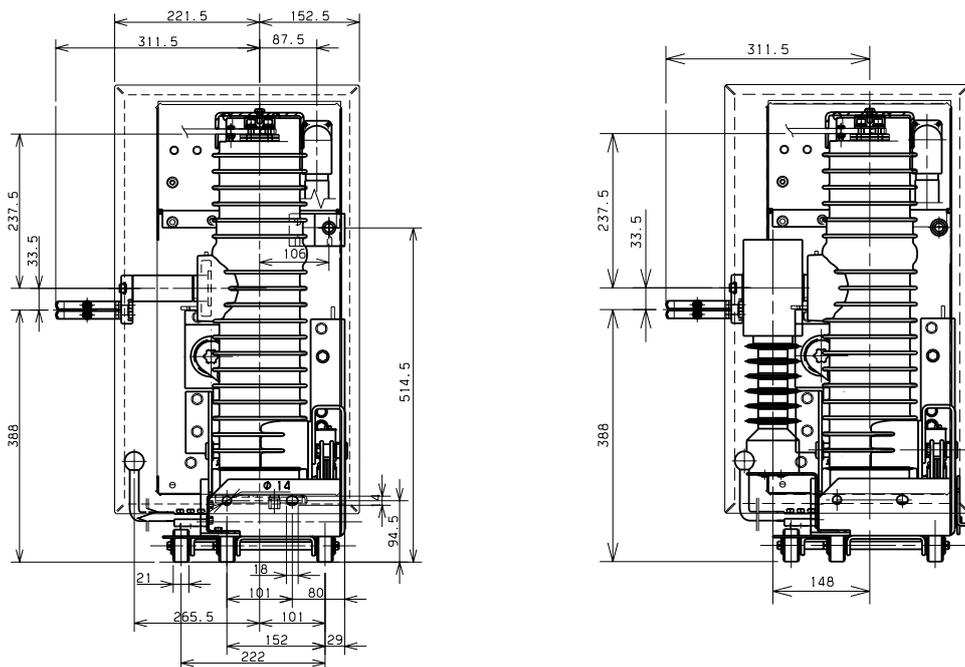
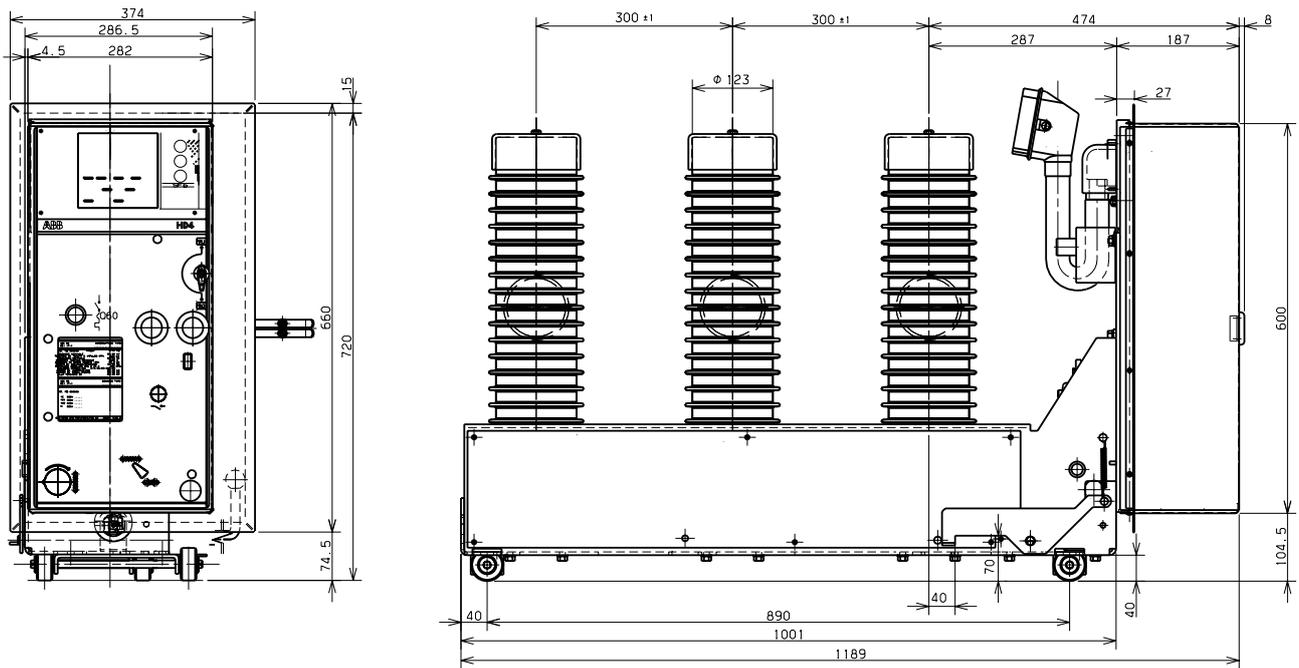
TN 7274



# 4. Overall dimensions

Fixed circuit-breaker HD4/UniAir-A for UniAir switchgear - Unit P1/A - rh lateral operating mechanism - 12-17.5-24 kV pole center-distance P = 300 mm

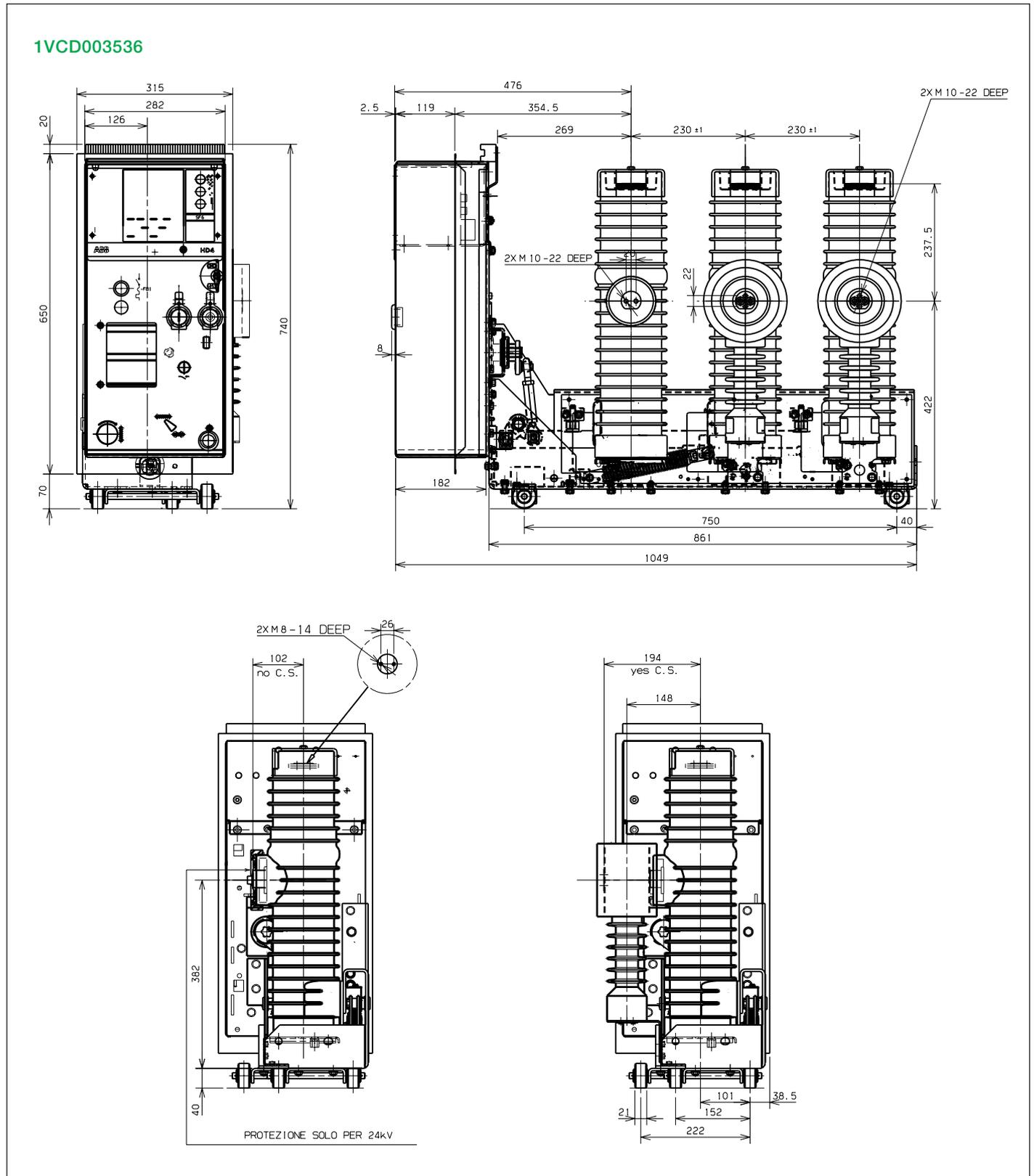
TN 7273





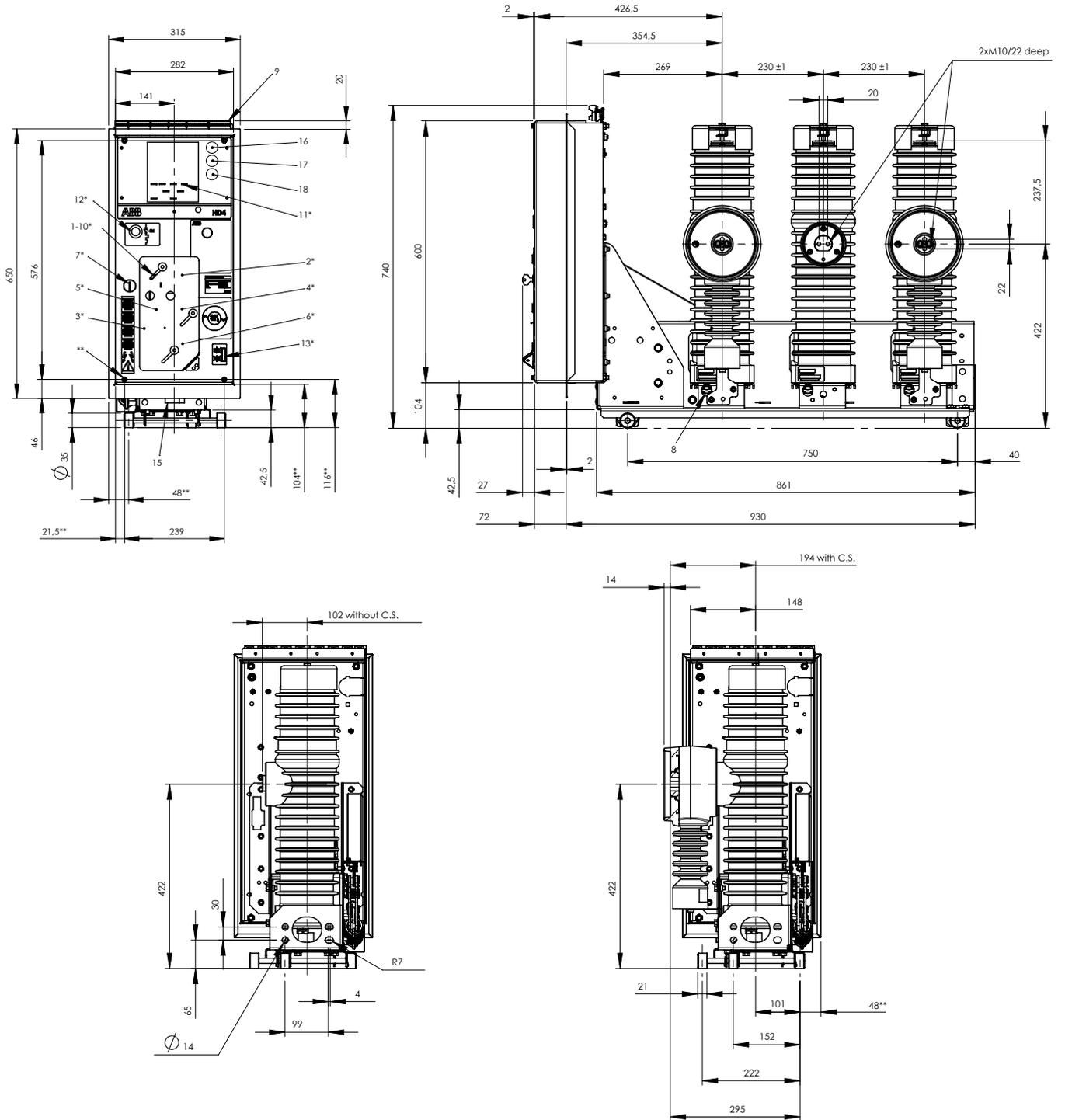
# 4. Overall dimensions

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



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



# 5. Electric circuit diagram

## Application diagrams

**1VCD400017** for circuit-breaker HD4/R “without overcurrent protection device” / “with PR521 protection device installed”

**1VCD400114** illustrates the circuit diagrams of circuit-breakers HD4/R, HD4/UniAir-F and HD4/UniMix-F with and without protection device REF601 (both the IEC and CEI 0-16 versions) and the relative sensors (Rogowsky coil)

**1VCD400119** illustrates the circuit diagrams of HD4/R-Sec circuit-breakers with and without protection device REF601 (both the IEC and CEI 0-16 versions) and the relative sensors (Rogowsky coil)

**1VCD400150** for circuit-breaker HD4/RE “without REF 601 protection device” / “with REF 601 protection device installed”

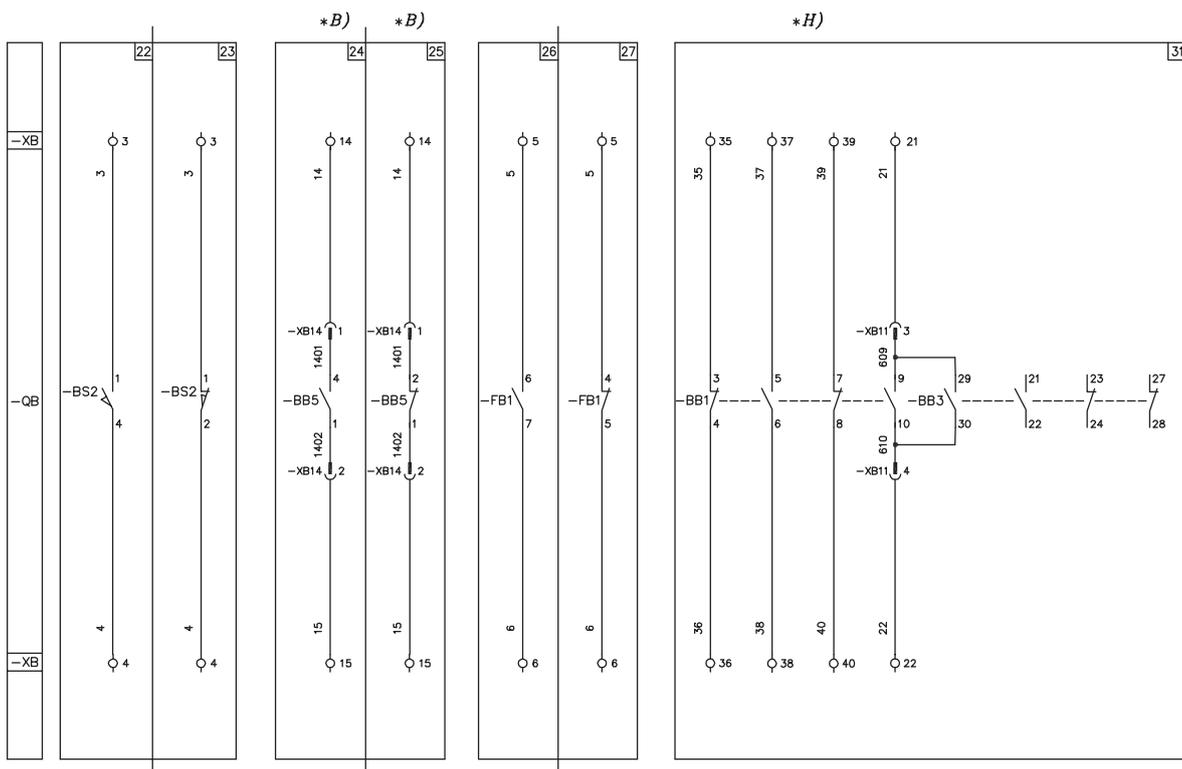
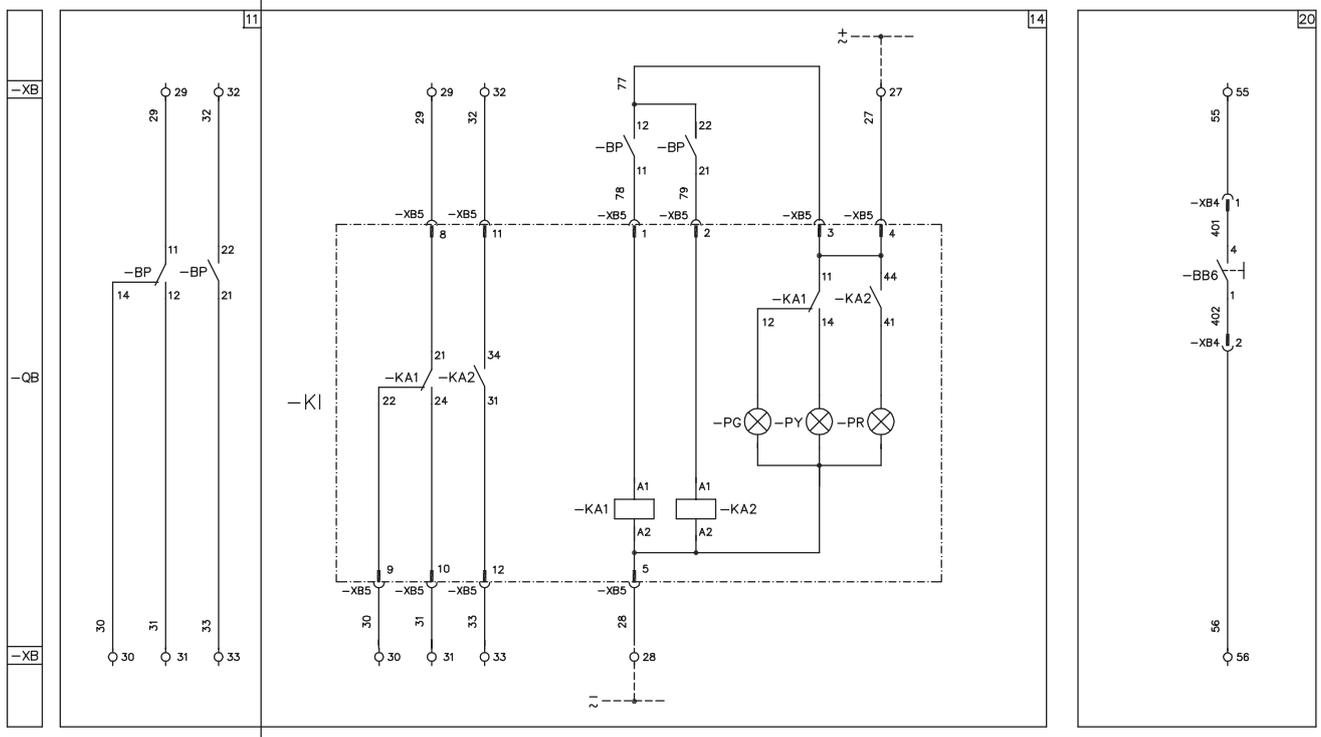
## Symbols for wiring diagrams

	Thermal effect		Terminal or clamp		Rectifier with two half-waves		Control coil (general symbol)
	Electromagnetic effect		Socket and plug (female and male)		Make contact		Overcurrent relay with adjustable long-time delay feature
	Push-button control		Resistor (general symbol)		Break contact		Overcurrent relay with adjustable inverse long-time delay feature
	Earth (general symbol)		Capacitor (general symbol)		Make contact with retained position and reset by manual actuator		Overcurrent relay with adjustable short-time delay feature
	Earth, frame		Motor (general symbol)		Make position contact (limit)		Instantaneous overcurrent relay
	Conductor in shielded cable (e.g. two conductors)		Current sensor		Break position contact (limit)		Earth fault overcurrent relay with adjustable long-time delay feature
	Conductor connections		Current sensor with wound secondary and primary formed by three feed-throughs		Automatically opening circuit-breaker		Lamp (general symbol)
	Isolated digital binary input		Current sensor				



# 5. Electric circuit diagram

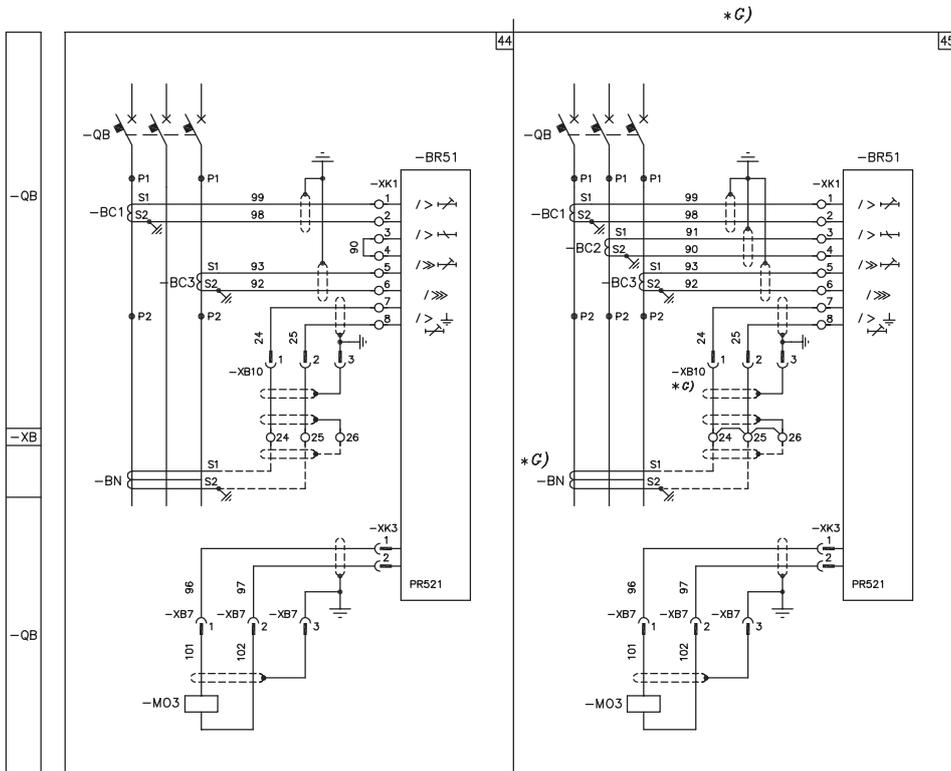
Diagram 1VCD40017





# 5. Electric circuit diagram

Diagram 1VCD400017



## Diagram 1VCD400017

### Operating state shown

The diagram illustrates the components in the following conditions:

- circuit-breaker open
- circuits de-energized
- closing springs discharged
- releases not tripped
- undervoltage release activated
- SF<sub>6</sub> gas pressure at nominal duty value (380 kPa absolute).

### Key

- = Figure number of the diagram
- \* = See note indicated by the letter
- BB1...-BB3 = Auxiliary contacts of the circuit-breaker (3 packs of 5 contacts)
- BB5 = Contact for the undervoltage release energized/de-energized electrical signal
- BB6 = Contact for the undervoltage release de-energized electrical signal
- BC1...-BC3 = Current sensors located on phases L1-L2-L3 for powering microprocessor release PR521
- BM = Device for monitoring the continuity of the opening release winding (see note E)
- BN = Homopolar current sensor outside the circuit-breaker, with connections at the customer's charge. For microprocessor release PR521 (see note G)
- BP = Pressure switch with two tripping thresholds:
  - intervention for low pressure  
Contact 11-12-14 switches in relation to the position shown in the diagram when the gas pressure drops from 380 kPa absolute to a value below 310 kPa absolute. If the rated pressure value returns, this same contact switches again when, beginning with a lower value than 310 kPa absolute, the value of 340 kPa absolute is reached
  - intervention for insufficient gas pressure  
Contact 21-22 switches when the gas pressure drops from 380 kPa absolute to a value below 280 kPa absolute. If the rated pressure value returns, this same contact switches again when, beginning with a value less than 280 kPa absolute, the value of 310 kPa absolute is reached
- BR51 = Type PR521 microprocessor-based overcurrent release with the following protection functions (in accordance with IEC 60255-3):
  - against overload with definite, inverse, very inverse or extremely inverse long tripping time
  - against short-circuits with definite short tripping time
  - against short-circuits with instantaneous tripping time
  - against earth faults with definite short tripping time (on request)
- BS1, -BS2 = Limit contacts of the spring loading motor
- DO 1 = For microprocessor release PR521: contact for electrical signalling of solenoid -M03 tripped owing to overcurrent (I> or I>> or I>>> or Io>)
- FB1 = Thermal magnetic circuit-breaker for spring loading motor protection (see note F)
- KI = Integrated circuit for gas pressure control, including:
  - PG = Green led for signalling normal gas pressure
  - PR = Red led for signalling insufficient gas pressure
  - PY = Yellow led for signalling low gas pressure
  - KA1 = Auxiliary relay for duplicating the contacts of pressure switch -BP, with tripping for low gas pressure
  - KA2 = Auxiliary relay for duplicating the contacts of pressure switch -BP, with tripping for insufficient gas pressure
  - XB5 = Connector
- MC = Shunt closing release
- MO1 = First shunt opening release (see note E)
- MO2 = Second shunt opening release (see note E)
- MO3 = Opening solenoid of microprocessor release PR521
- MS = Motor for loading the closing springs (see note C)
- MU = Undervoltage release, instantaneous or with solid-state time-lag device (see note B)
- NC = Contact for controlling the undervoltage opening controlled by the relay
- PI1 = Man-machine interface for signalling phase overcurrent and/or earth fault and reset control
- QB = Main circuit-breaker
- SC = Circuit-breaker closing pushbutton or contact
- SO = Circuit-breaker opening pushbutton or contact
- SO3 = Contact for opening the circuit-breaker by means of solenoid -M03
- SR = Reset button
- TR1,-TR2 = Rectifiers for releases -MO1 and -MO2
- VF = Filter (only available for 220 V.d.c. power supply voltage)

# 5. Electric circuit diagram

## Diagram 1VCD400017

- XB = Delivery terminal box of the circuit-breaker circuits
- XB4..-XB19 = Connectors of the applications
- XK1 = Terminal box of the current circuits of microprocessor release PR521
- XK2,-XK3 = Connectors of the auxiliary circuits of microprocessor release PR521

### Description of the figures

- Fig. 1 = Circuit of the motor for loading the closing springs (see note C).
- Fig. 2 = Shunt closing release (anti-pumping is achieved mechanically).
- Fig. 5 = Undervoltage release, instantaneous or with time-lag device (see note B) .
- Fig. 7 = Circuit of first opening release with option for continuous monitoring of the winding (see note E).
- Fig. 9 = Circuit of second shunt opening release with option for continuous monitoring of the winding (see note E).
- Fig. 10 = Opening solenoid of microprocessor release PR521.
- Fig. 11 = Gas pressure monitoring circuit. Includes:
  - contacts for remote signalling of normal, low and insufficient gas pressure. Consult the key for the tripping values of pressure switch -BP.
- Fig. 14 = Integrated gas pressure monitoring circuit. Includes:
  - 3 leds for remote signalling of normal, low and insufficient gas pressure.
  - contacts for remote signalling of normal, low and insufficient gas pressure.
  - circuit-breaker closing locked by means of an auxiliary contact of relay -KA2 if the gas pressure is insufficient.

Choose fig. 15 or 16 to achieve, respectively, automatic opening or locking of circuit-breaker opening in the case of insufficient gas pressure. Provide the same power supply as the circuit of the first shunt opening release (fig. 7). Consult the key for the tripping values of pressure switch -BP.
- Fig. 15 = Circuit for automatic circuit-breaker opening in the case of insufficient gas pressure (only available if fig. 14 is used).
- Fig. 16 = Circuit for locking circuit-breaker opening in the case of insufficient gas pressure (only available if fig. 14 is used).

- Fig. 20 = Contact for electrical signalling of undervoltage release de-energized.
- Fig. 21 = Thermal magnetic circuit-breaker for spring loading motor protection (see note F).
- Fig. 22 = Contact for electrical signalling of springs loaded.
- Fig. 23 = Contact for electrical signalling of springs discharged.
- Fig. 24 = Contact for electrical signalling of undervoltage release energized (see note B).
- Fig. 25 = Contact for electrical signalling of undervoltage release de-energized (see note B).
- Fig. 26 = Contact for electrical signalling of motor protection circuit-breaker closed.
- Fig. 27 = Contact for electrical signalling of motor protection circuit-breaker open.
- Fig. 31 = Available auxiliary contacts of the circuit-breaker.
- Fig. 33 = Available auxiliary contacts of the circuit-breaker.
- Fig. 41 = Auxiliary circuits of microprocessor release PR521.
- Fig. 42 = Current circuits of microprocessor-based release PR521 without earth fault protection, powered by two current sensors (can only be used with networks with insulated neutral and negligible earth fault currents).
- Fig. 43 = Current circuits of microprocessor-based release PR521 without earth fault protection, powered by three current sensors.
- Fig. 44 = Current circuits of microprocessor-based release PR521 with earth fault protection, powered by two current sensors and by a homopolar current sensor.
- Fig. 45 = Current circuits of microprocessor-based release PR521 with earth fault protection, powered by three current sensors and (if required, at customer's charge) by a homopolar current sensor (see note G).

### Incompatibility

The circuits indicated in the following figures cannot be supplied at the same time in the same circuit-breaker:

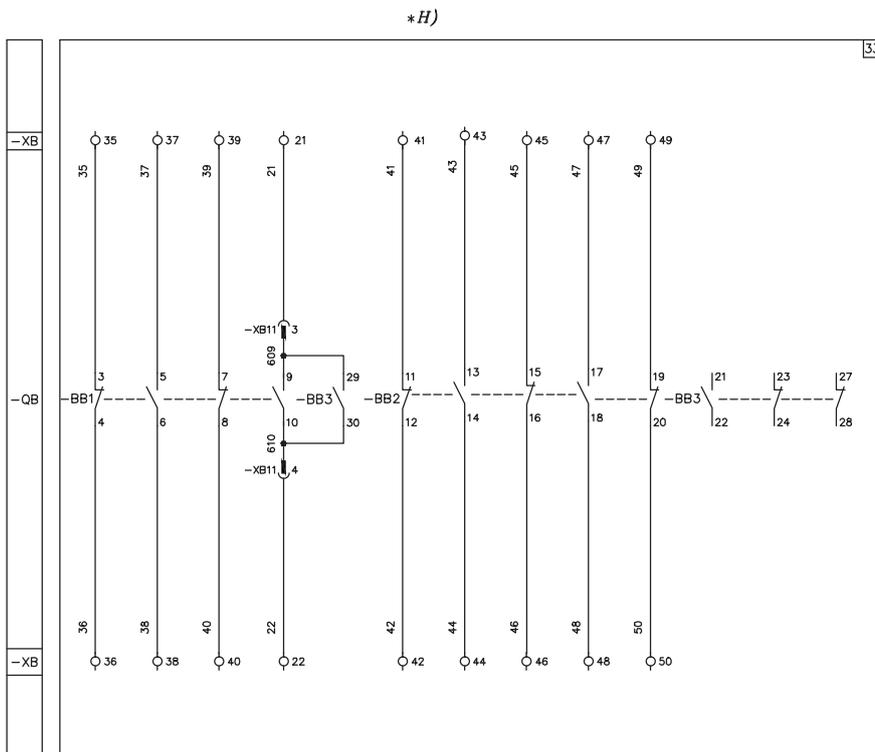
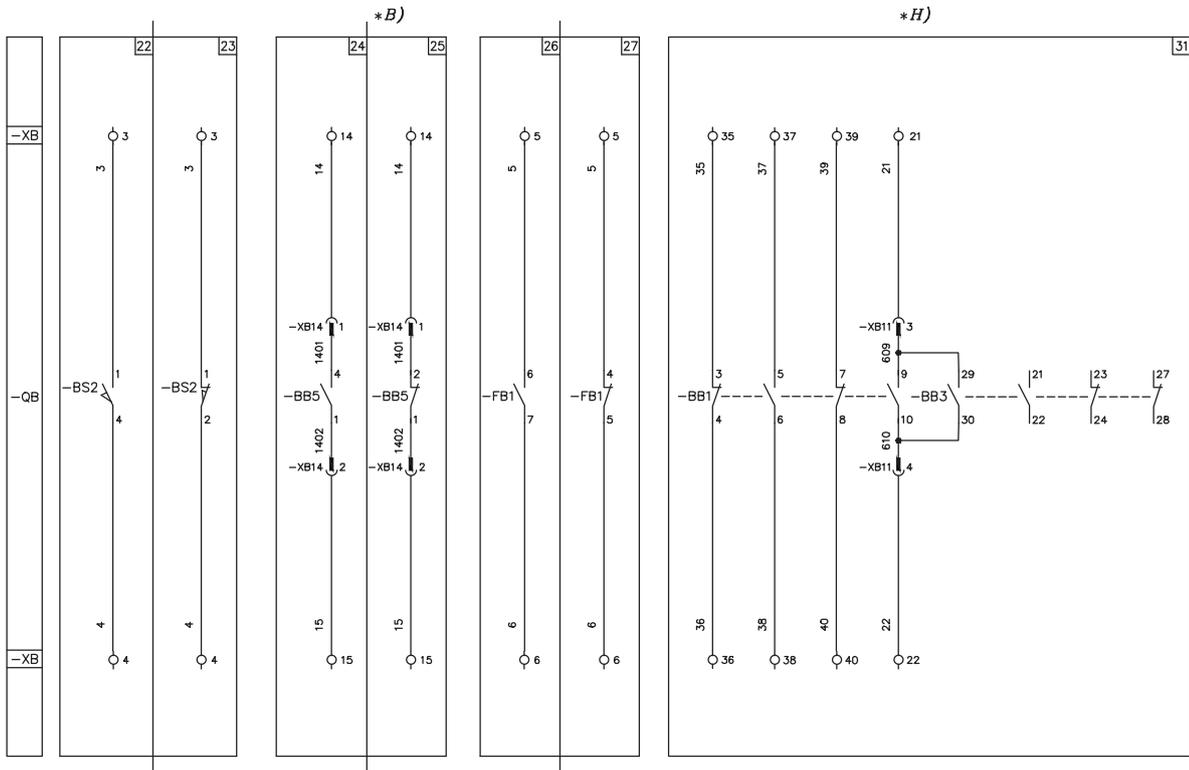
<b>5-16</b>	<b>9-16</b>	<b>22-23</b>
<b>10 - 41</b>	<b>5- 9-10-16-41-42-43-44-45</b>	<b>24-25</b>
<b>10-16-41</b>	<b>11-14</b>	<b>26-27</b>
<b>31-33</b>	<b>11-15-16</b>	<b>9-10</b>
<b>5-14</b>		

## Notes

- A) The circuit-breaker comes solely equipped with the specific applications in the order confirmation. Consult the catalogue of the device for instructions about how to make out the order.
- B) The undervoltage release can be supplied for powering with voltage branching from the supply side of the circuit-breaker or from an independent source.  
Use of both the instantaneous undervoltage release and the one with electronic time-lag device (outside the circuit-breaker) is allowed. The circuit-breaker can only close when the release is energized (the closing lock is obtained mechanically).  
The contact shown in fig. 24 or the one in fig. 25 (signalling is persistent) are available on request. If there is the same power supply for the closing and undervoltage releases and the circuit-breaker must close automatically when the auxiliary voltage returns, there must be a 50 ms delay between the undervoltage release's enabling instant and energizing of the closing release. This can be achieved by means of a circuit outside the circuit-breaker comprising a permanent closing contact, the contact indicated in fig. 24 and a time-delay relay.
- C) Check the power available in the auxiliary circuit to find out whether several motors for loading the closing springs can operate at the same time. To prevent excessive power draw, the springs must be loaded by hand before auxiliary circuit is powered.
- E) The circuit for monitoring the continuity of the opening release winding must only be used for that purpose.  
With a power supply of less than 220V, connect the "Control Coil Continuity" device or a relay or signalling lamp which absorbs a current of not more than 20 mA.  
With a power supply of 220V or more, connect a relay or signalling lamp which absorbs a current of not more than 10 mA.  
Other uses compromise the soundness of the release.
- F) Circuit-breaker -FB1 of fig. 21 must always be installed if the spring loading motor is powered at 24 V.d.c.  
If opening is caused by a fault in the motor, spring loading must always be completed with the relative handle before proceeding with the manual reset.
- G) Remove the bridges between terminals 24-25-26 of terminal box -XB if sensor -BN is required.
- H) When fig. 9 is required, the contact to terminals 9-10 of pack -BB1 is no longer available for figs. 31-33.  
If fig. 9 is not required, the contact to terminals 29-30 of pack -BB3 can be used by eliminating the connection in parallel with the contact to terminals 9-10 of pack -BB1.



Diagram 1VCD400114



# 5. Electric circuit diagram

Diagram 1VCD400114

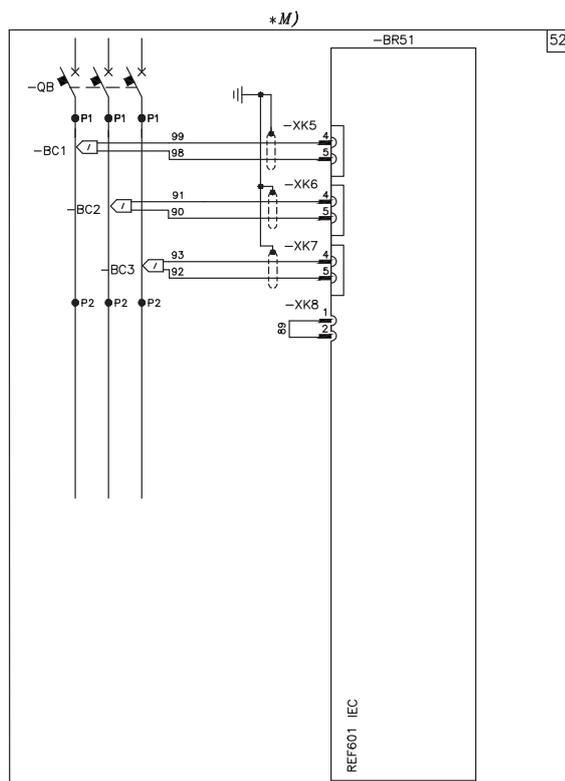
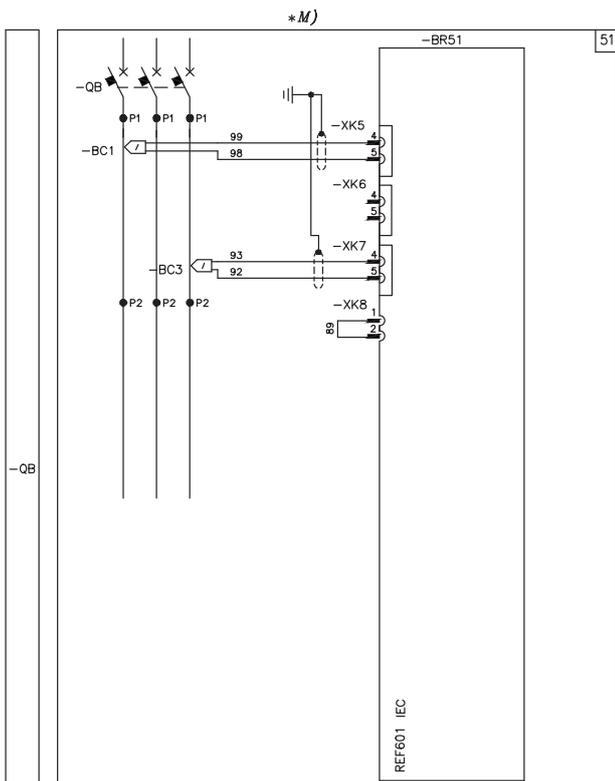
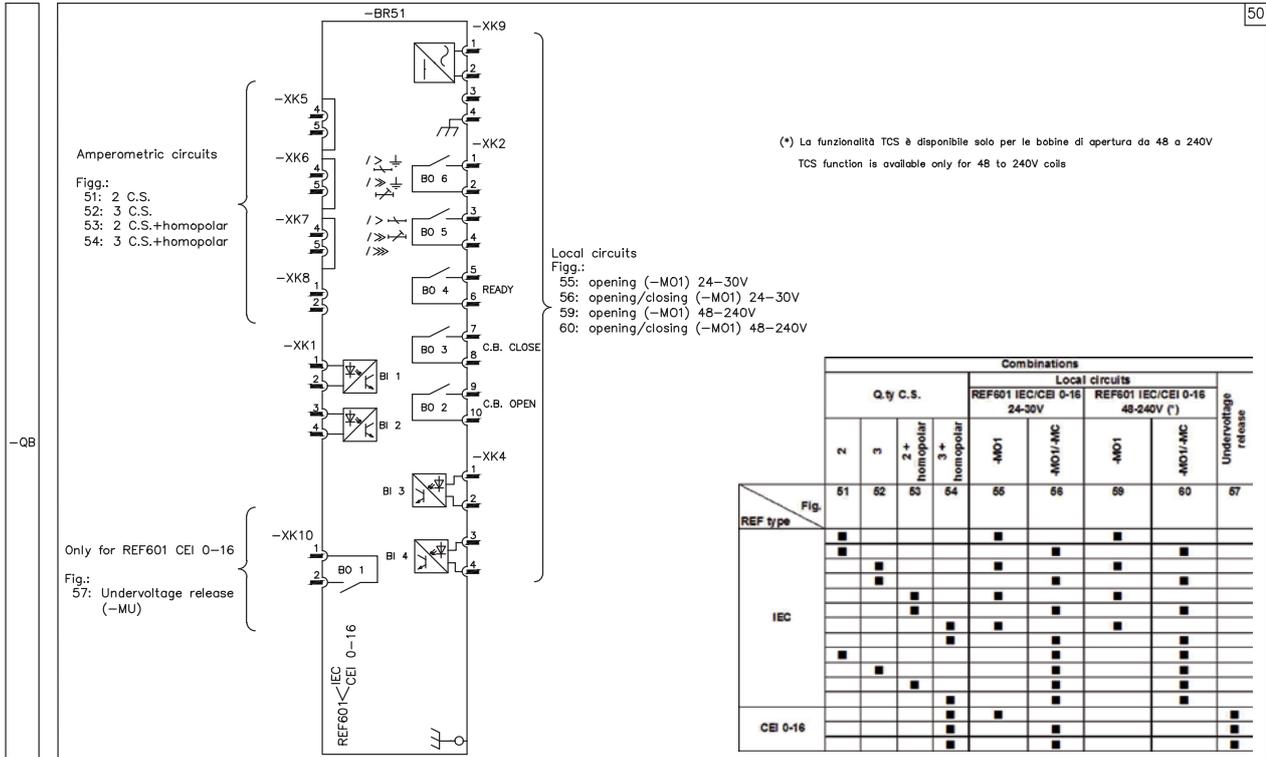


Diagram 1VCD400114

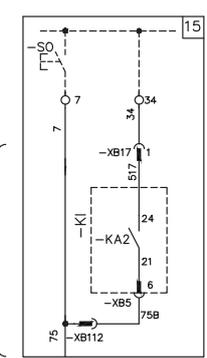
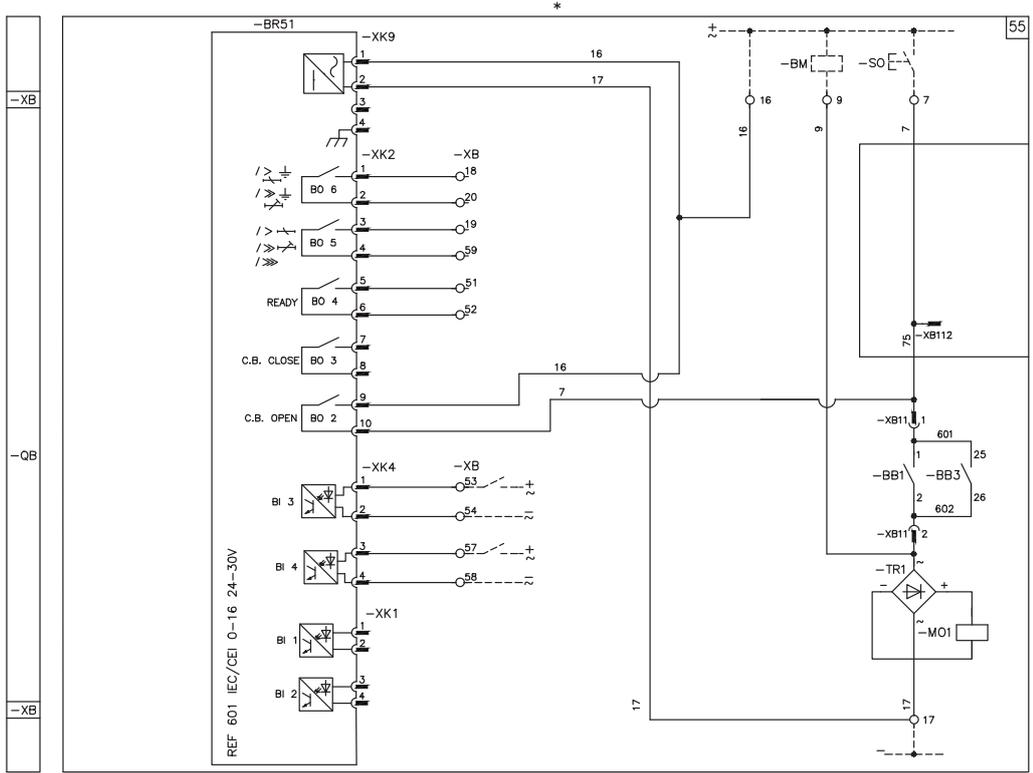
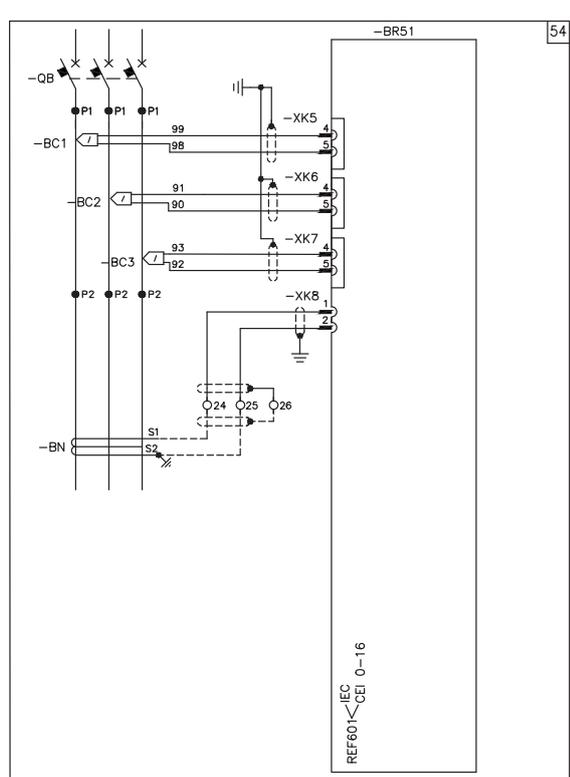
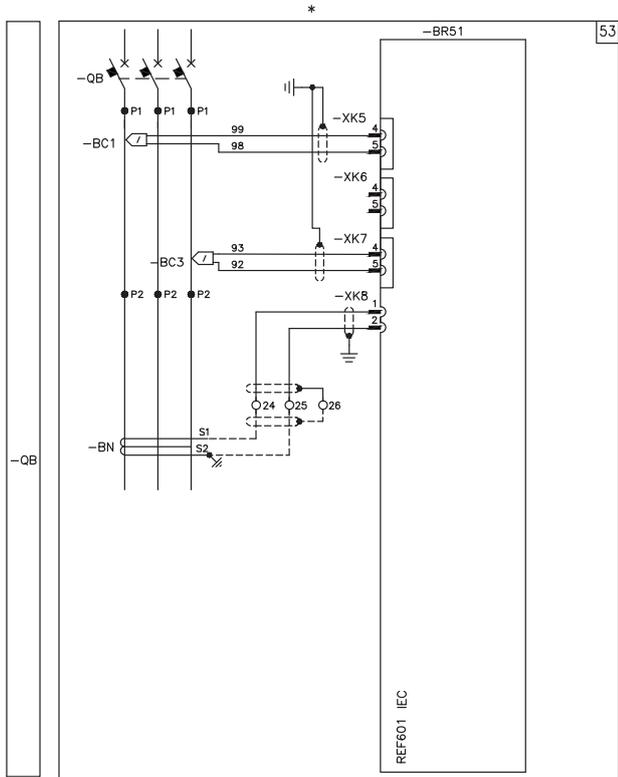
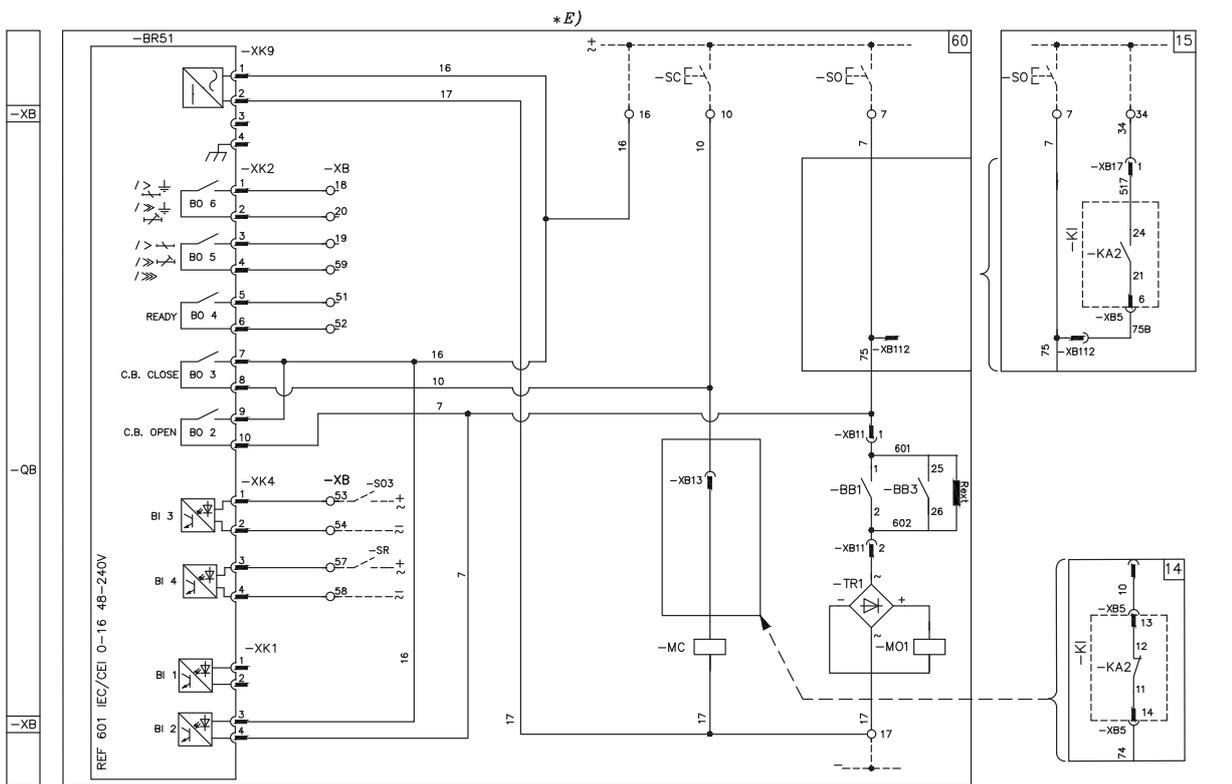
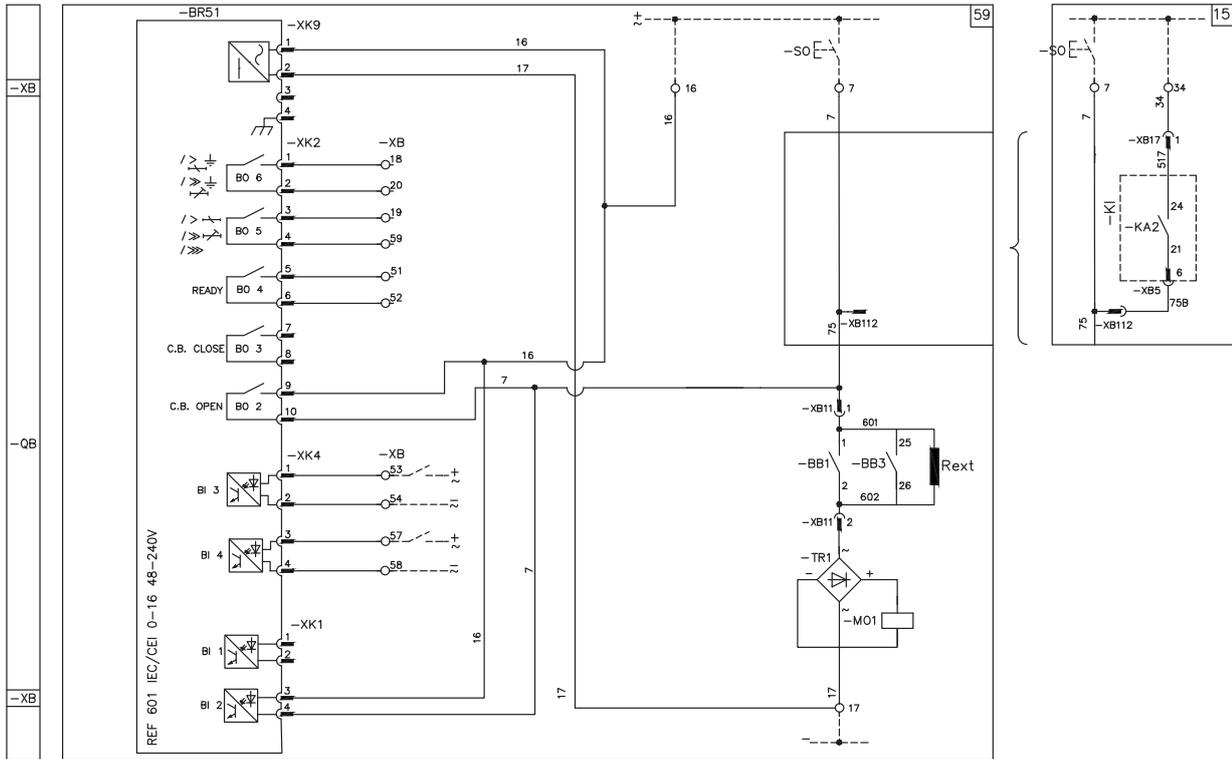




Diagram 1VCD400114



# 5. Electric circuit diagram

## Diagram 1VCD400114

### Operating state shown

The diagram illustrates the components in the following conditions:

- circuit-breaker open
- circuits de-energized
- closing springs discharged
- releases not tripped
- mechanical override of the undervoltage release de-activated.
- SF<sub>6</sub> gas pressure at nominal duty value (380 kPa absolute)

### Key

- = Figure number of the diagram
- \* = See note indicated by the letter
- BB1,...-BB3 = Auxiliary contacts of the circuit-breaker
- BB5 = Contact for the undervoltage release energized/de-energized electrical signal
- BB6 = Contact for the undervoltage release de-energized electrical signal
- BC1,...-BC3 = Current sensors located on phases L1-L2-L3 for measuring the current in microprocessor releases REF601 or REF601 / CEI 0-16
- BM = Device for monitoring the continuity of the opening release winding (see note E)
- BN = Homopolar current transformer outside the circuit-breaker, with connections at the customer's charge. For microprocessor release REF601 or for REF601 / CEI 0-16
- BP = Pressure switch with two tripping thresholds:
  - intervention for low gas pressure  
Contact 11-12-14 switches in relation to the position shown in the diagram when the gas pressure drops from 380 kPa absolute to a value below 310 kPa absolute. If the rated pressure value returns, this same contact switches again when, beginning with a value less than 310 kPa absolute, the value of 340 kPa absolute is reached
  - intervention for insufficient gas pressure  
Contact 21-22 switches when the gas pressure drops from 380 kPa absolute to a value below 280 kPa absolute. If the rated pressure value returns, this same contact switches again when, beginning with a lower value than 280 kPa absolute, the value of 310 kPa absolute is reached
- BR51 = Type REF601 overcurrent microprocessor-based release (in accordance with IEC 60255-3) with the following protection functions:
  - against overload with definite, inverse, very inverse or extremely inverse long tripping time
  - against short-circuits with definite short tripping time
  - against short-circuits with instantaneous tripping time
  - against earth faults with definite short tripping time
  - against earth fault short-circuits with instantaneous tripping time
- BS1 = Limit contacts of the spring loading motor
- BS2 = Springs loaded or discharged signalling contact
- BI 4 = Digital input for Reset (for microprocessor releases REF601 - REF601 / CEI 0-16)
- BI 3 = Digital input for Ext. Trip (for microprocessor releases REF601 - REF601 / CEI 0-16)
- BO 5 = Digital output for the contact that signals relay tripped owing to overcurrent (I> or I>> or I>>>) (for microprocessor releases REF601 - REF601 / CEI 0-16)
- BO 6 = Digital output for the contact that signals relay tripped owing to homopolar overcurrent (Io> or Io>>) (for microprocessor releases REF601 - REF601 / CEI 0-16)
- BO 4 = Digital output for the contact that signals monitoring and actuating circuits ready (for microprocessor releases REF601 - REF601 / CEI 0-16). The following conditions are verified:
  - availability of actuation power -MU
  - microprocessor functioning
  - auxiliary power present
- BO 1 = Digital output for the release contact by means of undervoltage release -MU (for microprocessor-based release REF601 / CEI 0-16)
- BO 3 = Digital output for circuit-breaker closing (200 ms time setting)
- BO 2 = Digital output for circuit-breaker opening (200 ms time setting)
- FB1 = Thermal magnetic circuit-breaker for spring loading motor protection
- KI = Integrated circuit for gas pressure control, including:
  - PG = Green led for signalling normal gas pressure

-PR	= Red led for signalling insufficient gas pressure		
-PY	= Yellow led for signalling low gas pressure		
-KA1	= Auxiliary relay for duplicating the contacts of pressure switch -BP, with tripping for low gas pressure		
-KA2	= Auxiliary relay for duplicating the contacts of pressure switch -BP, with tripping for insufficient gas pressure		
-XB5	= Connector		
-MC	= Shunt closing release		
-MO1	= First shunt opening release (see note E)		
-MO2	= Second shunt opening release (see note E)		
-MS	= Motor for loading the closing springs (see note C)		
-MU	= Undervoltage release, instantaneous or with time-lag device (see note B)		
-QB	= Main circuit-breaker		
-SC	= Circuit-breaker closing push-button or contact		
-SO	= Circuit-breaker opening pushbutton or contact		
-SO3	= Contact for opening the circuit-breaker by means of relay REF601 - REF601 / CEI 0-16		
-SR	= Reset button (resets the protection tripping signals)		
-TR1,-TR2	= Rectifiers for releases -MO1 and -MO2		
-VF	= Filter (only available for 220 VDC power supply voltage)		
-XB	= Delivery terminal box of the circuit-breaker circuits		
-XB2 to -XB22	= Connectors of the applications		
-XK1	= Binary impulses: – BI 1, terminals 1-2 = configurable – BI 2, terminals 3-4 = TCS		
-XK2	= Output connector: – BO 6, terminals 1-2: earth fault – BO 5, terminals 3-4: phase overcurrent – BO 4, terminals 5-6: unit ready – BO 3, terminals 7-8: circuit-breaker closing (200 ms time setting) – BO 2, terminals 9-10: circuit-breaker opening (200 ms time setting)		
-XK4	= Input connector: – BI 3, terminals 1-2: opening by remote control – BI 4, terminals 3-4: signalling reset		
-XK5	= Connector of current sensor -BC1		
-XK6	= Connector of current sensor -BC2		
-XK7	= Connector of current sensor -BC3		
-XK8	= Connector of homopolar current sensor -BN		
-XK9	= Power supply connector of relays REF601 or REF601 / CEI 0-16		
-XK10	= Connector of shunt opening release -MU (only for REF601 / CEI 0-16)		
		<b>Description of the figures</b>	
		Fig. 1	= Circuit of the motor for loading the closing springs (see note C).
		Fig. 5	= Undervoltage release, instantaneous or with time-lag device (see note B) .
		Fig. 9	= Circuit of second shunt opening release with option for continuous monitoring of the winding (see notes E - H).
		Fig. 11	= Gas pressure monitoring circuit. Includes: – contacts for remote signalling of normal, low and insufficient gas pressure. Consult the key for the tripping values of pressure switch -BP.
		Fig. 14	= Integrated gas pressure monitoring circuit. Includes: – 3 leds for remote signalling of normal, low and insufficient gas pressure. – contacts for remote signalling of normal, low and insufficient gas pressure. – circuit-breaker closing locked by means of an auxiliary contact of relay -KA2 if the gas pressure is insufficient. Choose fig. 15 to achieve automatic opening of the circuit-breaker in the case of insufficient gas pressure. Provide the same power supply as the circuit of the first shunt opening release (-MO1). Consult the key for the tripping values of pressure switch -BP.
		Fig. 15	= Circuit for automatic circuit-breaker opening in the case of insufficient gas pressure (only available if fig. 14 is used).
		Fig. 20	= Contact for electrical signalling of undervoltage release de-energized.
		Fig. 21	= Thermal magnetic circuit-breaker for spring loading motor protection
		Fig. 22	= Contact for electrical signalling of springs loaded.
		Fig. 23	= Contact for electrical signalling of springs discharged.
		Fig. 24	= Contact for electrical signalling of undervoltage release energized (see note B).
		Fig. 25	= Contact for electrical signalling of undervoltage release de-energized (see note B).
		Fig. 26	= Contact for electrical signalling of motor protection circuit-breaker closed.
		Fig. 27	= Contact for electrical signalling of motor protection circuit-breaker open.
		Fig. 31	= Available auxiliary contacts of the circuit-breaker (see note H).

# 5. Electric circuit diagram

## Diagram 1VCD400114

- Fig. 33 = Available auxiliary contacts of the circuit-breaker (see note H).
- Fig. 50 = Microprocessor release REF601-IEC and REF601-CEI0-16.
- Fig. 51 = Current circuits of microprocessor release REF601-IEC with two current sensors (can only be used with isolated neutral networks and earth fault current protection not activated).
- Fig. 52 = Current circuits of microprocessor release REF601-IEC with three current sensors (can only be used with isolated neutral networks and earth fault current protection not activated).
- Fig. 53 = Current circuits of microprocessor release REF601-IEC with earth fault protection, powered by two current sensors and by a homopolar current sensor.
- Fig. 54 = Current circuits of microprocessor release REF601-IEC and REF601-CEI 0-16 with earth fault protection, powered by three current sensors and by a homopolar current sensor.
- Fig. 55 = Local opening circuit (-MO1) by means of REF601-IEC or REF601-CEI 0-16 (see notes E - L). 24-30 V
- Fig. 56 = Local opening/closing circuits (-MO1, -MC) by means of REF601-IEC or REF601-CEI 0-16 (see notes E - L). 24-30 V
- Fig. 57 = Local opening circuit (-MU) by means of REF601-CEI 0-16).
- Fig. 59 = Local opening circuit (-MO1) by means of REF601-IEC or REF601-CEI 0-16 (see notes E - L). 48-240 V
- Fig. 60 = Local opening/closing circuits (-MO1, -MC) by means of REF601-IEC or REF601-CEI 0-16 (see notes E - L). 48-240 V
- B) The undervoltage release can be supplied for powering with voltage branching from the supply side of the circuit-breaker or from an independent source. Use of both the instantaneous undervoltage release and the one with electronic time-lag device (outside the circuit-breaker) is allowed. **The electronic time-delay is incompatible with fig. 57.** The circuit-breaker can only close when the release is energized (the closing lock is obtained mechanically). The contact shown in fig. 24 or the one in fig. 25 (signalling is persistent) are available on request. If there is the same power supply for the closing and undervoltage releases and the circuit-breaker must close automatically when the auxiliary voltage returns, there must be a 50 ms delay between the undervoltage release's enabling instant and energizing of the closing release. This can be achieved by means of a circuit outside the circuit-breaker comprising a permanent closing contact, the contact indicated in fig. 24 and a time-delay relay.
- NOTE.** When overvoltage release REF601/CEI 0-16 is required, the undervoltage release is supplied as part of the standard equipment and is only the instantaneous type (Fig. 57).
- C) Check the power available in the auxiliary circuit to find out whether several motors for loading the closing springs can operate at the same time. To prevent excessive power draw, the springs must be loaded by hand before auxiliary circuit is powered.
- E) The circuit for monitoring the continuity of the opening release winding must only be used for that purpose. With a power supply of less than 240 V, connect the "Control Coil Continuity" device or a relay or signalling lamp which absorbs a current of not more than 20 mA. With a power supply of 240 V or more, connect a relay or signalling lamp which absorbs a current of not more than 10 mA. Other uses compromise the soundness of the release.
- F) Circuit-breaker -FB1 of fig. 21 must always be installed if the spring loading motor is powered at 24 V.d.c. If opening is caused by a fault in the motor, spring loading must always be completed with the relative handle before proceeding with the manual reset.
- H) When fig. 9 is required, the contact to terminals 9-10 of pack -BB1 and the contact to terminals 29-30 of pack BB3 are not available for figs. 31-33.
- L) Release by means of -MU, only obligatory for REF601 / CEI 0-16. The power supply voltage -MU, -MO1, -MC (if applicable) must be the same and within the powering range of protection REF601.
- M) Only for relay REF601-IEC.

## Incompatibility

The circuits indicated in the following figures cannot be supplied at the same time in the same circuit-breaker:

<b>5-57</b>	<b>20-57</b>	<b>26-27</b>	<b>51-52-53-54</b>
<b>11-14</b>	<b>22-23</b>	<b>31-33</b>	<b>57-51-52-53</b>
<b>11-15</b>	<b>24-25</b>	<b>55-56-59-60</b>	

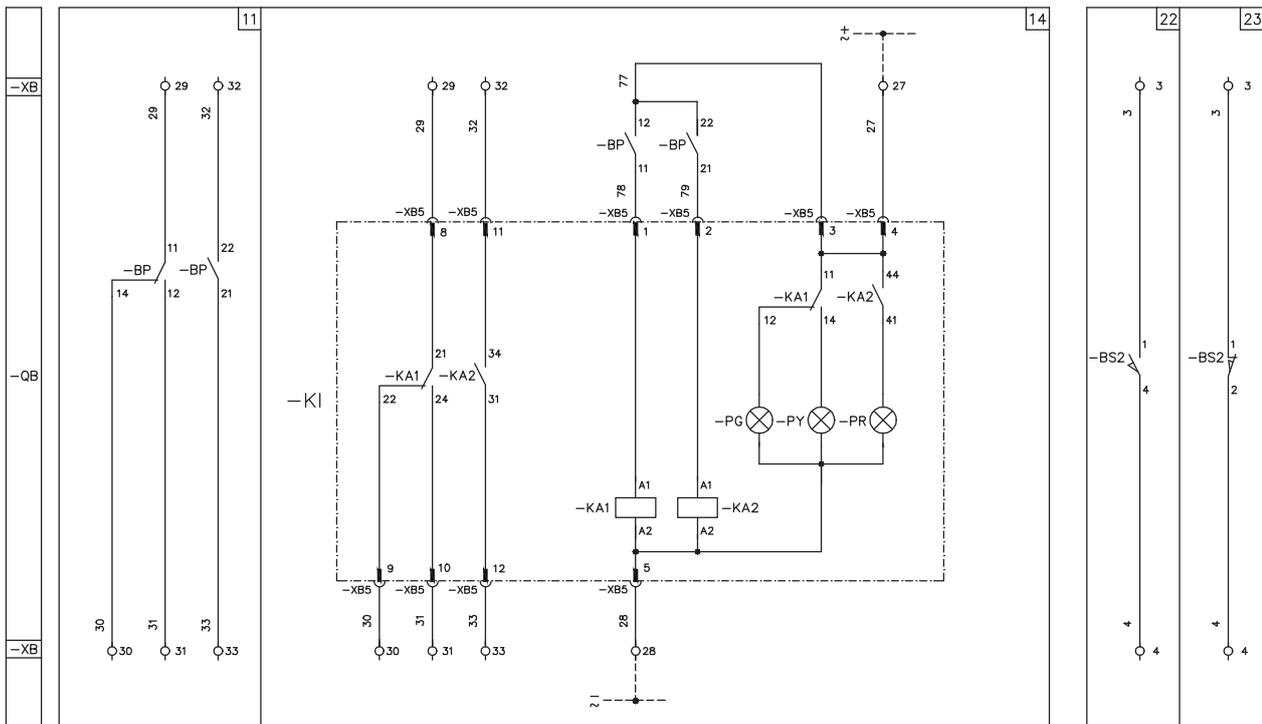
## Notes

- A) The circuit-breaker comes solely equipped with the specific applications in the order confirmation. Consult the catalogue of the device for instructions about how to make out the order.



# 5. Electric circuit diagram

Diagram 1VCD400119



\*B)

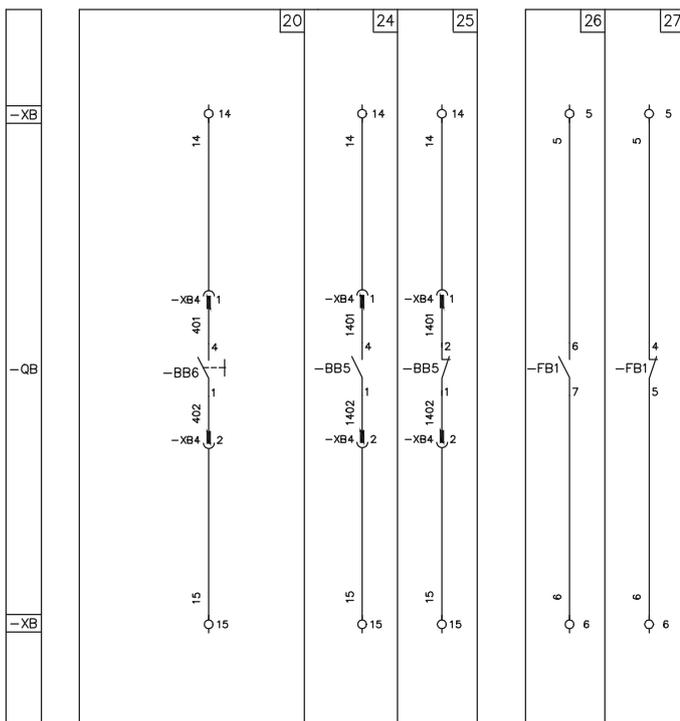


Diagram 1VCD400119

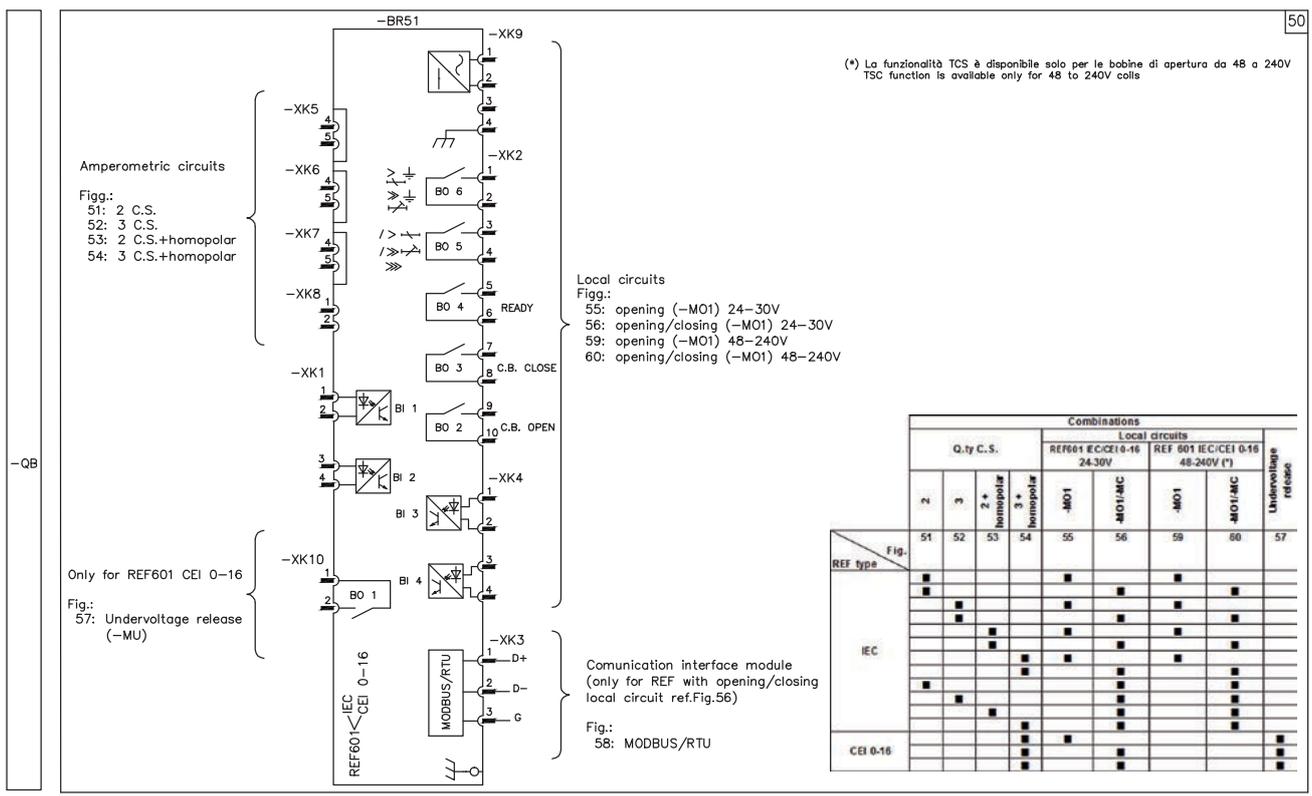
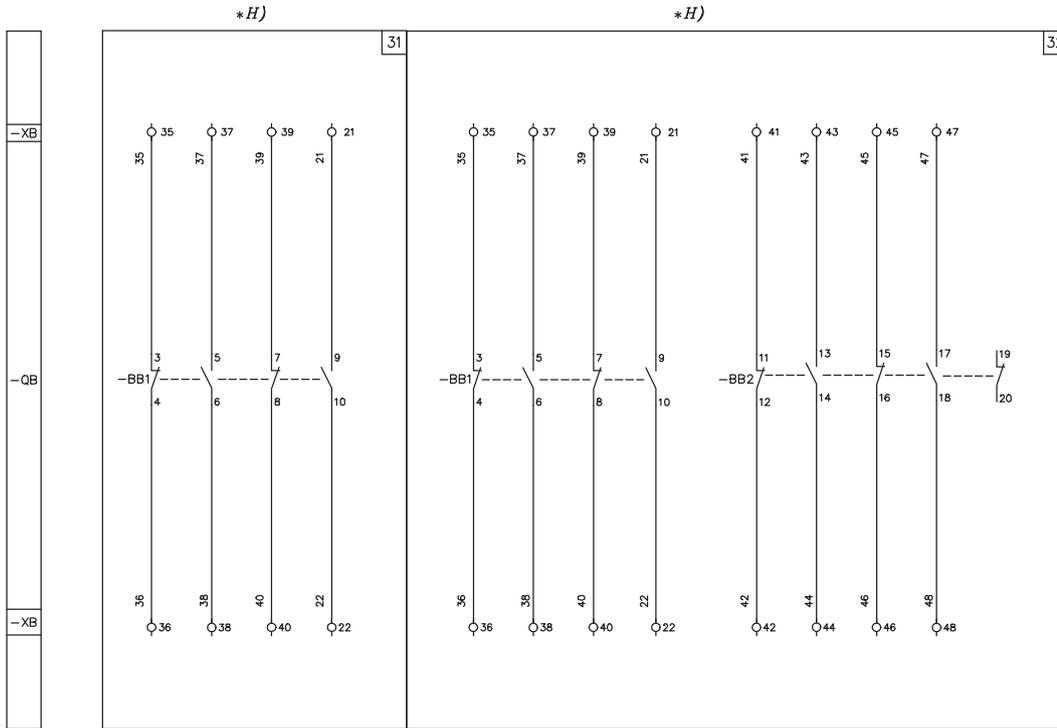
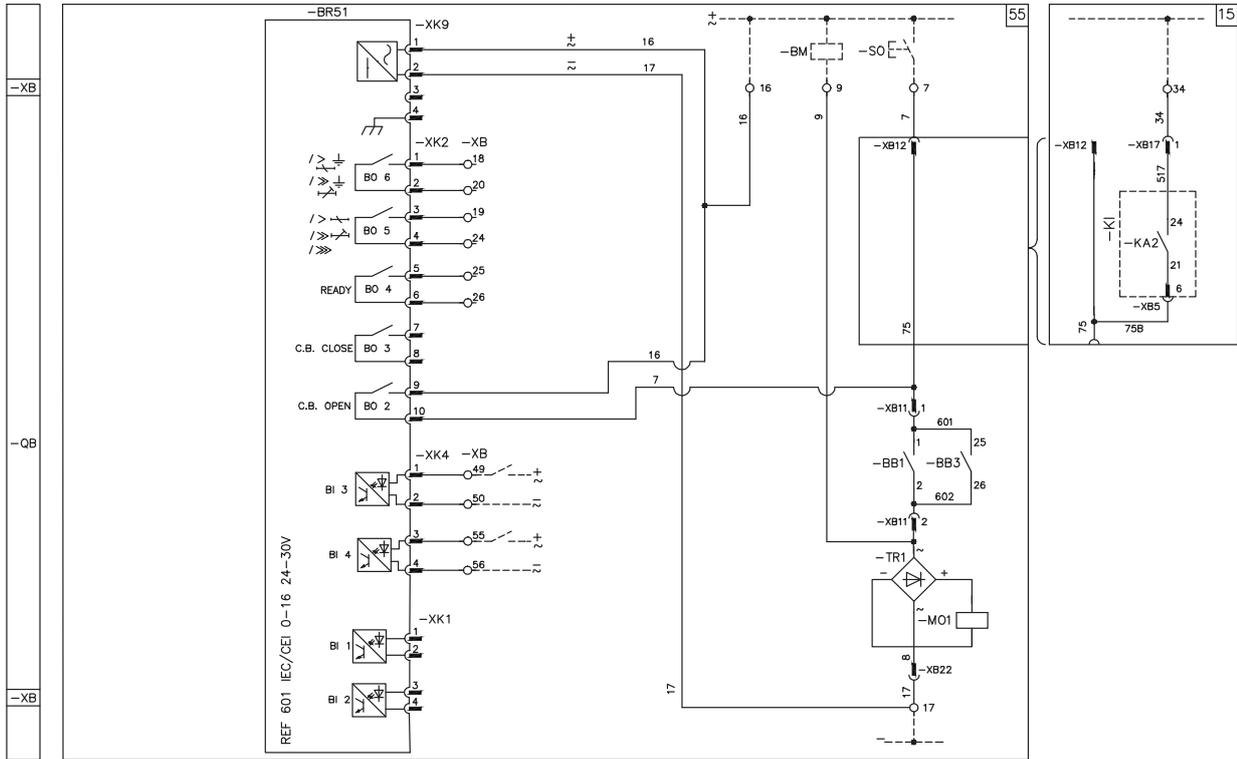


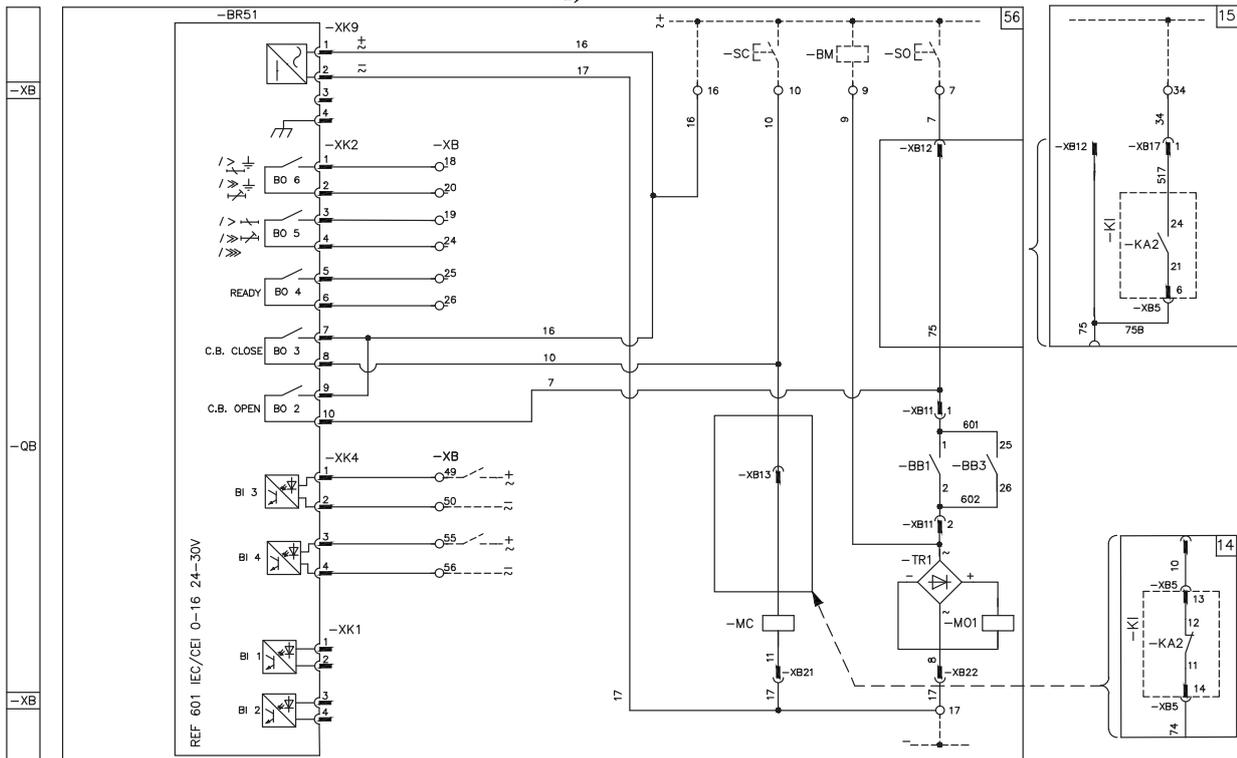


Diagram 1VCD400119

\*E)



\*E)







# 5. Electric circuit diagram

## Diagram 1VCD400119

### Operating state shown

The diagram illustrates the components in the following conditions:

- circuit-breaker open
- circuits de-energized
- closing springs discharged
- releases not tripped
- mechanical override of the undervoltage release de-activated.
- SF<sub>6</sub> gas pressure at nominal duty value (380 kPa absolute)

### Key

- = Figure number of the diagram
- \* = See note indicated by the letter
- BB1,...-BB3 = Auxiliary contacts of the circuit-breaker
- BB5 = Contact for the undervoltage release energized/de-energized electrical signal
- BB6 = Contact for the undervoltage release de-energized electrical signal
- BC1,...-BC3 = Current sensors located on phases L1-L2-L3 for measuring the current in microprocessor releases REF601 or REF601/ CEI 0-16
- BM = Device for monitoring the continuity of the opening release winding (see note E)
- BN = Homopolar current transformer outside the circuit-breaker, with connections at the customer's charge. For microprocessor release REF601 or for REF601 / CEI 0-16
- BP = Pressure switch with two tripping thresholds:
  - intervention for low gas pressure  
Contact 11-12-14 switches in relation to the position shown in the diagram when the gas pressure drops from 380 kPa absolute to a value below 310 kPa absolute. If the rated pressure value returns, this same contact switches again when, beginning with a value less than 310 kPa absolute, the value of 340 kPa absolute is reached
  - intervention for insufficient gas pressure  
Contact 21-22 switches when the gas pressure drops from 380 kPa absolute to a value below 280 kPa absolute. If the rated pressure value returns, this same contact switches again when, beginning with a lower value than 280 kPa absolute, the value of 310 kPa absolute is reached
- BR51 = Type REF601 overcurrent microprocessor-based release (in accordance with IEC 60255-3) with the following protection functions:
  - against overload with definite, inverse, very inverse or extremely inverse long tripping time
  - against short-circuits with definite short tripping time
  - against short-circuits with instantaneous tripping time
  - against earth faults with definite short tripping time
  - against earth fault short-circuits with instantaneous tripping time
- BR51 = Type REF601 / CEI 0-16 (in accordance with CEI 0-16) overcurrent microprocessor-based release with the following protection functions:
  - against overload with definite time
  - against short-circuits with definite time
  - against earth faults with definite time
  - against earth fault short-circuits with instantaneous tripping time
- BS1 = Limit contacts of the spring loading motor
- BS2 = Springs loaded or discharged signalling contact
- BI 4 = Digital input for Reset (for microprocessor releases REF601 - REF601 / CEI 0-16)
- BI 3 = Digital input for Ext. Trip (for microprocessor releases REF601 - REF601 / CEI 0-16)
- BO 5 = Digital output for the contact that signals relay tripped owing to overcurrent (I> or I>> or I>>>) (for microprocessor releases REF601 - REF601 / CEI 0-16)
- BO 6 = Digital output for the contact that signals relay tripped owing to homopolar overcurrent (Io> or Io>>) (for microprocessor releases REF601 - REF601 / CEI 0-16)
- BO 4 = Digital output for the contact that signals monitoring and actuating circuits ready (for microprocessor releases REF601 - REF601 / CEI 0-16). The following conditions are verified:
  - availability of actuation power -MU
  - microprocessor functioning
  - auxiliary power present
- BO 1 = Digital output for the release contact by means of undervoltage release -MU (for microprocessor-based release REF601 / CEI 0-16)
- BO 3 = Digital output for circuit-breaker closing (200 ms time setting)
- BO 2 = Digital output for circuit-breaker opening (200 ms time setting)
- FB1 = Thermal magnetic circuit-breaker for spring loading motor protection
- KI = Integrated circuit for gas pressure control, including:
  - PG = Green led for signalling normal gas pressure
  - PR = Red led for signalling insufficient gas pressure
  - PY = Yellow led for signalling low gas pressure

-KA1	= Auxiliary relay for duplicating the contacts of pressure switch -BP, with tripping for low gas pressure
-KA2	= Auxiliary relay for duplicating the contacts of pressure switch -BP, with tripping for insufficient gas pressure
-XB5	= Connector
-MC	= Shunt closing release
-MO1	= First shunt opening release (see note E)
-MO2	= Second shunt opening release (see note E)
-MO3	= Opening solenoid of microprocessor release PR521
-MS	= Motor for loading the closing springs (see note C)
-MU	= Undervoltage release, instantaneous or with time-lag device (see note B)
-QB	= Main circuit-breaker
-SC	= Circuit-breaker closing push-button or contact
-SO	= Circuit-breaker opening pushbutton or contact
-SO3	= Contact for opening the circuit-breaker by means of relay REF601 - REF601 / CEI 0-16
-SR	= Reset button (resets the protection tripping signals)
-TR1,-TR2	= Rectifiers for releases -MO1 and -MO2
-VF	= Filter (only available for 220 VDC power supply voltage)
-XB	= Delivery terminal box of the circuit-breaker circuits
-XB2 to -XB22	= Connectors of the applications
-XK1	= Binary impulses: <ul style="list-style-type: none"> <li>- BI 1, terminals 1-2 = configurable</li> <li>- BI 2, terminals 3-4 = TCS</li> </ul>
-XK2	= Output connector: <ul style="list-style-type: none"> <li>- BO 6, terminals 1-2: earth fault</li> <li>- BO 5, terminals 3-4: phase overcurrent</li> <li>- BO 4, terminals 5-6: unit ready</li> <li>- BO 3, terminals 7-8: circuit-breaker closing (200 ms time setting).</li> <li>- BO 2, terminals 9-10: circuit-breaker opening (200 ms time setting)</li> </ul>
-XK3	= Connector of the communication board of microprocessor release REF601
-XK4	= Input connector: <ul style="list-style-type: none"> <li>- BI 3, terminals 1-2: opening by remote control</li> <li>- BI 4, terminals 3-4: signalling reset</li> </ul>
-XK5	= Connector of current sensor -BC1
-XK6	= Connector of current sensor -BC2
-XK7	= Connector of current sensor -BC3
-XK8	= Connector of homopolar current sensor -BN
-XK9	= Power supply connector of relays REF601 or REF601 / CEI 0-16
-XK10	= Connector of shunt opening release -MU (only for REF601 / CEI 0-16)

## Description of the figures

Fig. 1	= Circuit of the motor for loading the closing springs (see note C).
Fig. 2	= Shunt closing release (anti-pumping is achieved mechanically).
Fig. 5	= Undervoltage release, instantaneous or with time-lag device (see note B) .
Fig. 7	= Circuit of second shunt opening release with option for continuous monitoring of the winding (see note E).
Fig. 9	= Circuit of second shunt opening release with option for continuous monitoring of the winding (see notes E - H).
Fig. 10	= Opening solenoid for microprocessor release PR521 .
Fig. 11	= Gas pressure monitoring circuit. Includes: <ul style="list-style-type: none"> <li>- contacts for remote signalling of normal, low and insufficient gas pressure.</li> </ul> Consult the key for the tripping values of pressure switch -BP.
Fig. 14	= Integrated gas pressure monitoring circuit. Includes: <ul style="list-style-type: none"> <li>- 3 leds for remote signalling of normal, low and insufficient gas pressure.</li> <li>- contacts for remote signalling of normal, low and insufficient gas pressure.</li> <li>- circuit-breaker closing locked by means of an auxiliary contact of relay -KA2 if the gas pressure is insufficient.</li> </ul> Choose fig. 15 or 16 to achieve, respectively, automatic opening or locking of circuit-breaker opening in the case of insufficient gas pressure. Provide the same power supply as the circuit of the first shunt opening release (fig. 7). Consult the key for the tripping values of pressure switch -BP.
Fig. 15	= Circuit for automatic circuit-breaker opening in the case of insufficient gas pressure (only available if fig. 14 is used).
Fig. 20	= Contact for electrical signalling of undervoltage release de-energized.
Fig. 21	= Thermal magnetic circuit-breaker for spring loading motor protection
Fig. 22	= Contact for electrical signalling of springs loaded.
Fig. 23	= Contact for electrical signalling of springs discharged.
Fig. 24	= Contact for electrical signalling of undervoltage release energized (see note B).
Fig. 25	= Contact for electrical signalling of undervoltage release de-energized (see note B).

# 5. Electric circuit diagram

## Diagram 1VCD400119

- Fig. 26 = Contact for electrical signalling of motor protection circuit-breaker closed.
- Fig. 27 = Contact for electrical signalling of motor protection circuit-breaker open.
- Fig. 31 = Available auxiliary contacts of the circuit-breaker (see note H).
- Fig. 32 = Available auxiliary contacts of the circuit-breaker (see note H).
- Fig. 50 = Microprocessor release REF601-IEC and REF601-CEI 0-16.
- Fig. 51 = Current circuits of microprocessor release REF601-IEC with two current sensors (can only be used with isolated neutral networks and earth fault current protection not activated).
- Fig. 52 = Current circuits of microprocessor release REF601-IEC with three current sensors (can only be used with isolated neutral networks and earth fault current protection not activated).
- Fig. 53 = Current circuits of microprocessor release REF601-IEC with earth fault protection, powered by two current sensors and by a homopolar current sensor.
- Fig. 54 = Current circuits of microprocessor release REF601-IEC and REF601-CEI 0-16 with earth fault protection, powered by three current sensors and by a homopolar current sensor.
- Fig. 55 = Local opening circuit (-MO1) by means of REF601-IEC or REF601-CEI 0-16 (see notes E - L). 24-30 V
- Fig. 56 = Local opening/closing circuits (-MO1, -MC) by means of REF601-IEC or REF601-CEI 0-16 (see notes E - L). 24-30 V
- Fig. 57 = Local opening circuit (-MU) by means of REF601-CEI 0-16).
- Fig. 58 = Connector -XK3 for communication board (MODBUS/RTU) of microprocessor release REF601-IEC and REF601-CEI 0-16.
- Fig. 59 = Local opening circuit (-MO1) by means of REF601-IEC or REF601-CEI 0-16 (see notes E - L). 48-240 V
- Fig. 60 = Local opening/closing circuits (-MO1, -MC) by means of REF601-IEC or REF601-CEI 0-16 (see notes E - L). 48-240 V

### Incompatibility

The circuits indicated in the following figures cannot be supplied at the same time in the same circuit-breaker:

<b>2-56</b>	<b>10-50-51-52-53-54-55-56-57-58</b>
<b>5-16</b>	<b>11-14</b>
<b>5-57</b>	<b>11-15-16</b>
<b>7-55-56</b>	<b>15-16</b>
<b>9-16</b>	<b>16-55-56</b>
<b>9-10</b>	<b>31-32</b>
<b>20-24-25</b>	<b>51-52-53-54</b>
<b>20-57</b>	<b>55-56-59-60</b>
<b>22-23</b>	<b>57-51-52-53</b>
<b>26-27</b>	<b>58-55</b>

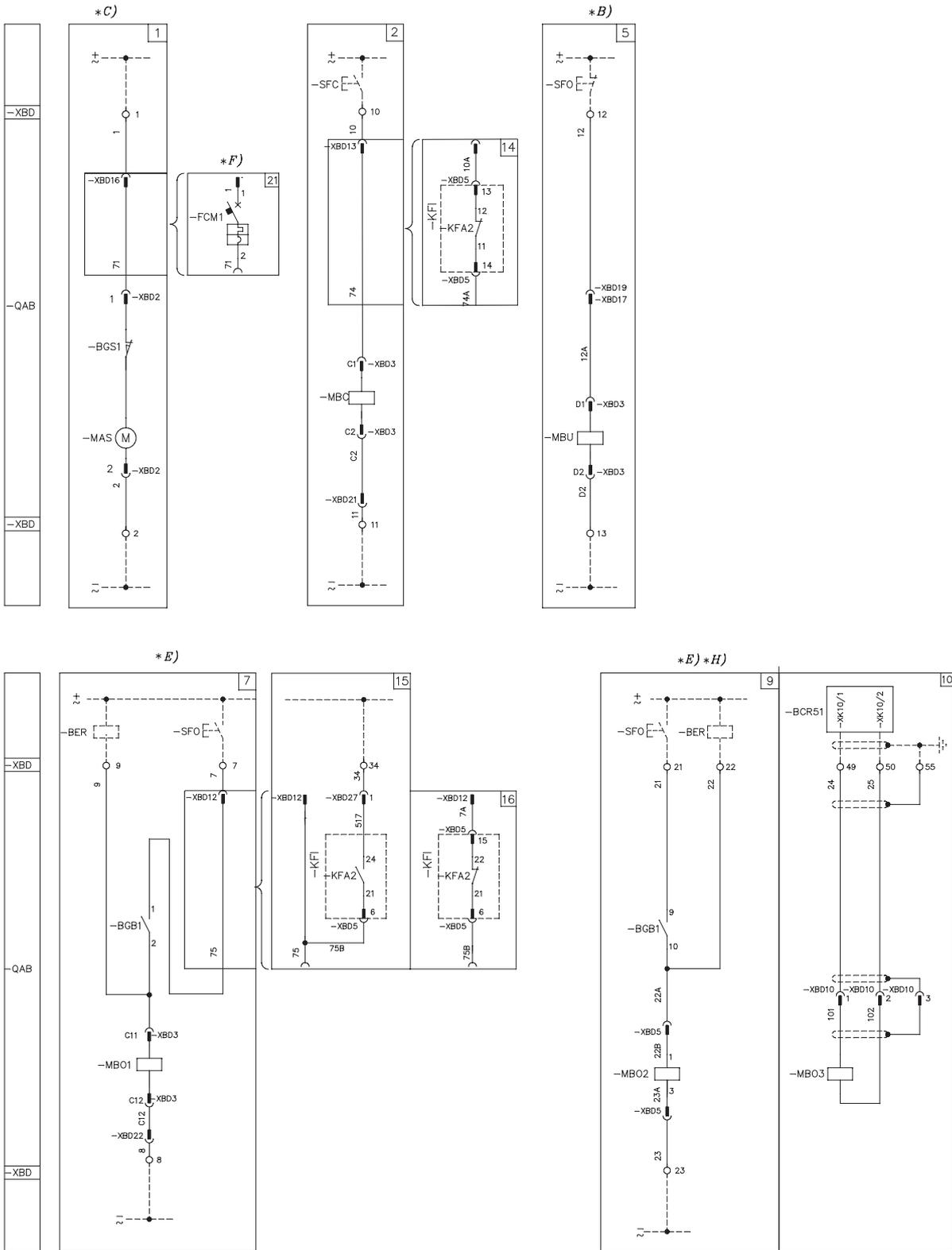
### Notes

- A) The circuit-breaker comes solely equipped with the specific applications in the order confirmation. Consult the catalogue of the device for instructions about how to make out the order.
- B) The undervoltage release can be supplied for powering with voltage branching from the supply side of the circuit-breaker or from an independent source. Use of both the instantaneous undervoltage release and the one with electronic time-lag device (outside the circuit-breaker) is allowed. **The electronic time-delay is incompatible with fig. 57.** The circuit-breaker can only close when the release is energized (the closing lock is obtained mechanically). The contact shown in fig. 24 or the one in fig. 25 (signalling is persistent) are available on request. If there is the same power supply for the closing and undervoltage releases and the circuit-breaker must close automatically when the auxiliary voltage returns, there must be a 50 ms delay between the undervoltage release's enabling instant and energizing of the closing release. This can be achieved by means of a circuit outside the circuit-breaker comprising a permanent closing contact, the contact indicated in fig. 24 and a time-delay relay. **NOTE.** When overvoltage release REF601/CEI 0-16 is required, the undervoltage release is supplied as part of the standard equipment and is only the instantaneous type.
- C) Check the power available in the auxiliary circuit to find out whether several motors for loading the closing springs can operate at the same time. To prevent excessive power draw, the springs must be loaded by hand before auxiliary circuit is powered.

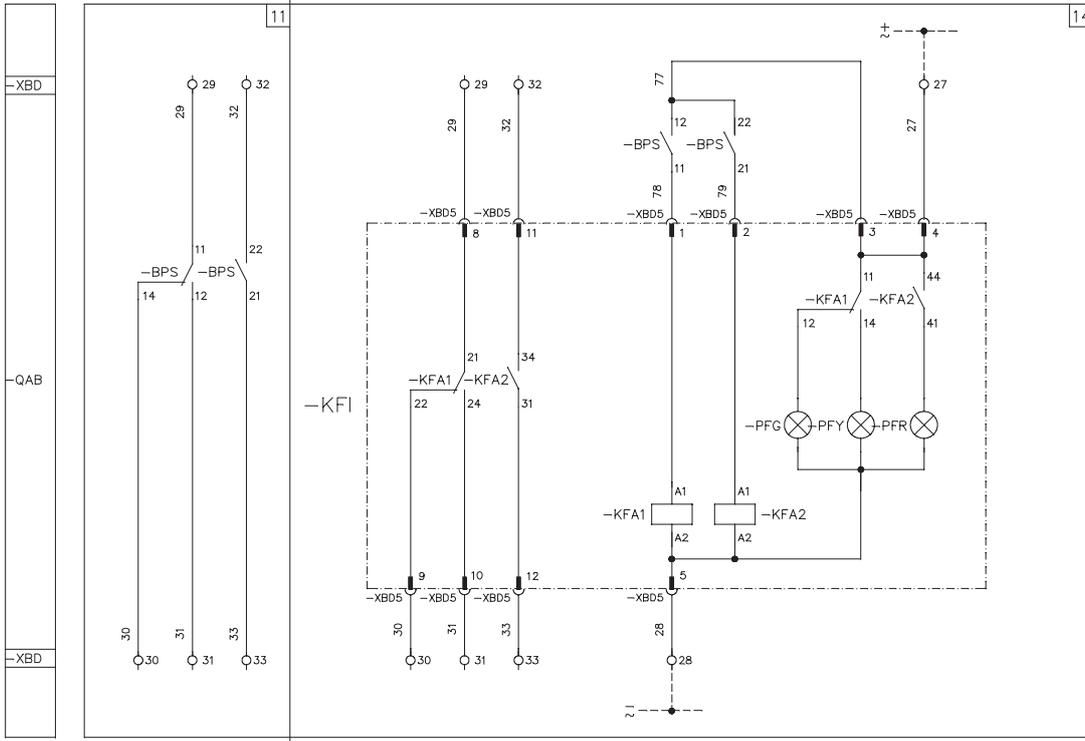
- E) The circuit for monitoring the continuity of the opening release winding must only be used for that purpose. With a power supply of less than 240 V, connect the "Control Coil Continuity" device or a relay or signalling lamp which absorbs a current of not more than 20 mA. With a power supply of 240 V or more, connect a relay or signalling lamp which absorbs a current of not more than 10 mA. Other uses compromise the soundness of the release.
- F) Circuit-breaker -FB1 of fig. 21 must always be installed if the spring loading motor is powered at 24 V.d.c.
- If opening is caused by a fault in the motor, spring loading must always be completed with the relative handle before proceeding with the manual reset.
- H) When fig. 9 is required, the contact to terminals 9-10 of pack -BB1 is not available for figs. 31-32.
- L) Release by means of -MU, only obligatory for REF601 / CEI 0-16. The power supply voltage -MU, -MO1, -MC (if applicable) must be the same and within the powering range of protection REF601.
- M) Only for relay REF601-IEC.

# 5. Electric circuit diagram

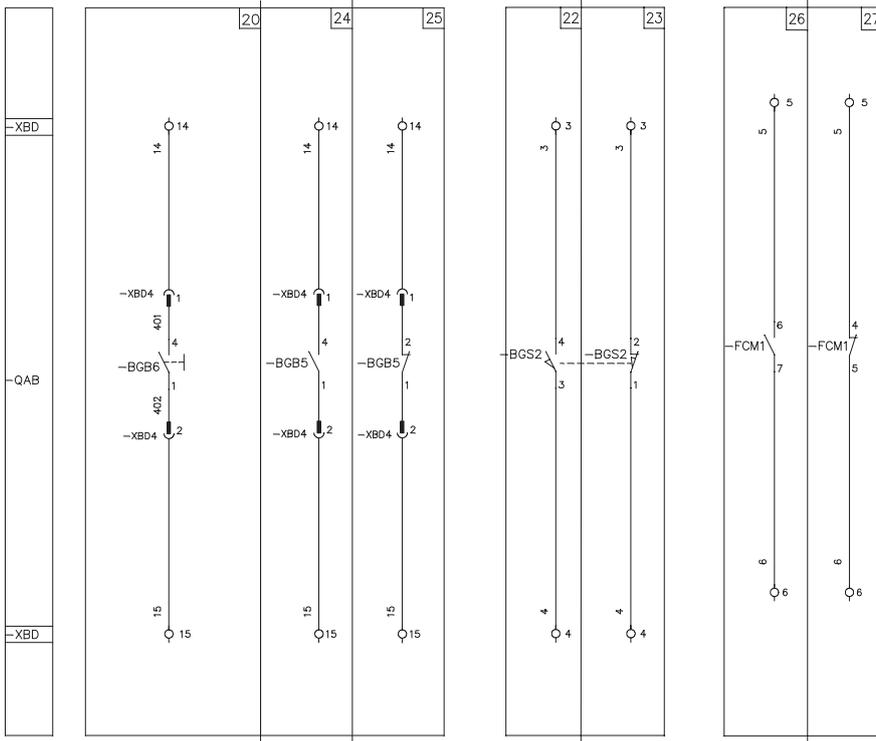
Diagram 1VCD400150



# Diagram 1VCD400150



\*B)



# 5. Electric circuit diagram

Diagram 1VCD400150

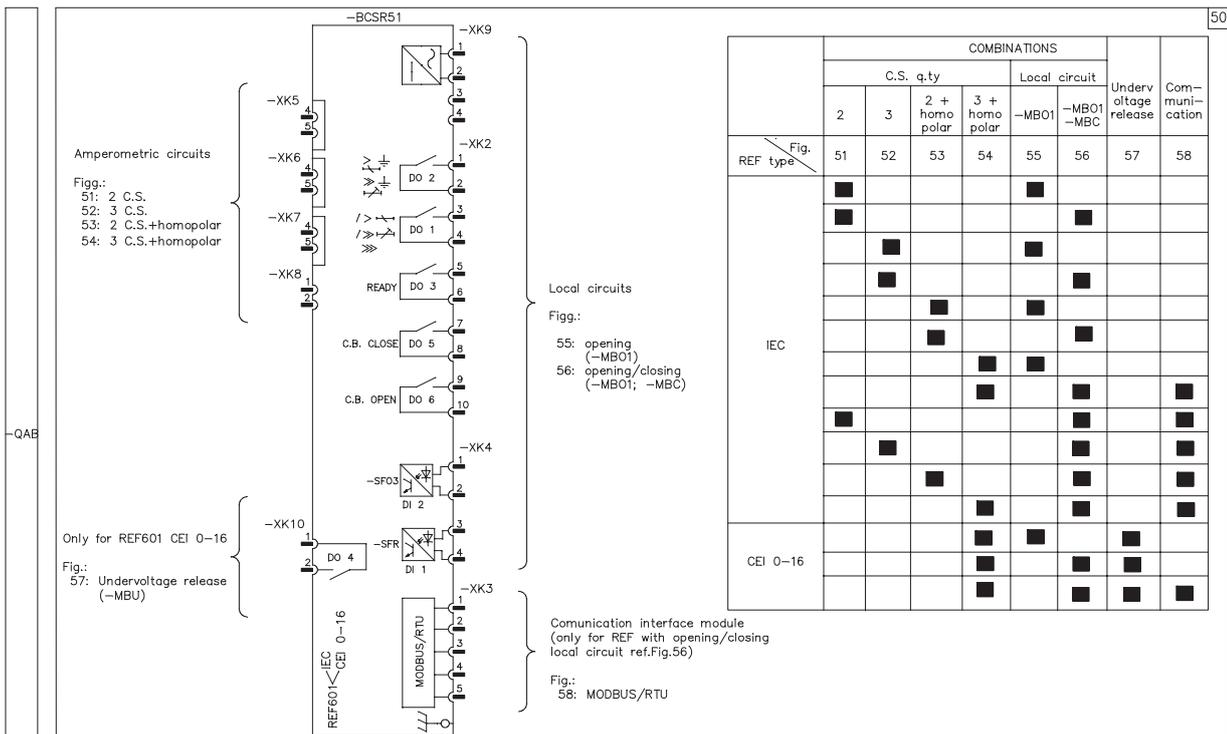
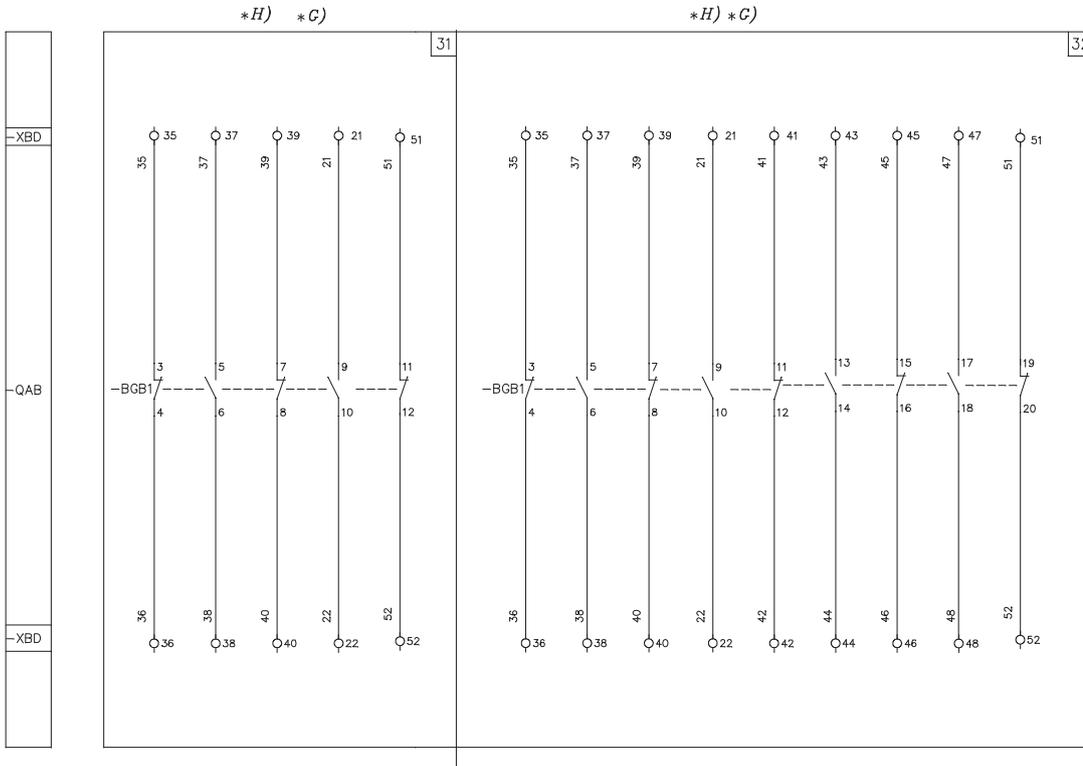
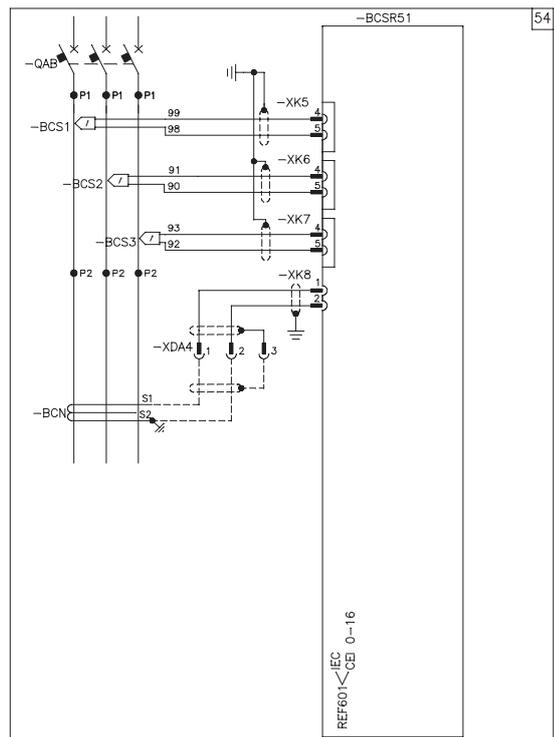
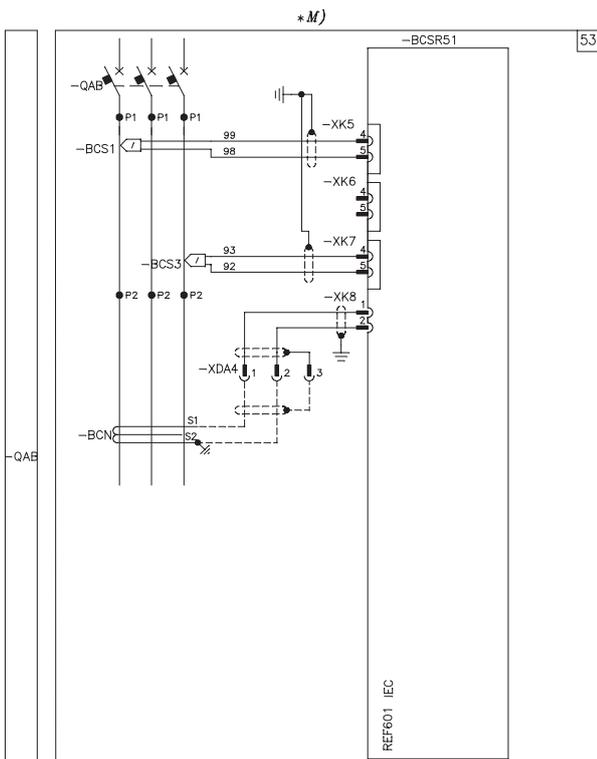
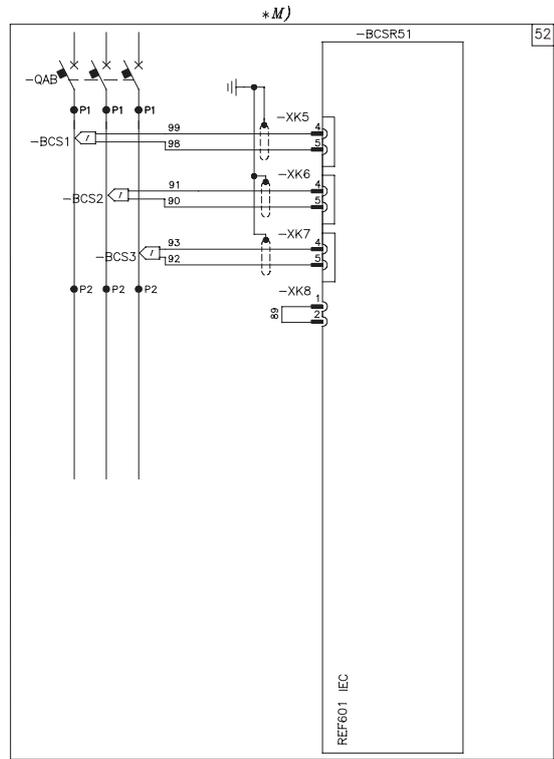
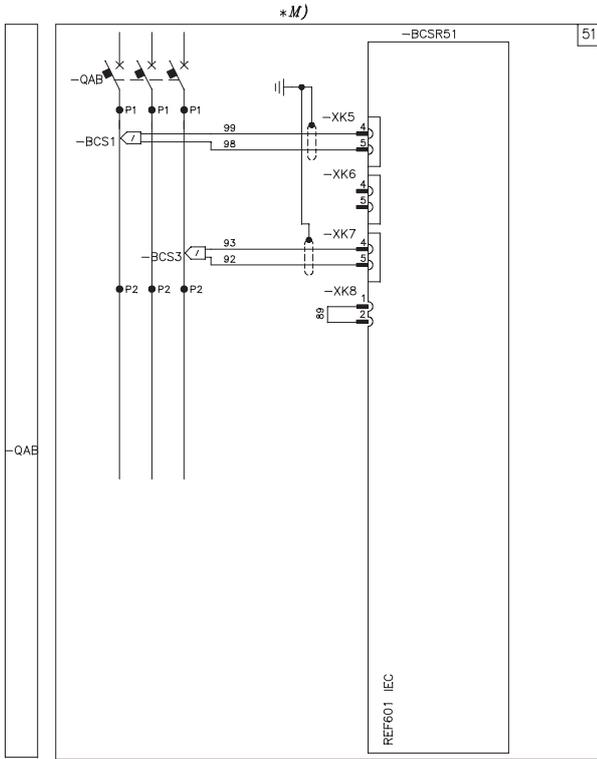


Diagram 1VCD400150



# 5. Electric circuit diagram

Diagram 1VCD400150

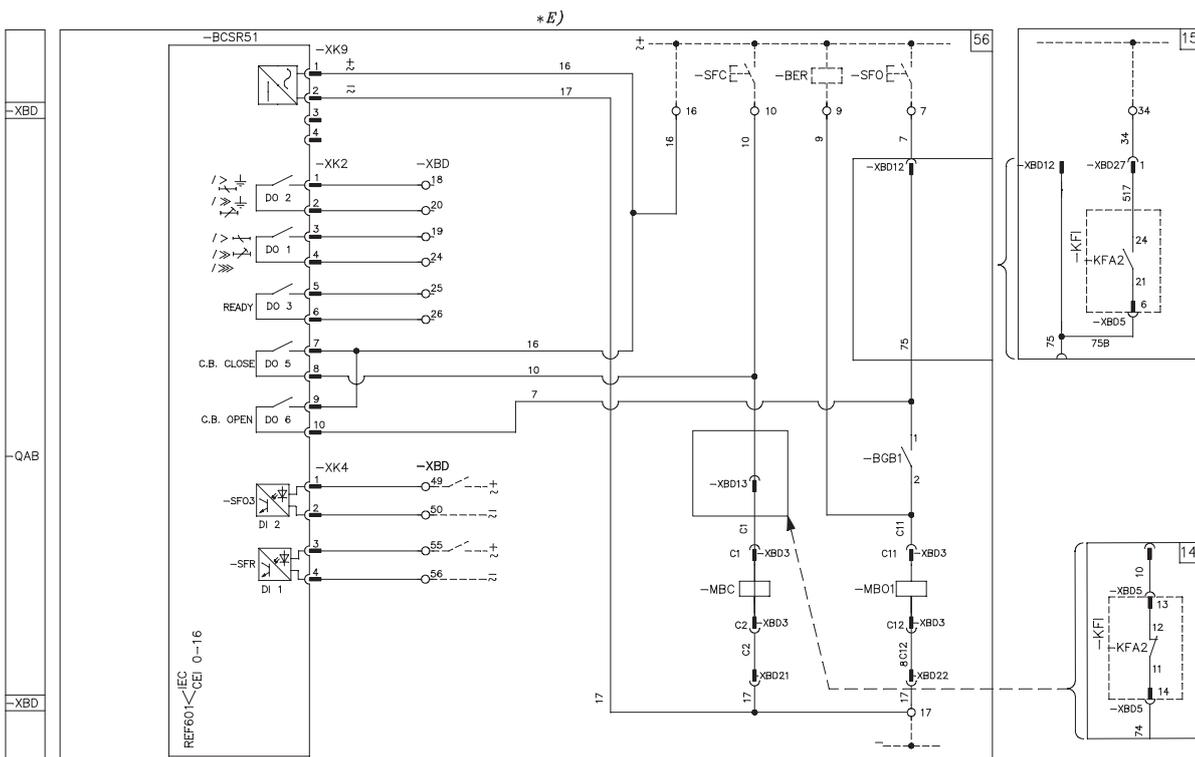
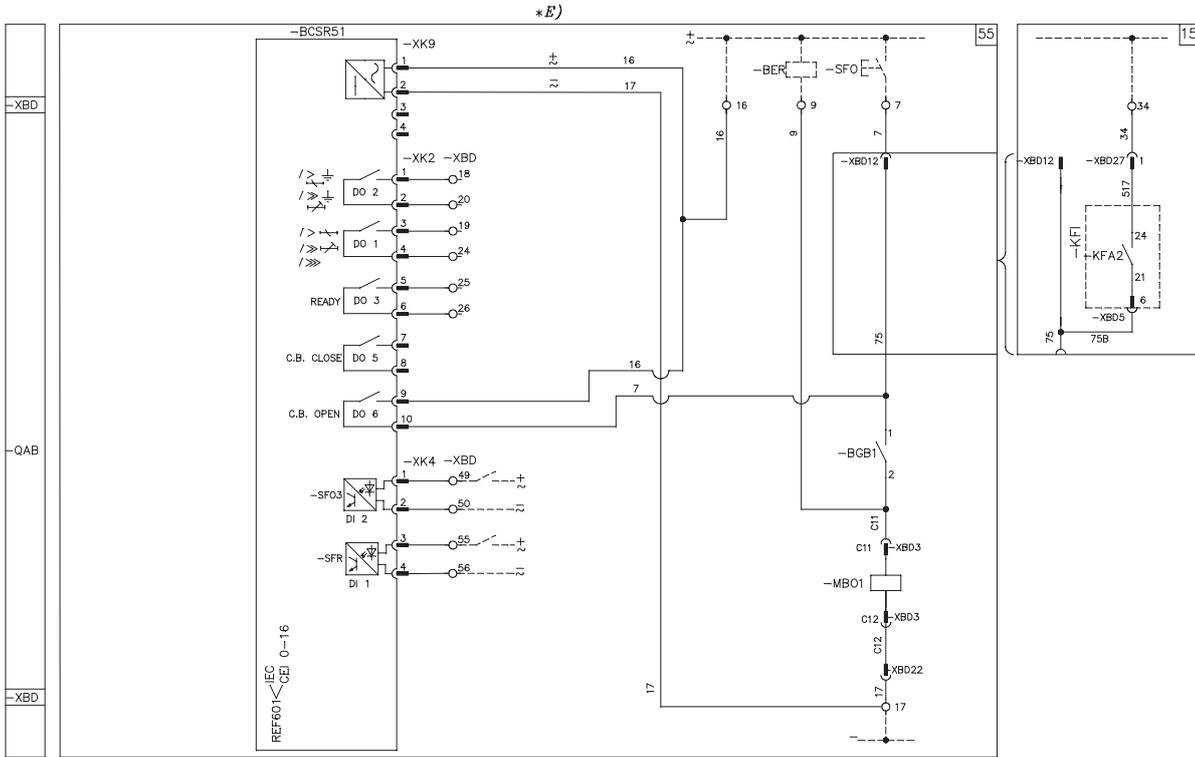
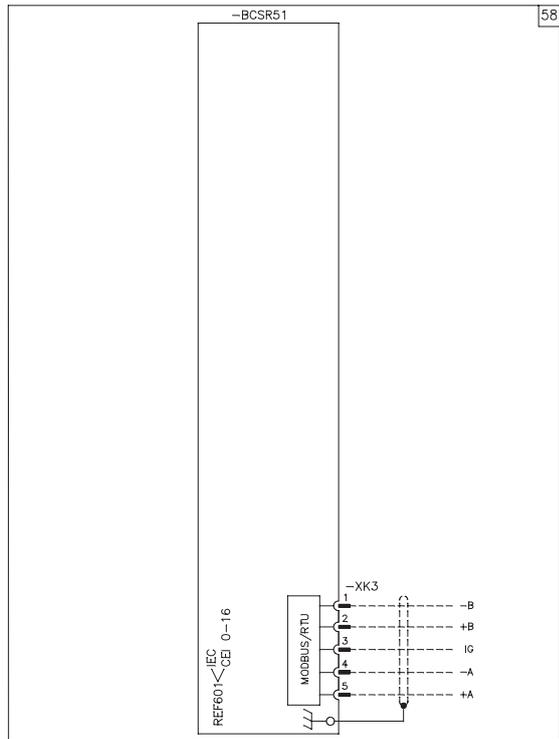
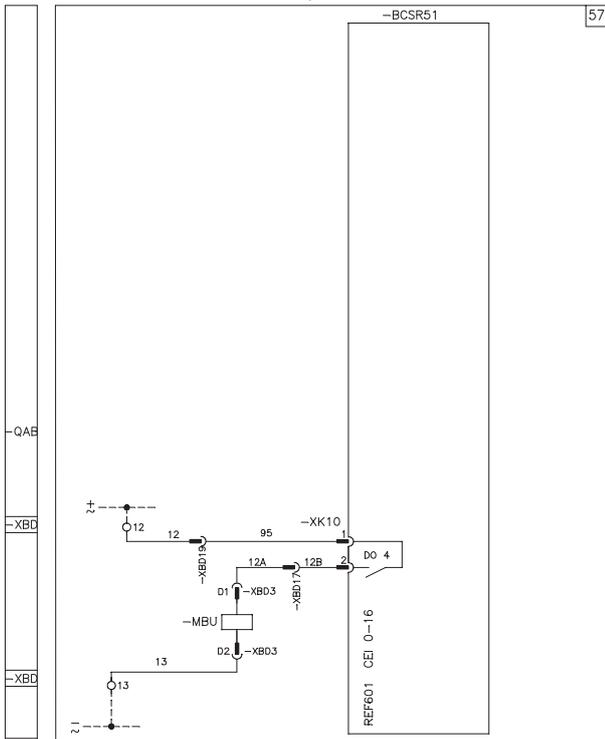


Diagram 1VCD400150

\*L)



# 5. Electric circuit diagram

## Diagram 1VCD400150

### Operating state shown

The diagram illustrates the components in the following conditions:

- circuit-breaker open
- circuits de-energized
- closing springs discharged
- releases not tripped
- mechanical override of the undervoltage release de-activated.
- SF<sub>6</sub> gas pressure at nominal duty value (380 kPa absolute)

### Key

- = Figure number of the diagram
- \* = See note indicated by the letter
- BGB1,...-BGB3 = Auxiliary contacts of the circuit-breaker
- BGB5 = Contact for under-voltage release energized/de-energized electrical signal
- BGB6 = Contact for the undervoltage release de-energized electrical signal
- BCS1,...-BCS3 = Current sensors located on phases L1-L2-L3 for measuring the current in microprocessor releases REF601 or REF601/ CEI 0-16
- BER = Device for monitoring the continuity of the opening release winding (see note E)
- BCN = Homopolar current transformer outside the circuit-breaker, with connections at the customer's charge. For microprocessor release REF601 or for REF601 / CEI 0-16
- BPS = Pressure switch with two tripping thresholds:
  - intervention for low gas pressure  
Contact 11-12-14 switches in relation to the position shown in the diagram when the gas pressure drops from 380 kPa absolute to a value below 310 kPa absolute. If the rated pressure value returns, this same contact switches again when, beginning with a value less than 310 kPa absolute, the value of 340 kPa absolute is reached
  - intervention for insufficient gas pressure  
Contact 21-22 switches when the gas pressure drops from 380 kPa absolute to a value below 280 kPa absolute. If the rated pressure value returns, this same contact switches again when, beginning with a value less than 280 kPa absolute, the value of 310 kPa absolute is reached
- BCSR51 = Type REF601 overcurrent microprocessor-based release (in accordance with IEC 60255-3) with the following protection functions:
  - against short-circuits with definite short tripping time
  - against short-circuits with instantaneous tripping time
  - against earth faults with definite short tripping time
  - against earth fault short-circuits with instantaneous tripping time
- BCSR51 = Type REF601 / CEI 0-16 (in accordance with CEI 0-16) overcurrent microprocessor-based release with the following protection functions:
  - against overload with definite time
  - against short-circuits with definite time
  - against earth faults with definite time
  - against earth fault short-circuits with instantaneous tripping time
- BGS1 = Limit contacts of the spring loading motor
- BGS2 = Springs loaded or relieved signalling contact
- DI 1 = Digital input for resetting signalling contacts DO 1, DO 2, DO 3 (for microprocessor releases REF601 - REF601 / CEI 0-16)
- DI 2 = Digital input for the opening contact -SFO3 (for microprocessor releases REF601-REF601 / CEI 0-16)
- DO 1 = Digital output for the contact that signals relay tripped owing to overcurrent (I> or I>> or I>>>) (for microprocessor releases REF601 - REF601 / CEI 0-16)
- DO 2 = Digital output for the contact that signals relay tripped owing to homopolar overcurrent (I<sub>o</sub>> or I<sub>o</sub>>>) (for microprocessor releases REF601 - REF601 / CEI 0-16)
- DO 3 = Digital output for the contact that signals monitoring and actuating circuits ready (for microprocessor releases REF601-REF601 / CEI 0-16).  
The following conditions are verified:
  - availability of actuation power -MBU
  - microprocessor functioning
  - auxiliary power present
- DO 4 = Digital output for the release contact by means of undervoltage release -MBU (for microprocessor-based release REF601 / CEI 0-16)
- DO 5 = Digital output for circuit-breaker closing (200 ms time setting)
- DO 6 = Digital output for circuit-breaker opening (200 ms time setting)
- FCM1 = Thermal magnetic circuit-breaker for spring loading motor protection

<p>-KFI = Integrated circuit for gas pressure control, including:</p> <ul style="list-style-type: none"> <li>-PFG = Green led for signalling normal gas pressure</li> <li>-PFR = Red led for signalling insufficient gas pressure</li> <li>-PFY = Yellow led for signalling low gas pressure</li> <li>-KFA1 = Auxiliary relay for duplicating the contacts of pressure switch -BP, with tripping for low gas pressure</li> <li>-KFA2 = Auxiliary relay for duplicating the contacts of pressure switch -BP, with tripping for insufficient gas pressure</li> <li>-XBD5 = Connector</li> </ul> <p>-MBC = Shunt closing release</p> <p>-MBO1 = First shunt opening release (see note E)</p> <p>-MBO2 = Second shunt opening release (see note E)</p> <p>-MBO3 = Opening solenoid of microprocessor release PR521</p> <p>-MAS = Motor for loading the closing springs (see note C)</p> <p>-MBU = Undervoltage release, instantaneous or with time-lag device (see note B)</p> <p>-QAB = Main circuit-breaker</p> <p>-SFC = Circuit-breaker closing push-button or contact</p> <p>-SFO = Circuit-breaker opening pushbutton or contact</p> <p>-SFO3 = Contact for opening the circuit-breaker by means of relay REF601 - REF601 / CEI 0-16</p> <p>-SFR = Reset button (resets the protection tripping signals)</p> <p>-TB1, -TB2 = Rectifiers for releases -MBO1 and -MBO2</p> <p>-VF = Filter (only available for 220 VDC power supply voltage)</p> <p>-XDA4 = Terminal box in switchgear, outside circuit-breaker (special terminals for current signal)</p> <p>-XBD = Delivery terminal box of the circuit-breaker circuits</p> <p>-XBD2 to -XBD27 = Connectors of the applications</p> <p>-XK2 = Output connector:</p> <ul style="list-style-type: none"> <li>- DO 1, terminals 1-2: earth fault</li> <li>- DO 2, terminals 3-4: phase overcurrent</li> <li>- DO 3, terminals 5-6: unit ready</li> <li>- DO 5, terminals 7-8: circuit-breaker closing (200 ms time setting)</li> <li>- DO 6, terminals 9-10: circuit-breaker opening (200 ms time setting)</li> </ul> <p>-XK3 = Connector of the communication board of microprocessor release REF601</p>	<p>-XK4 = Input connector:</p> <ul style="list-style-type: none"> <li>- DI 1, terminals 1-2: opening by remote control</li> <li>- DI 2, terminals 3-4: signalling reset</li> </ul> <p>-XK5 = Connector of current sensor -BCS1</p> <p>-XK6 = Connector of current sensor -BCS2</p> <p>-XK7 = Connector of current sensor -BCS3</p> <p>-XK8 = Connector of homopolar current sensor -BCN</p> <p>-XK9 = Power supply connector of relays REF601 or REF601 / CEI 0-16</p> <p>-XK10 = Connector of shunt opening release -MBU (only for REF601 / CEI 0-16)</p>
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### Description of the figures

<p>Fig. 1</p> <p>Fig. 2</p> <p>Fig. 5</p> <p>Fig. 7</p> <p>Fig. 9</p> <p>Fig. 10</p> <p>Fig. 11</p> <p>Fig. 14</p>	<p>= Circuit of the motor for loading the closing springs (see note C).</p> <p>= Shunt closing release (anti-pumping is achieved mechanically).</p> <p>= Undervoltage release, instantaneous or with time-lag device (see note B) .</p> <p>= Circuit of first opening release with option for continuous monitoring of the winding (see note E).</p> <p>= Circuit of second shunt opening release with option for continuous monitoring of the winding (see notes E - H).</p> <p>= Opening solenoid for microprocessor release PR521.</p> <p>= Gas pressure monitoring circuit. Includes:</p> <ul style="list-style-type: none"> <li>- contacts for remote signalling of normal, low and insufficient gas pressure.</li> </ul> <p>Consult the key for the tripping values of pressure switch -BPS.</p> <p>= Integrated gas pressure monitoring circuit. Includes:</p> <ul style="list-style-type: none"> <li>- 3 leds for remote signalling of normal, low and insufficient gas pressure.</li> <li>- contacts for remote signalling of normal, low and insufficient gas pressure.</li> <li>- circuit-breaker closing locked by means of an auxiliary contact of relay -KFA2 if the gas pressure is insufficient.</li> </ul> <p>Choose fig. 15 or 16 to achieve, respectively, automatic opening or locking of circuit-breaker opening in the case of insufficient gas pressure.</p> <p>Provide the same power supply as the circuit of the first shunt opening release (fig. 7).</p> <p>Consult the key for the tripping values of pressure switch -BPS.</p>
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# 5. Electric circuit diagram

## Diagram 1VCD400150

- Fig. 15 = Circuit for automatic circuit-breaker opening in the case of insufficient gas pressure (only available if fig. 14 is used).
- Fig. 16 = Circuit for locking circuit-breaker opening in the case of insufficient gas pressure (only available if fig. 14 is used).
- Fig. 20 = Contact for electrical signalling of undervoltage release de-energized.
- Fig. 21 = Thermal magnetic circuit-breaker for spring loading motor protection
- Fig. 22 = Contact for electrical signalling of springs loaded.
- Fig. 23 = Contact for electrical signalling of springs discharged.
- Fig. 24 = Contact for electrical signalling of undervoltage release energized (see note B).
- Fig. 25 = Contact for electrical signalling of undervoltage release de-energized (see note B).
- Fig. 26 = Contact for electrical signalling of motor protection circuit-breaker closed.
- Fig. 27 = Contact for electrical signalling of motor protection circuit-breaker open.
- Fig. 31 = Available auxiliary contacts of the circuit-breaker (see note H).
- Fig. 32 = Available auxiliary contacts of the circuit-breaker (see note H).
- Fig. 50 = Microprocessor release REF601-IEC and REF601-CEI0-16.
- Fig. 51 = Current circuits of microprocessor release REF601-IEC with two current sensors (can only be used with isolated neutral networks and earth fault current protection not activated).
- Fig. 52 = Current circuits of microprocessor release REF601-IEC with three current sensors (can only be used with isolated neutral networks and earth fault current protection not activated).
- Fig. 53 = Current circuits of microprocessor release REF601-IEC with earth fault protection, powered by two current sensors and by a homopolar current sensor.
- Fig. 54 = Current circuits of microprocessor release REF601-IEC and REF601-CEI 0-16 with earth fault protection, powered by three current sensors and by a homopolar current sensor.
- Fig. 55 = Local opening circuit (-MBO1) by means of REF601-IEC or REF601-CEI 0-16 (see notes E - L).
- Fig. 56. = Local opening/closing circuits (-MBO1, -MBC) by means of REF601-IEC or REF601-CEI 0-16 (see notes E - L).

Fig. 57. = Local opening circuit (-MBU) by means of REF601-CEI 0-16).

Fig. 58 = Connector -XK3 for communication board (MODBUS/RTU) of microprocessor release REF601-IEC and REF601-CEI 0-16.

### Incompatibility

The circuits indicated in the following figures cannot be supplied at the same time in the same circuit-breaker:

<b>2-56</b>	<b>20-24-25</b>
<b>5-16</b>	<b>20-57</b>
<b>5-57</b>	<b>22-23</b>
<b>7-55-56</b>	<b>26-27</b>
<b>9-16</b>	<b>31-32</b>
<b>10-50-51-52-53-54-55-56-57-58</b>	<b>51-52-53-54</b>
<b>11-14</b>	<b>55-56</b>
<b>11-15-16</b>	<b>57-51-52-53</b>
<b>15-16</b>	<b>58-55</b>
<b>16-55-56</b>	<b>10-16</b>
<b>9-10</b>	

### Notes

- A) The circuit-breaker comes solely equipped with the specific applications in the order confirmation. Consult the catalogue of the device for instructions about how to make out the order.
- B) The undervoltage release can be supplied for powering with voltage branching from the supply side of the circuit-breaker or from an independent source. Use of both the instantaneous undervoltage release and the one with electronic time-lag device (outside the circuit-breaker) is allowed. The electronic time-delay is incompatible with fig. 57. The circuit-breaker can only close when the release is energized (the closing lock is obtained mechanically). The contact shown in fig. 24 or the one in fig. 25 (signalling is persistent) are available on request. If there is the same power supply for the closing and undervoltage releases and the circuit-breaker must close automatically when the auxiliary voltage returns, there must be a 50 ms delay between the undervoltage release's enabling instant and energizing of the closing release. This can be achieved by means of a circuit outside the circuit-breaker comprising a permanent closing contact, the contact indicated in fig. 24 and a time-delay relay.
- NOTE.** When overvoltage release REF601/CEI 0-16 is required, the undervoltage release is supplied as part of the standard equipment and is only the instantaneous type.

- C) Check the power available in the auxiliary circuit to find out whether several motors for loading the closing springs can operate at the same time. To prevent excessive power draw, the springs must be loaded by hand before auxiliary circuit is powered.
- E) The circuit for monitoring the continuity of the opening release winding must only be used for that purpose. With a power supply of less than 220 V, connect the "Control Coil Continuity" device or a relay or signalling lamp which absorbs a current of not more than 20 mA. With a power supply of 220 V or more, connect a relay or signalling lamp which absorbs a current of not more than 10 mA. Other uses compromise the soundness of the release.
- F) Circuit-breaker -FCM1 of fig. 21 must always be installed if the spring loading motor is powered at 24 VDC. If opening is caused by a fault in the motor, spring loading must always be completed with the relative handle before proceeding with the manual reset.
- G) Terminals 51 and 52 are not available for version HD4/RE-Sec.
- H) When fig. 9 is required, the contact to terminals 9-10 of pack -BGB1 is not available for figs. 31-32.
- L) Release by means of -MBU, only obligatory for REF601 / CEI 0-16. The power supply voltage -MBU, -MBO1, -MBC (if applicable) must be the same and within the powering range of protection REF601.
- M) Only for relay REF601-IEC.

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