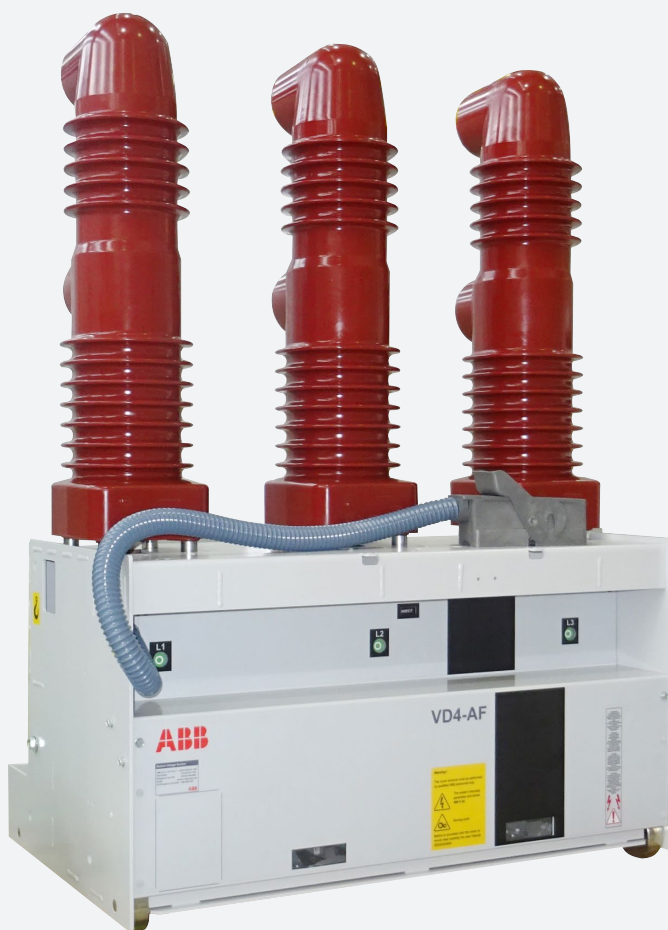DISTRIBUTION SOLUTIONS

VD4-AF

Circuit breaker for safe and relentless steel furnace operation and protection up to 38kV - 2500A - 31.5kA

⊕

- Ensures safety and protection of personnel and assets
- Guarantees continuous and reliable operation of critical processes
- Reduces maintenance and logistic efforts

Indoor vacuum circuit breaker with servomotor actuation for steel furnaces safe and relentless operation and protection. To ensure no downtime for breaker overhaul, thus reducing the total cost of furnace operation, ABB has developed a unique indoor circuit breaker able to perform up to 150,000 close-open operations. The VD4 Arc Furnace circuit breaker is based on vacuum technology and innovative actuation systems to provide a new high quality, reliable and efficient solution.

Table of contents

Your benefits, ABB strength

**Productivity
maximizes
your output**

Reduced
downtimes
effort

**Efficiency
optimized
investments**

Reduced
operation
cost

**Reliability
protects
your assests**

Prevent incorrect
and hazardous
operations

VD4-AF: relentless operation
Thanks to the VD4-AF you can:

Maximize your productivity
- 150,000 operations without refurbishment
- No downtimes for breaker overhaul
- Fastest replacement with roll on floor drawout solution
- Tested for shunt reactor current switching according to IEC 62271-110
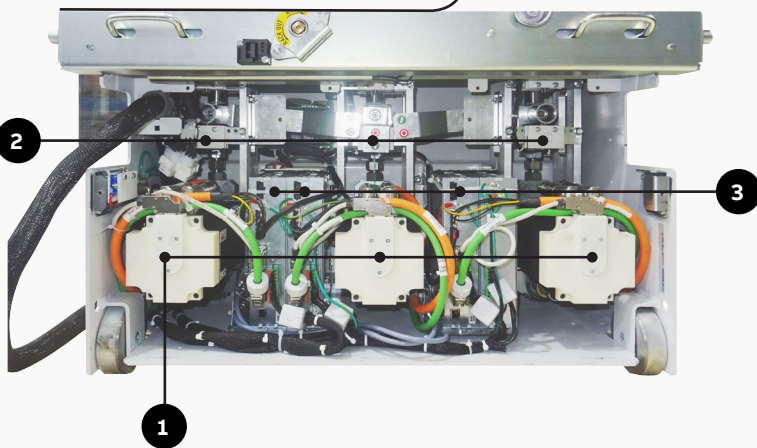
Optimize your investment
- Lowest total cost per operation
- Reduced spare inventories
- Enabled for Service monitoring offer

Safeguard your personnel and assets
- Embedded advanced diagnostics
- Built-in interlocks
- Prevention of incorrect operations and hazards

Description

Relentless operation and protection for steel furnaces

The VD4-AF is a unique solution based on vacuum technology and an innovative actuation systems to provide up to 150,000 close-open operations. Its technological breakthrough is based on servomotors, controlled by an efficient and smart electronic.

The circuit breaker comprises:
• three poles in epoxy resin containing the vacuum interrupters
• three brushless servomotors, one per phase with double encoder
• three electronic controllers, one per phase, which communicate hierarchically with each other and where the first unit controls the entire system
• an electronic supply unit
• a capacitor for storing the energy required to operate the circuit breaker in the absence of auxiliary supply
• three sensors and three mechanical position indicators
• a operating lever seat for opening the circuit breaker in the manual mode

1. Servo motor
2. Phase position contact (mechanical and electrical)
3. Phase controller

Selection and ordering
Fixed circuit breakers

—

Fixed VD4-AF circuit breakers

VD4-AF			
Rated and Insulation voltage	kV	36	38
Withstand voltage (1min)	kV	95	95
Impulse withstand voltage	kVp	185	185
Rated frequency	Hz	50-60	50-60
Rated normal current	A	1250-2000-2500	1250-2000-2500
Rated breaking capacity and rated short-time withstand current (3s)	kA	31.5	31.5
Making capacity	kAp	82	82
Mechanical endurance	Close-Open operations	150,000	150,000
Operating sequence		O-0.3s-CO-15s-CO	O-0.3s-CO-15s-CO
Opening time	ms	35	35
Arc time	ms	10 … 15	10 … 15
Total interruption time	ms	45 … 50	45 … 50
Closing time	ms	50	50
Overall dimensions	H mm (inches)	1575 (60)	1575 (60)
	W mm (inches)	1100 (43)	1100 (43)
	D mm (inches)	605 (24)	605 (24)
	P mm (inches)	360 (14)	360 (14)
Weight Fixed	Kg (lbs) (approx.)	230 (507)	230 (507)

H = Height of the circuit breaker
W = Width of the circuit breaker
D = Depth of the circuit breaker
P = Pole horizontal centre distance

Selection and ordering
Withdrawable circuit breakers

—

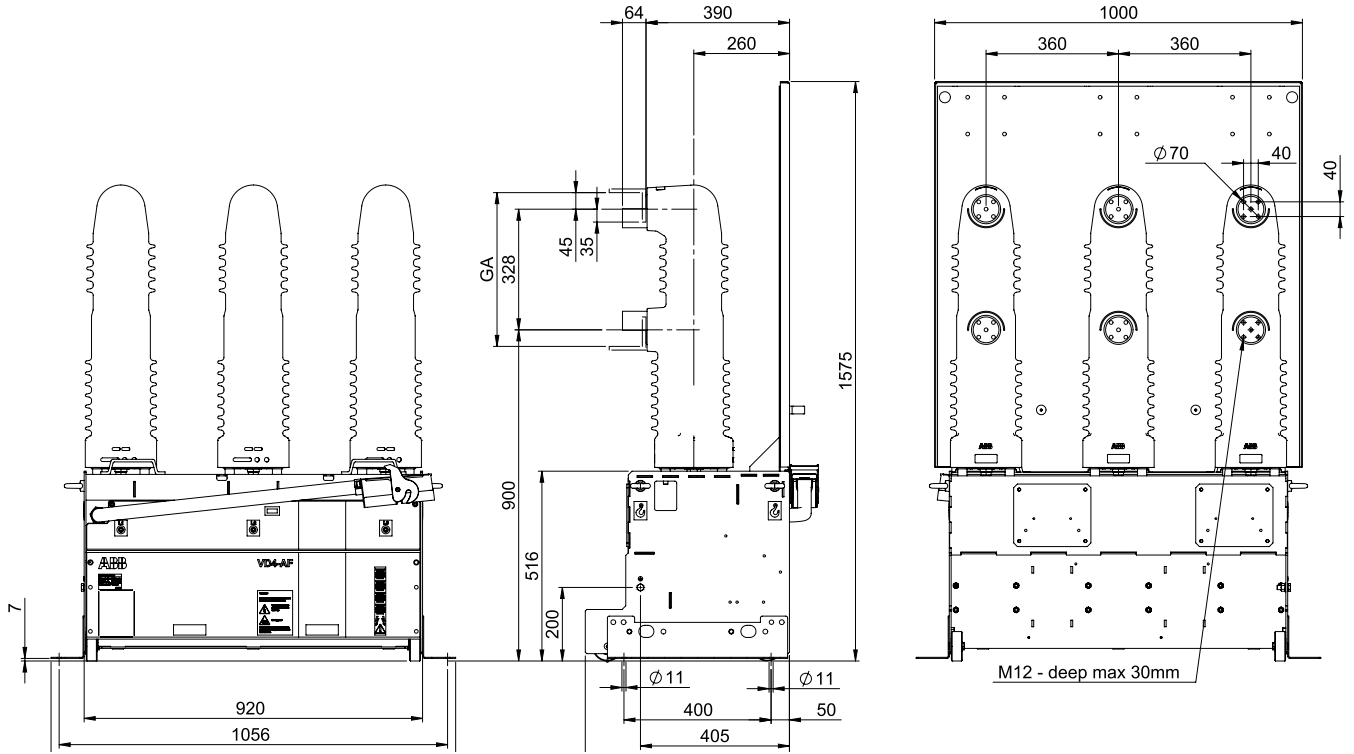Withdrawable circuit breakers for Powerbloc and Unigear ZS3.2 switchgear

| VD4-AF/P			
Rated and Insulation voltage	kV	36	38
Withstand voltage (1min)	kV	95	95
Impulse withstand voltage	kVp	185	185
Rated frequency	Hz	50-60	50-60
Rated normal current	A	1250-2000-2500	1250-2000-2500
Rated breaking capacity and rated short-time withstand current (3s)	kA	31.5	31.5
Making capacity	kAp	82	82
Mechanical endurance	Close-Open operations	150,000	150,000
Operating sequence		O-0.3s-CO-15s-CO	O-0.3s-CO-15s-CO
Opening time	ms	35	35
Arc time	ms	10 … 15	10 … 15
Total interruption time	ms	45 … 50	45 … 50
Closing time	ms	50	50
Overall dimensions	H mm (inches)	1575 (60)	1575 (60)
	W mm (inches)	945 (32)	945 (32)
	D mm (inches)	750 (29,5)	750 (29,5)
	P mm (inches)	280 (11)	280 (11)
Weight Withdrawable	Kg (lbs) (approx.)	250 (551)	250 (551)

H   =   Height of the circuit breaker
W   =   Width of the circuit breaker
D   =   Depth of the circuit breaker
P   =   Pole horizontal centre distance

Overall dimensions

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Fixed VD4-AF circuit breakers

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Withdrawable circuit breakers for Powerbloc and Unigear ZS3.2 switchgear
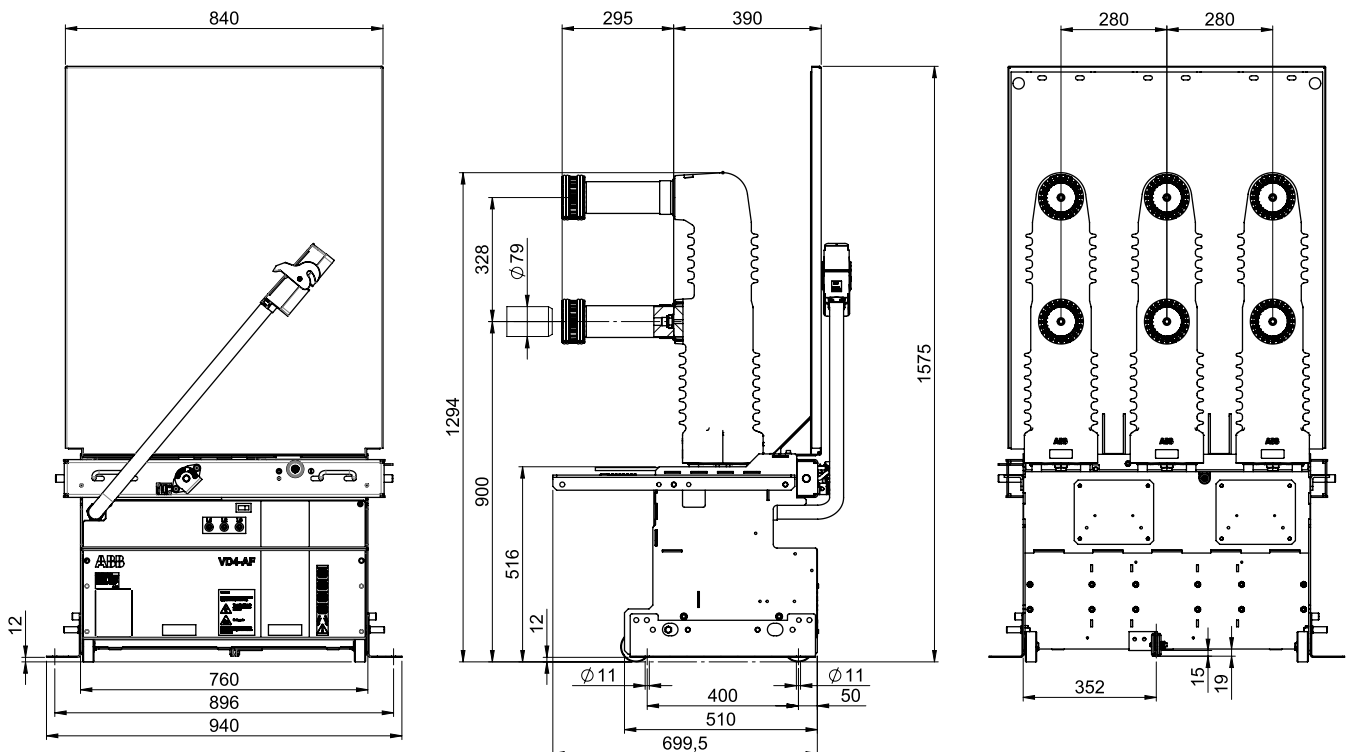
Electrical diagrams

Represented operational state
The diagram illustrates the following conditions:
• Circuit breaker in open position and inserted (for withdrawable version)
• Circuits de-energized
• Frontal cover of the circuit breaker closed

Graphical symbols for electrical diagrams (60617 IEC and 60617 CEI EN Standards)

Thermal effect	Terminal	Rectifier in full wave (bridge) connection	Operating device (general symbol)
Electromagnetic effect	Plug and socket (male and female)	Make contact	Overcurrent relay with adjustable long time-lag characteristic
Operated by pushing	Make contact without spring return (stay put) with manual actuator reset	Break contact	Overcurrent relay with inverse long time-lag characteristic
Earth, ground (general symbol)	Capacitor (general symbol)	Insulated binary digital input	Overcurrent relay with adjustable short time-lag characteristic
Frame, chassis	Motor (general symbol)	Position switch (limit switch), make contact	Instantaneous overcurrent or rate-of-rise relay
Conductors in a screened cable, two conductors shown	Current sensing element	Position switch (limit switch), break contact	Lamp (general symbol)
Connection of conductors	Current sensor with one permanent winding and three threated windings	Circuit breaker with automatic release	Timer switch

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Electrical diagram 1VCD400300: VD4-AF (fixed version)
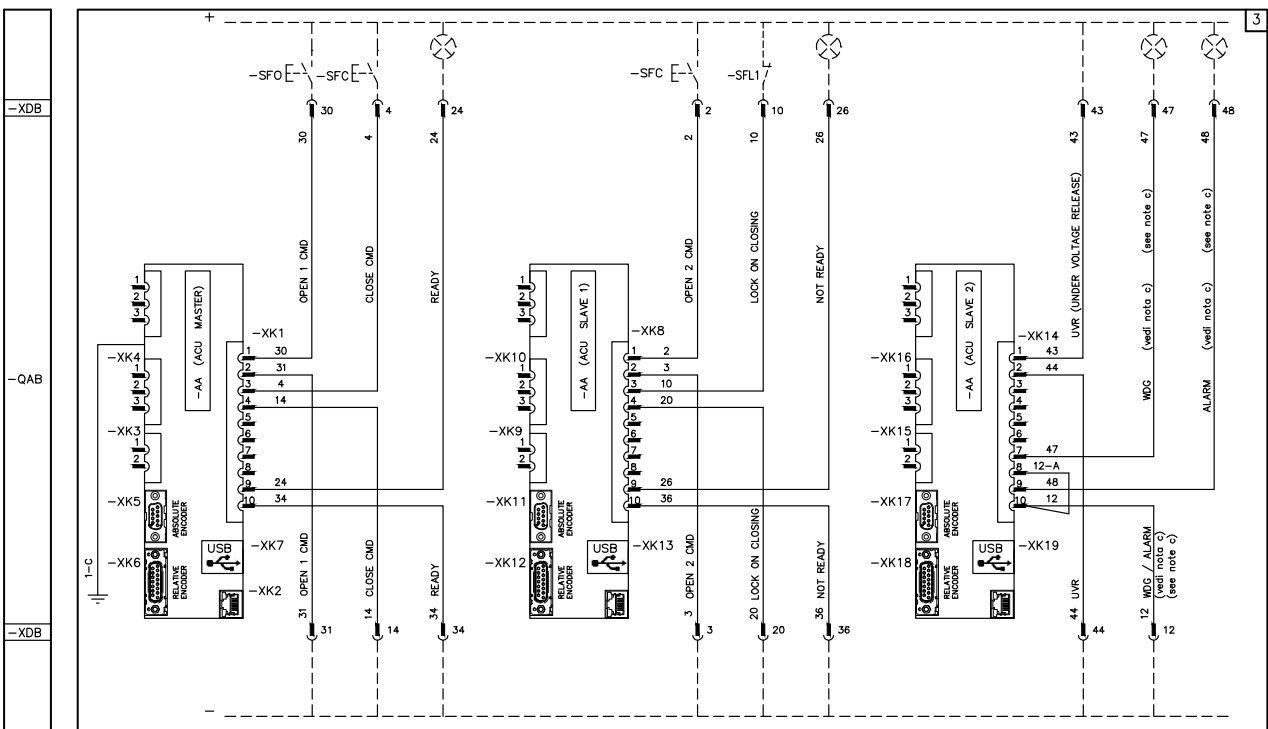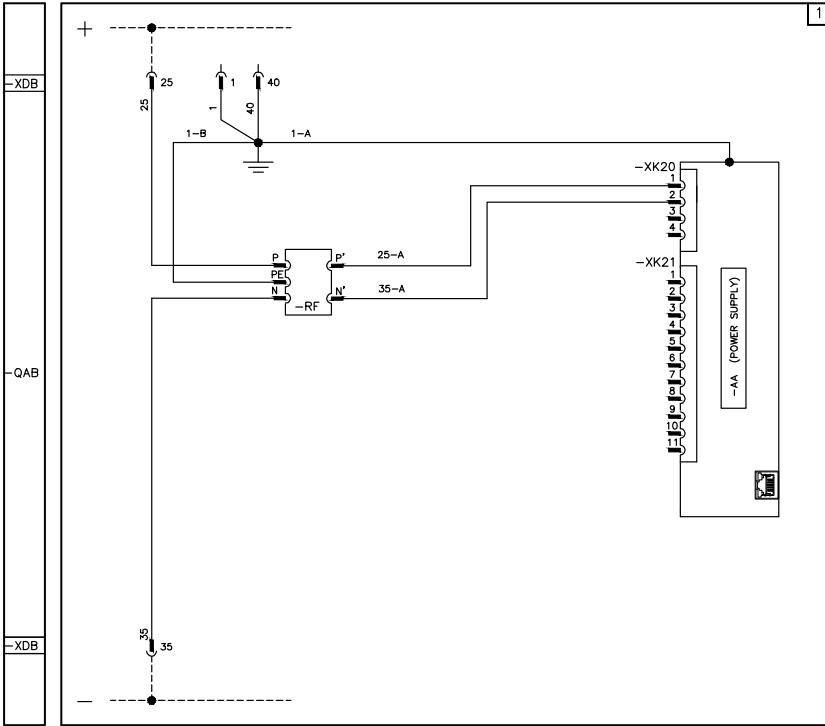
Electrical diagrams

Electrical diagram 1VCD400300: VD4-AF (fixed version)

Electrical diagrams

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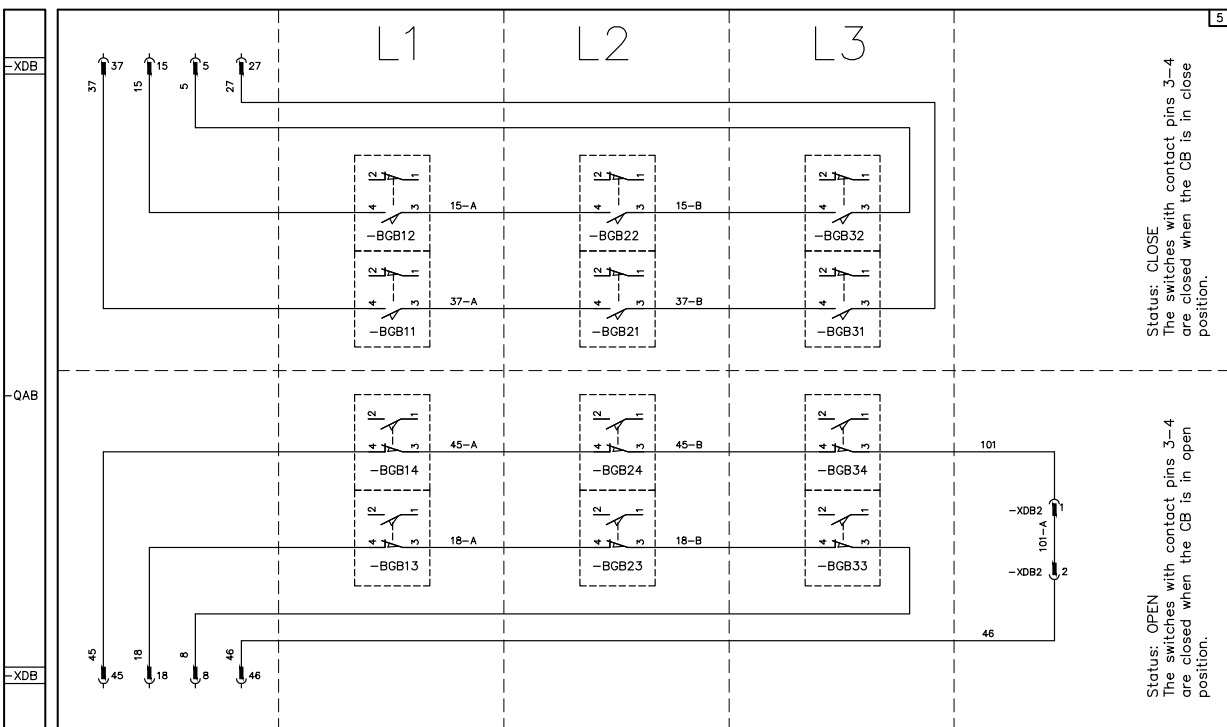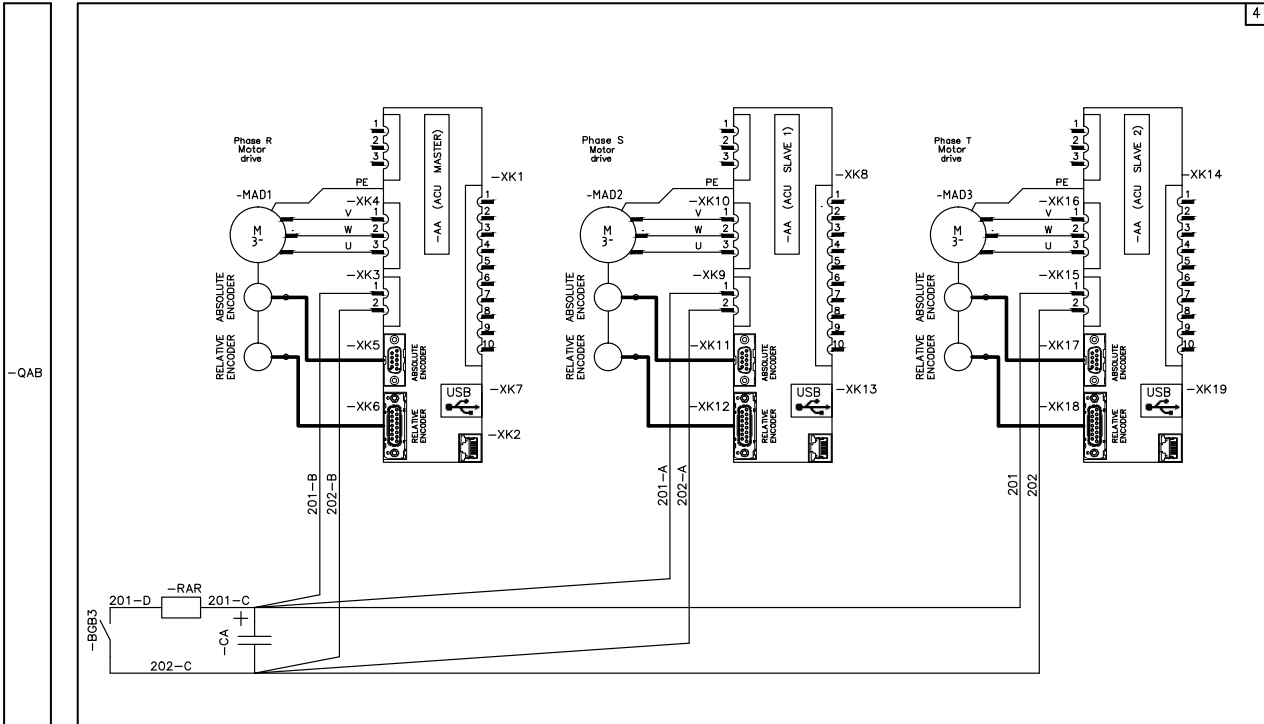
Electrical diagram 1VCD400300: VD4-AF (fixed version)

Caption		
☐	=	Reference number of diagram figure
-AA	=	Control and switching unit
-BGB1	=	C.breaker auxiliary contacts
-BGB11/12	=	Position switch phase L1 status CLOSE
-BGB13/14	=	Position switch phase L1 status OPEN
-BGB2	=	C.breaker auxiliary contacts
-BGB21/22	=	Position switch phase L2 status CLOSE
-BGB23/24	=	Position switch phase L2 status OPEN
-BGB3	=	Frontal cover switch. When the frontal cover is removed the switch get closed and the capacitor will be discharged by -R1 resistor
-BGB31/32	=	Position switch phase L3 status CLOSE
-BGB33/34	=	Position switch phase L3 status OPEN
-CA	=	Capacitor 450V
-CA2	=	Capacitor 100 nF 100 Vdc
-MAD1	=	Motor for operating the phase L1 pole
-MAD2	=	Motor for operating the phase L2 pole
-MAD3	=	Motor for operating the phase L3 pole
-PFF1	=	Commutation relays for auxiliary contacts -BGB1
-PFF2	=	Commutation relays for auxiliary contacts -BGB2
-QAB	=	Main circuit breaker
-RAR	=	Discharge resistor 150 ohm - 150 W
-RAR2	=	Resistor 10 kΩ 1 W
-RF	=	Supply input Filter
-SFC	=	Pushbutton or contact for the circuit breaker closing
-SFL1	=	Contact locking the c.breaker closing
-SFO	=	Pushbutton or contact for the circuit breaker opening
-XDB	=	Connector for the c.breaker circuit.
-XDB2...	=	Connectors for accessories

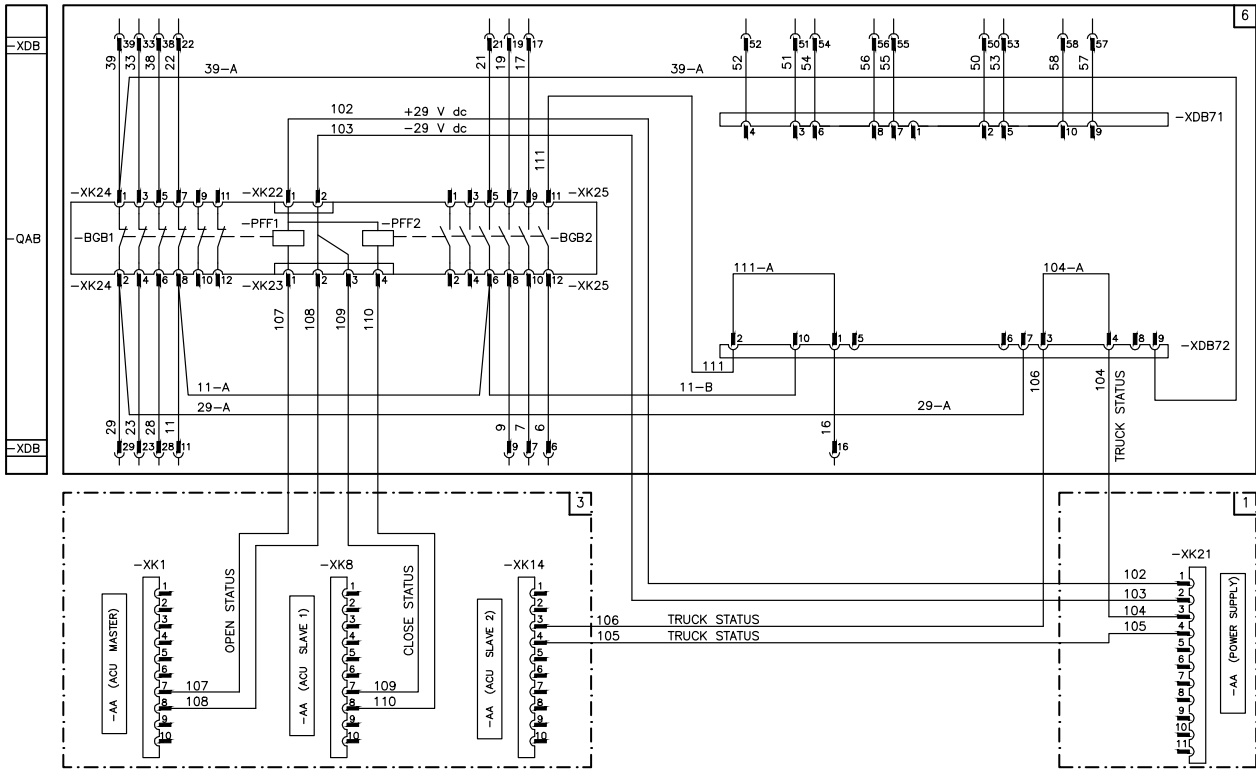| Connectors for module "Master" of the control switching unit -AA		
-XK1	=	Binary input/output connector
-XK2	=	Analog input connector
-XK3	=	Connector for 350V DC link
-XK4	=	Three phase motor output -MAD1
-XK5	=	Connector for the absolute encoder of motor -MAD1
-XK6	=	Connector for the relative encoder of motor -MAD1
-XK7	=	USB connector for data transfer
Connectors for module "Slave 1" of the control switching unit -AA		
-XK8	=	Binary input/output connector
-XK9	=	Connector for 350V DC link
-XK10	=	Three phase motor output -MAD2 connector
-XK11	=	Connector for the absolute encoder of motor -MAD2
-XK12	=	Connector for the relative encoder of motor -MAD2
-XK13	=	USB connector for data transfer
Connectors for module "Slave 2" of the control switching unit -AA		
-XK14	=	Binary input/output connector
-XK15	=	Connector for 350V DC link
-XK16	=	Three phase motor output -MAD3 connector
-XK17	=	Connector for the absolute encoder of motor -MAD3
-XK18	=	Connector for the relative encoder of motor -MAD3
-XK19	=	USB connector for data transfer
Connectors for module "Power supply" of the control switching unit -AA		
-XK20	=	Supply input connector.
-XK21	=	Auxiliary voltage output connector.
Connectors for extended auxiliary contacts		
-XK22	=	Supply input connector for extended auxiliary contacts
-XK23	=	Connector of commutation relays
-XK24	=	Connector of auxiliary contacts (open position)
-XK25	=	Connector of auxiliary contacts (close position)

Diagram figures description

1	Power supply connection
3	Binay input/output of control and switching unit -AA
4	Motor control circuits on the three phases
5	Position switches for the status open/close of the three phases
6	C.breaker available auxiliary contacts

Incompatibility

No incompatibility

Notes

a	The c.breaker is delivered complete with the accessories listed in the order acknowledgement only. To draw up the order examine the apparatus catalogue.
b	"Warning! Before operate on auxiliary circuits, power off the apparatus and wait at least 1 minut in order to let the capacitor -CA to completely discharge."
c	The signalling switches: "WDG" and "ALARM" must be working at the same supply voltage surce.

Electrical diagrams

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Electrical diagram 1VCD400294: VD4-AF/P (withdrawable version)

Phase R Motor drive
-MAD1
-XK1 -AA (ACU MASTER)
PE
-XK4
V
W
U
-XK3
-XK5 ABSOLUTE ENCODER
-XK6 RELATIVE ENCODER
USB -XK7
-XK2
ABSOLUTE ENCODER
RELATIVE ENCODER
201-B
202-B

Phase S Motor drive
-MAD2
-XK8 -AA (ACU SLAVE 1)
PE
-XK10
V
W
U
-XK9
-XK11 ABSOLUTE ENCODER
-XK12 RELATIVE ENCODER
USB -XK13
ABSOLUTE ENCODER
RELATIVE ENCODER
201-A
202-A

Phase T Motor drive
-MAD3
-XK14 -AA (ACU SLAVE 2)
PE
-XK16
V
W
U
-XK15
-XK17 ABSOLUTE ENCODER
-XK18 RELATIVE ENCODER
USB -XK19
ABSOLUTE ENCODER
RELATIVE ENCODER
201
202

-QAB

-BGB3 201-D -RAR 201-C
-CA
202-C

L1   L2   L3

-XDB
37 15 5 27

-BGB12 15-A -BGB22 15-B -BGB32
-BGB11 37-A -BGB21 37-B -BGB31

-QAB

-BGB14 45-A -BGB24 45-B -BGB34
-BGB13 18-A -BGB23 18-B -BGB33

101
1 -XDB2
-TB5
E1
-RLE2
E2
2 -XDB2

-XDB
45 18 8

Status: CLOSE
The switches with contact pins 3-4 are closed when the CB is in close position.

Status: OPEN
The switches with contact pins 3-4 are closed when the CB is in open position.

Electrical diagrams

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Electrical diagram 1VCD400294: VD4-AF/P (withdrawable version)

Caption		
☐	=	Reference number of diagram figure
-AA	=	Control and switching unit
-BGB1	=	C.breaker auxiliary contacts
-BGB11/12	=	Position switch phase L1 status CLOSE
-BGB13/14	=	Position switch phase L1 status OPEN
-BGB2	=	C.breaker auxiliary contacts
-BGB21/22	=	Position switch phase L2 status CLOSE
-BGB23/24	=	Position switch phase L2 status OPEN
-BGB3	=	Frontal cover switch. When the frontal cover is removed the switch get closed and the capacitor will be discharged by -R1 resistor
-BGB31/32	=	Position switch phase L3 status CLOSE
-BGB33/34	=	Position switch phase L3 status OPEN
-BGT1	=	Contacts signalling c.breaker in the connected position
-BGT2	=	Contacts signalling c.breaker in the insulated position
-CA	=	Capacitor 450V
-CA2	=	Capacitor 100 nF 100 Vdc
-KFT	=	Temporized contact to unlock the c.breaker racking-in and racking-out
-MAD1	=	Motor for operating the phase L1 pole
-MAD2	=	Motor for operating the phase L2 pole
-MAD3	=	Motor for operating the phase L3 pole
-PFF1	=	Commutation relays for auxiliary contacts -BGB1
-PFF2	=	Commutation relays for auxiliary contacts -BGB2
-QAB	=	Main circuit breaker
-RAR	=	Discharge resistor 150 ohm - 150 W
-RAR2	=	Resistor 10 kΩ 1 W
-RF	=	Supply input Filter
-RLE2	=	Locking magnet on the truck. If de-energized it prevents the c.breaker racking-in and racking-out mechanically.
-SFC	=	Pushbutton or contact for the circuit breaker closing
-SFL1	=	Contact locking the c.breaker closing
-SFO	=	Pushbutton or contact for the circuit breaker opening
-TB5	=	Rectifier for -RLE2
-XDB	=	Connector for the c.breaker circuit
-XDB2...	=	Connectors for accessories

Connectors for module "Master" of the control switching unit -AA		
-XK1	=	Binary input/output connector
-XK2	=	Analog input connector
-XK3	=	Connector for 350V DC link
-XK4	=	Three phase motor output -MAD1
-XK5	=	Connector for the absolute encoder of motor -MAD1
-XK6	=	Connector for the relative encoder of motor -MAD1
-XK7	=	USB connector for data transfer

Connectors for module "Slave 1" of the control switching unit -AA		
-XK8	=	Binary input/output connector
-XK9	=	Connector for 350V DC link
-XK10	=	Three phase motor output -MAD2 connector
-XK11	=	Connector for the absolute encoder of motor -MAD2
-XK12	=	Connector for the relative encoder of motor -MAD2
-XK13	=	USB connector for data transfer

Connectors for module "Slave 2" of the control switching unit -AA		
-XK14	=	Binary input/output connector
-XK15	=	Connector for 350V DC link
-XK16	=	Three phase motor output -MAD3 connector
-XK17	=	Connector for the absolute encoder of motor -MAD3
-XK18	=	Connector for the relative encoder of motor -MAD3
-XK19	=	USB connector for data transfer

Connectors for module "Power supply" of the control switching unit -AA		
-XK20	=	Supply input connector
-XK21	=	Auxiliary voltage output connector

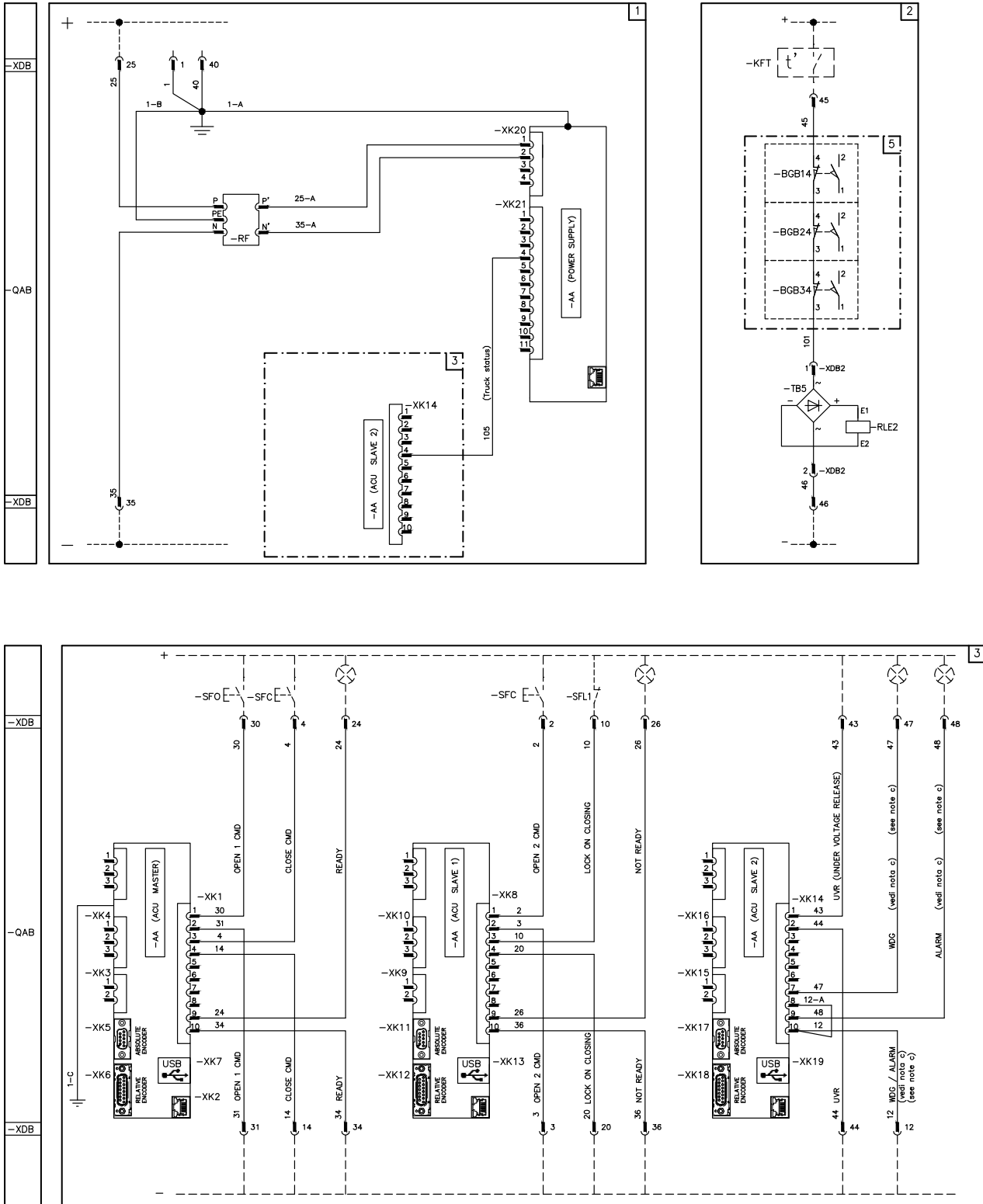| Connectors for extended auxiliary contacts		
-XK22	=	Supply input connector for extended auxiliary contacts
-XK23	=	Connector of commutation relays
-XK24	=	Connector of auxiliary contacts (open position)
-XK25	=	Connector of auxiliary contacts (close position)

Electric circuit diagram

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Electrical diagram 1VCD400294: VD4-AF/P (withdrawable version)

Diagram figures description	
1	Power supply connection
2	Locking magnet on the truck. If de-energized it prevents the c.breaker racking-in and racking-out mechanically.
3	Binay input/output of control and switching unit -AA
4	Motor control circuits on the three phases.
5	Position switches for the status open/close of the three phases
6	C.breaker available auxiliary contacts
7	Contact signalling circuit breaker in inserted and isolated position located on circuit breaker's truck.

Incompatibility
No incompatibility

Notes	
a	The c.breaker is delivered complete with the accessories listed in the order acknowledgement only. To draw up the order examine the apparatus catalogue.
b	"Warning! Before operate on auxiliary circuits, power off the apparatus and wait at least 1 minut in order to let the capacitor -CA to completely discharge."
c	The signalling switches: "WDG" and "ALARM" must be working at the same supply voltage surce.

Notes

ABB

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For further details please contact:

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Further details about the product:
abb.com/mediumvoltage
Your contact center:
abb.com/contactcenters
Further details about services:
abb.com/service