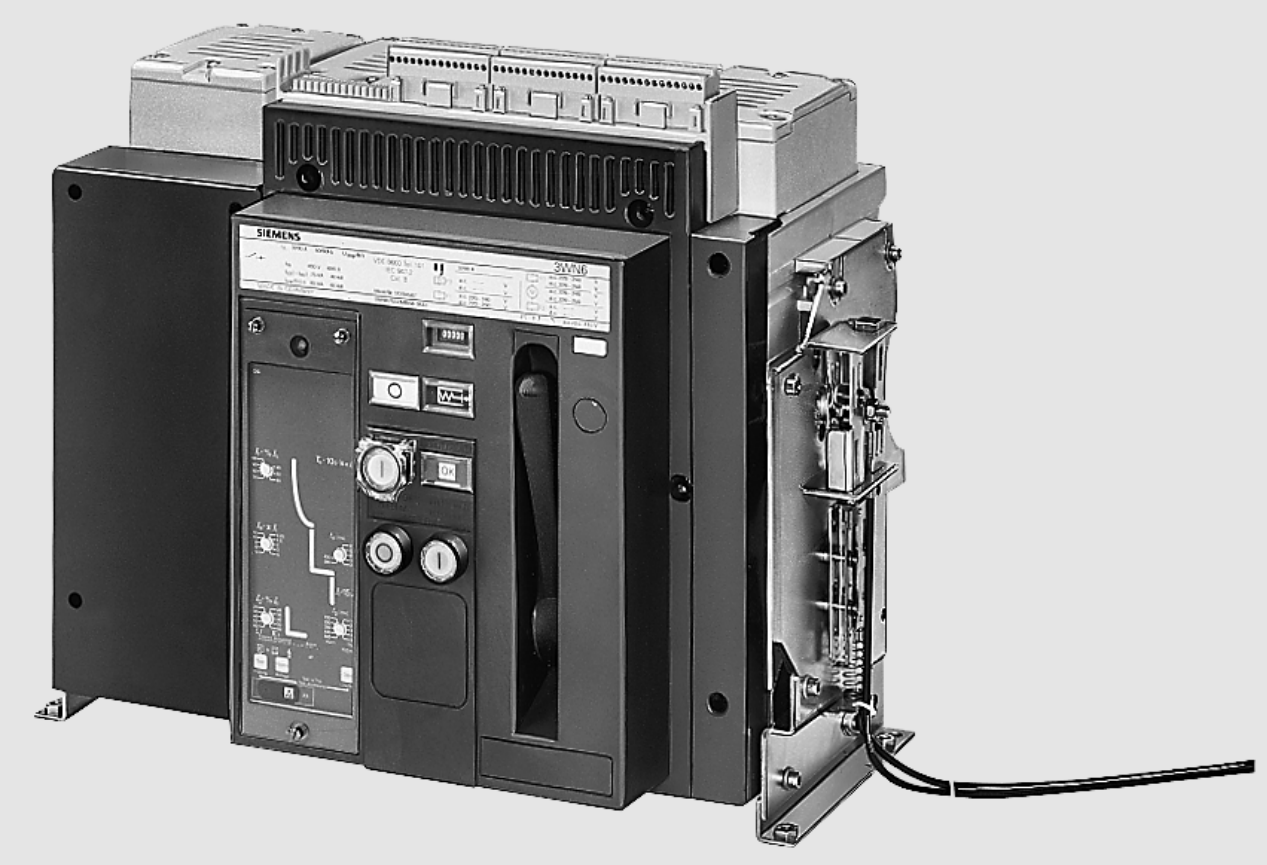
3WN6 Circuit-Breakers for Low Voltage

- Construction and Operation
- Versions
- Planning and Installation



3WN6, 4-pole version, with mutual mechanical interlocking (mounted on the left side) 3WX3666-1JA00

1. General Information 5
1.1. Application 5
1.2. Types 5
1.3. Specifications 5
1.4. Operating conditions 6
1.5. Installation 6
1.6. Effect of the transformers and cables on the short-circuit current 6
1.7. Selection criteria for circuit-breakers - in general 8

2. Construction and Operation of the Circuit-Breaker 9
2.1. Construction 9
2.2. Operating mechanism 11
2.3. Closing 12
2.3.1. Ready-to-close condition 12
2.3.2. Locking to prevent closing 12
2.4. Switch OFF 12
2.5. Auxiliary release 13
2.6. Opening and locking device 14
2.7. Mutual mechanical interlocking 17
2.8. Overcurrent release system 18
2.8.1. Construction 18
2.8.2. Overcurrent release; Functions' overview 20
2.8.2.1. Time current curves and tripping characteristics 24
2.8.3. Functions of the overcurrent release 31
2.8.3.1. Overload protection Inverse time overload release "a" 31
2.8.3.2. Short-circuit 32
2.8.3.3. Earth fault protection 32
2.8.3.4. LCD operational current display 34
2.8.3.5. Electronically displays and signals of tripping and/or alarms 34
2.8.3.6. Functional test 35
2.8.3.7. Additional functions 36
2.8.3.8. Selecting overcurrent releases for motor and generator circuit-breakers 37
2.8.4. Short-circuit protection with "short-time grading control" (ZSS) 38
2.8.4.1. General description 38
2.8.4.2. Examples for"short-time grading control" (ZSS) 39
2.8.5. Communication via PROFIBUS-DP 41
2.8.6. Manual operating device 43
2.9. Circuit-Breaker as load interrupters 43
2.10.Mechanical reclosing lockout 43

3. Versions 44
3.1. Fixed mounted circuit-breakers 44
3.1.1. Mounting 44
3.1.2. Blocking device 44
3.2. Draw-out circuit-breakers 44
3.2.1. Guide frame 44
3.2.2. Circuit-breaker positions in the guide frame 45
3.2.3. Position signalling switches 46
3.2.4. Shutter Protective mechanism against touching of current-carrying draw-out contacts 47
3.2.5. Coding system 48
3.2.6. Interlocks 48
3.3. Main connections for fixed mounted and draw-out circuit-breaker 49
3.4. Auxiliary connections 50
3.4.1. Auxiliary and signalling contacts 50
3.4.2. Auxiliary connections 50
3.4.2.1. Fixed mounted version 50
3.4.2.2. Draw-out version 50
3.4.3. Determining the required number of auxiliary connectors 51
3.5. Short-circuiting and earthing devices for 3WN6 52

4. Planning and installation 54
4.1. Circuit-breaker selection 54
4.2. Derating of the operational current 57
4.2.1. Surrounding temperature and rated operational current 57
4.2.2. Mounting into a cubicle 58
4.3. Safety clearances 61
4.3.1. Fixed mounted and draw-out version 61
4.3.2. Circuit-breaker without covering the arc chambers 62
4.3.3. Circuit-breaker with covering of the arc chambers 63
4.3.4. Separating plate on the rear side of the guide frame 64
4.3.5. Sheet plate for phase to phase separation 64
4.4. Installation 65
4.5. Main and auxiliaries connections 67
4.5.1. Connecting the auxiliary wiring to fixed mounted circuit-breakers 67
4.5.2. Connecting the auxiliary wiring to draw-out circuit-breakers 68
4.5.3. Control and measurement wiring to the connectors X300 and X400 68
4.6. Connecting the mains 69
4.6.1. Connecting via busbar 69
4.6.2. Examples for connecting via busbar 70
4.6.3. Tightening torque 71
4.6.4. Connecting via cables 71
4.6.5. Connecting copper busbar systems 72
4.6.6. Connecting aluminium busbar systems 74
4.7. Circuit examples 76
4.7.1. Interface module 76
4.7.2. Conditions for the "ready to close" signal 76
4.7.3. Earth fault detection between transformer and the L.V. incoming breaker 79
4.7.4. Control circuit for tripping and alarm signals 80
4.7.5. Signal conversion for control circuits 80
4.7.6. Control circuit for overtemperature and µP-Alarm 81
4.7.7. Control circuit for load monitoring and load shedding signals 81
4.7.8. Control circuit for overload or short-circuit signal 82
4.7.9. Control circuit for earth fault, overload or short-circuit signal 82

5. Technical Data 83

6. Circuit Diagram 86

7. Retrofitting and Conversions 91
7.1. Procedure 91
7.2. Rating plate and Ident-number 92
7.3. Structure of the ordering number 92
7.4. Replacement, Retrofit and Spare Parts 96
7.5. Adapter for replacing 3WN5 by 3WN6 104

8. Dimension Drawings 105

9. Troubleshooting 113

10. Form for adjustment of the overcurrent release 115

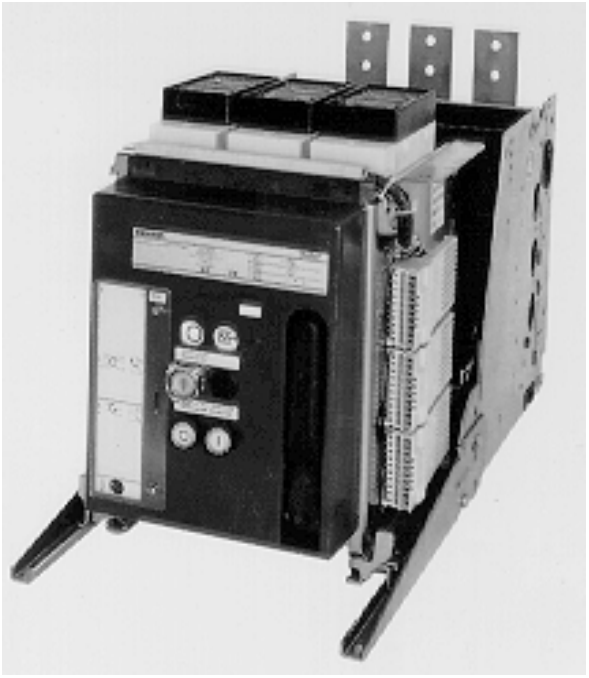
11. Operating instructions and planning tools 119

Additional Circuit-Breakers made by Siemens

3VF - compact, extensive and high performance

Compact MCCB range. Three ranges offering different levels of breaking capacity, ensuring the most economical solution the switching requirements of the system. Suitable for the protection of distribution systems, as well as motors and motor starter combinations.

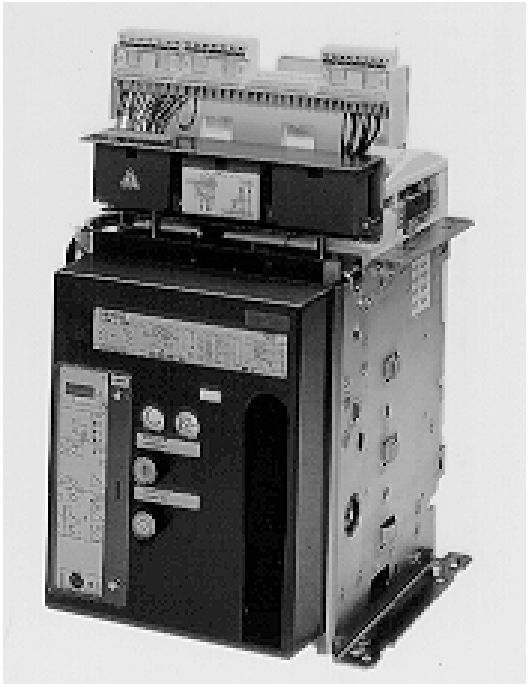
Rated current:	10 to 2500 A
Rated voltage:	690V
Switching capacity at 415 V:	up to 100 kA
Switching capacity at 415 V:	up to 35 kA



3WN1 - Switching strength for high performance

For distribution of energy in systems having a high level of short-circuit and discrimination times, such as power stations shipbuilding and large industrial processes for example.

Rated current	630 to 6300 A
Rated Voltage	1000 V
Switching capacity at 500 V:	up to 100 kA
Switching capacity at 690 V:	up to 80 kA



3WS1 - maintenance free for long electrical life

High electrical and mechanical life as well as vacuum technology ensures that the 3WS is ideal where a high level of electrical endurance is required. The 3WS1 has full discrimination capability up to 65 kA. Its electrical and mechanical life is 30,000 operations without maintenance. It can break up to 30 times its rated short-circuit

Rated current	630 to 2500 A
Rated Voltage	1000 V
Switching capacity at 690 V:	up to 65 kA
Switching capacity at 1000 V:	up to 40 kA

1. General Information

The 3WN6 circuit-breaker is an air circuit-breaker which has also an isolation function. It uses air as the arc extinguishing medium and is specially designed for discrimination category B

1.1. Application

The air circuit-breaker can be used

- as infeed and branch circuit-breakers in three-phase AC distribution systems;
- for switching and protecting motors, generators, transformers and capacitors;
- as main switch for all kinds of machines; the user must comply with the appropriate regulations governing enclosure, installation and operating mechanism (DIN VDE 0113);
- as EMERGENCY STOP device complying with DIN VDE 0113, when the circuit-breaker is fitted with an undervoltage release and is used in conjunction with an EMERGENCY STOP pushbutton;
- for switchgear installations with discriminating short circuit protection by time grading or „short time grading control ZSS". For this the circuit-breakers must be fitted with short time delay overcurrent releases („azn" or „azng");
- as meshed system switches in low voltage networks having several feeders in conjunction with meshed system relays for monitoring the direction of power flow;
- for installation requiring earth-fault monitoring.

1.2. Types

The 3WN6 circuit-breakers are available in 3-pole and 4-pole fixed-mounted and draw-out versions. For information on sizes and nominal currents see the following table

1.3. Specifications

DIN VDE 0660, IEC 947.

The 3WN6 circuit-breakers comply with the approval requirements of the following Marine Classification Societies: BV, GL, LRS, DNV.

Overview - 3WN6 circuit-breaker

Type designation	3-pole version			4-pole version			
	Size	Rated current		Size	Rated current		
		I_N	I_{CU}		I_N	I_N	I_{CU}
		Phase conductors	Neutral conductor		Phase conductors	Neutral conductor	
3WN6 0 [1])	I	630	65	I	630	630	65
3WN6 1	I	800	65	I	800	800	65
3WN6 2	I	1000	65	I	1000	1000	65
3WN6 3	I	1250	65	I	1250	1250	65
3WN6 4	I	1600	65	II	1600	1600	65
3WN6 5 [2])	II	2000	80	II	2000	2000	80
3WN6 6	II	2500	80	II	2500	2500	80
3WN6 7	II	3200	80		3200	3200	80

[1]) This size is also available with smaller current transformers having rated currents or 315 A, 400 A and 500 A

[2]) This size is also available with smaller current transformers having rated currents of 1250 A and 1600 A

Fig. 1/1 3WN6 in a switchgear installation

1.4. Operating conditions

The circuit-breakers are resistant to extreme climates. They are intended for use in closed rooms where there are no excessive operating conditions (e.g. dust, corrosive vapours or damaging gases).
Suitable housings must be provided, if the circuit-breakers have to be installed in dusty or humid locations. Sufficient fresh air supply must be provided if there are harmful gases (e.g. hydrogen-sulfide vapour) in the ambient air.

The maximum permissible ambient temperature range and the rated operational currents permitted at different ambient temperatures are given in the technical data.

1.5. Installation

The circuit-breakers are primarily intended for installation in closed switch boards (e.g. SIVACON, SIKUS 3200) and distribution systems.
The fixed mounted circuit-breaker and the guide frame of the draw-out type are bolted in place through their basis (Wall mounting brackets for the fixed mounted circuit-breaker available as accessories)
The feed-in to the circuit-breakers can be to the top or button terminals; the technical data remains identical in both cases.

1.6. Effect of the transformers and cables on the short-circuit current

The value of the short circuit current at operational voltage is dependent on the impedance of the conductive path between the transformer and the location of the short circuit.
In the low voltage network the decisive factor is the impedance of the infeed transformer and the cables / conductors. Apart from this, there are other ohmic and inductive resistances in the conductive path such as contact resistance and inductive interferences from neighbouring iron construction that cannot be included in the calculation or only with great difficulty.

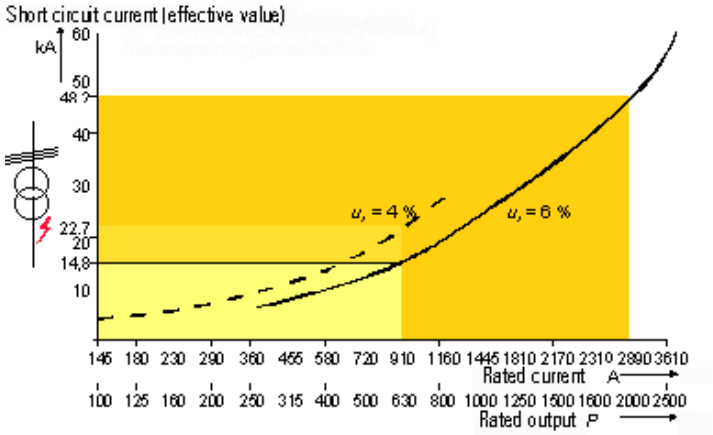


Figure 1/2 Initial short circuit alternating current I''_k from transformers (400V, 50 Hz) as a function of the transformer output S_{nT} and short circuit voltage u_{kr}

The relationship between the short circuit current I''_k and both the output S_{nT} and short circuit voltage u_{kr} or the transformer at operational voltage is shown in Figure 1/2. These short circuit current values can only be expected directly at the terminals of the L.V. side of the transformer in the case of a dead three phase fault. The extensive damping effect of the cable on the value of short circuit current is shown in the diagrams in Figure 1/3 and 1/4 of a distribution system by the example. For further details see the Siemens technical description „Overload and short circuit protection in low voltage systems“, Order no. E20001-P285-A326.

Selection aid - PC tool „KUBS plus“

The KUBS plus program (short circuit current calculation, backup protection and discrimination) calculates the maximum single phase and three phase short circuit currents and the minimum single phase short circuit current in low voltage radial networks. Moreover it supports the user determining the cross sections of busbars and cables. At the same time it finds the appropriate circuit-breaker out of the complete spectrum (3WN1, 3WS1, 3WN6, 3VF).
The program is based on the instructions in DIN VDE 0102, Part 2 for calculating a single fed short circuit external to the transformer.
Order no.:
E20002-D1801-A107-A4-3Z00

Smallest short circuit current

For protection via switch off, e.g. in TN systems (network), it is necessary to determine the smallest short circuit current in the case of a short circuit between an outer conductor and the PEN conductor at the end of the cable. It must be determined whether the automatic switch off carried out by the protective device at this value of the short circuit current takes place within the specified time.

Rated short circuit breaking capacity

The rated short circuit breaking capacity I_{cn} (= I_{cu} = I_{cs}) and the rated short circuit making capacity I_{cm} for the circuit-breaker must be at least as high as or greater than the interference-free initial short circuit alternating current I''_k or peak short circuit current i_p that occurs at the mounting location.

Fig. 1/3

Initial short circuit alternating current I''_k as function of cable length l and cable cross-section q (example)

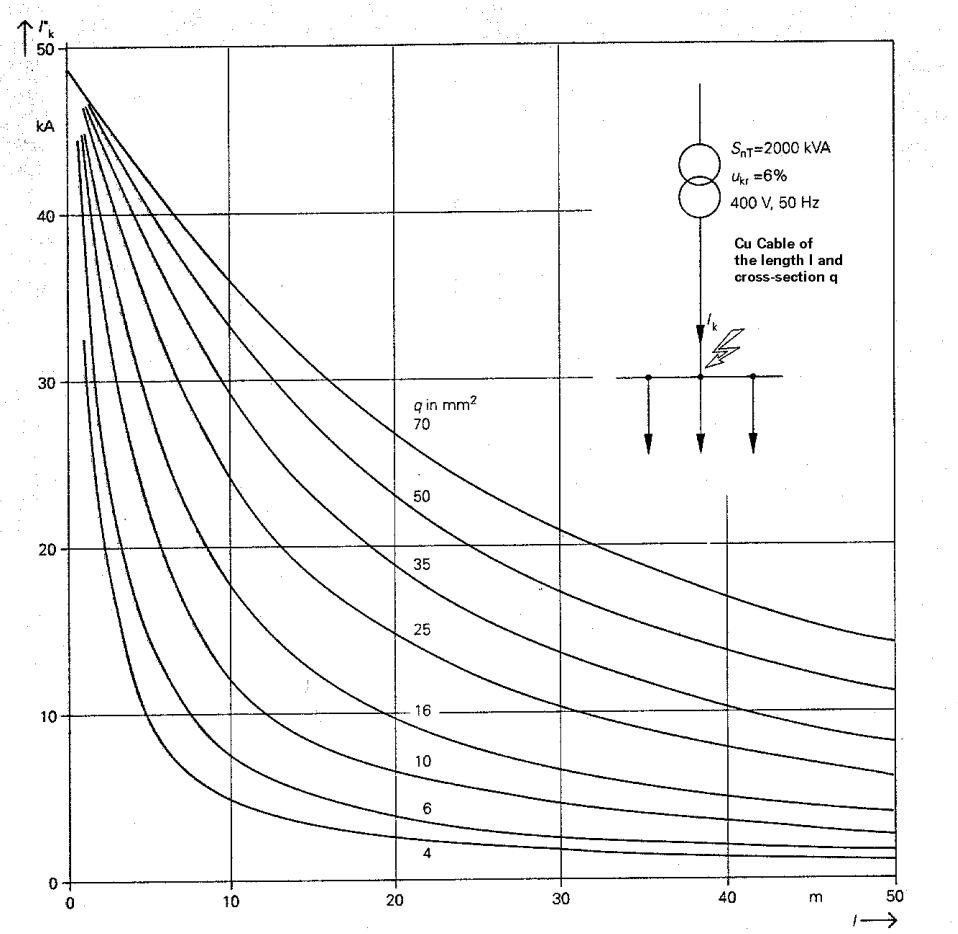
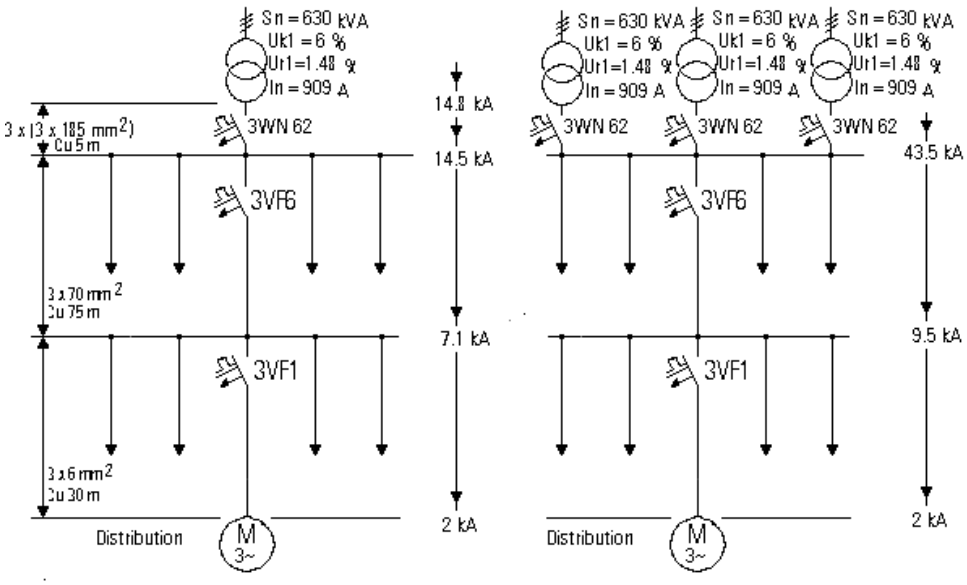


Fig. 1/4

Damping of the short circuit current due to cables and conductors of a distribution system for one (a)) and three (b)) transformers



a) Infeed via one transformer

b) Infeed via three transformers

1.7. Selection criteria for circuit-breakers - in general

⌦ Application
- AC applications
  System protection / general protection
  Motor protection
  Generator protection
  Protection of capacitors
- DC applications (3WN1)

> *Select the type of release and switching principle*

⌦ Operational current of the system/ branch I_e
- Surrounding temperature

> *Select the circuit-breaker size and nominal current*

⌦
- Expected short circuit current for the system at the mounting location I''_k
- Operational voltage for the system

> *Select the switching capacity for the circuit-breaker*,

characterised by the value pairs:

* I_{cu} (kA) at U_e (V)
Rated ultimate short circuit breaking capacity

* I_{cs} (kA) at U_e (V)
Rated service short circuit breaking capacity

⌦ Requirements for the short time withstand current I_{cw} (1-second current)

> I_{cw} *medium - high* — Air circuit-breaker (3WN)
Vacuum circuit-breaker (3WS1)
(grading for high current values)

> I_{cw} *low* — Air circuit-breaker (3W...) / (3VF...)
(time discriminating grading for low current values)

> I_{cw} *not specified* — Moulded case circuit-breaker (3VF...)
(time discriminating not necessary) — (current discriminating grading)

⌦ Is short circuit current limiting necessary ?

> *Moulded case circuit-breaker 3VF*

⌦ Operating / switching frequency:
Local or remote controlled?

> *Select the operating mechanism*
- Manual operating mechanism with spring closing
- Manual operating mechanism with stored spring energy
- Electrical closing for remote control
- Switch off for remote control

⌦ Requirements for contact life time / operating cycle counter

> high: Vacuum circuit-breaker (3WS1)
medium: Air circuit-breaker (3WN...)
low: Moulded case circuit-breaker contacts are not replaceable) 3VF...

⌦ Easy circuit-breaker maintenance / replacement or visible contact gap necessary

> Draw-out circuit-breaker

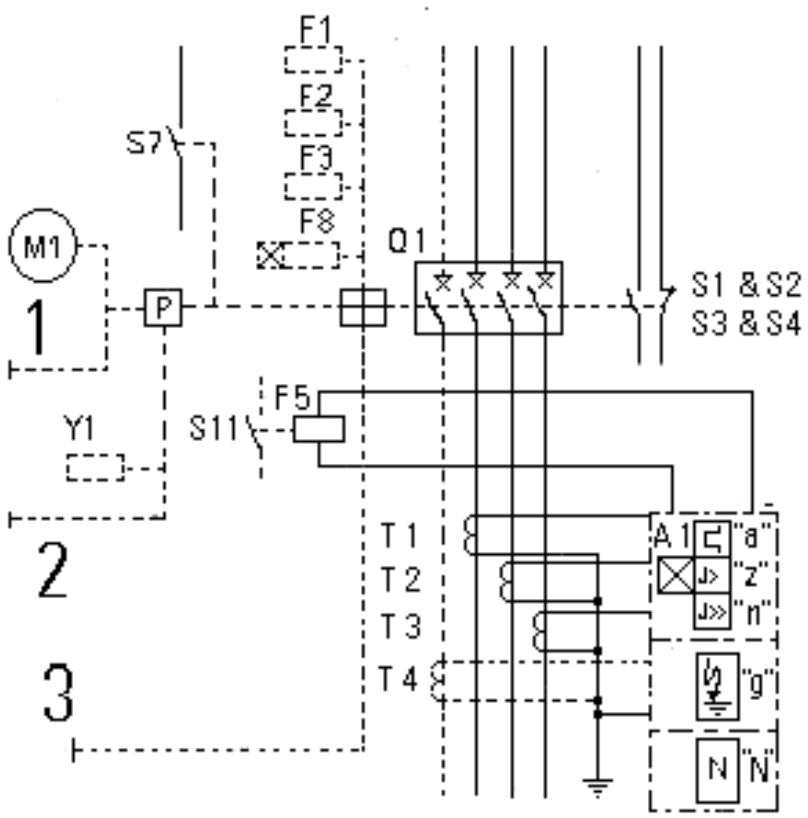
⌦ Accessories
E.g. Auxiliary release, mechanical interlocking, and auxiliary, tripped, and status signalling

2. Construction and Operation of the Circuit-Breaker

2.1. Construction

Depending on the particular version, 3WN6 circuit-breakers comprise the following component parts:

- Basic breakers with contact systems, breaker mechanism, spring storage and operating handle
- Motorised operated mechanism
- Closing solenoid system (used to switch on the circuit-breaker)
- Overcurrent release system (OCR) consisting of:
  - current transformers
  - evaluating electronics
  - tripping solenoid
  - mechanical reclosing lockout
  - tripped signalling contact
- Shunt release
- electrical closing lockout
- Auxiliary switches
- Signalling contact for spring charging status
- Signalling contact for "ready to close"
- Horizontal terminal bars supplied as standard for fixed mounted and draw-out circuit-breakers; as option:
  - Terminal bars accessible from the front with single tier screw-mounting or with two tier holes for mounting in accordance with DIN 43673
  - Vertical rear connections for the guide frames and also available as accessories for fixed mounted circuit-breakers
- Auxiliary connectors
- Control panel with displays for contact position, stored energy status and ready to close; an operating handle; overcurrent releases with adjustment and display elements as well as ON and OFF push buttons.



1 Handle for charging the spring
2 Mechanical ON push button
3 Mechanical OFF push button

Fig. 2/1 Functional diagram of the circuit-breaker

Q1	Main contacts		
	Operating handle	switch on	
	ON pushbutton		
P	Spring energy store		
Y1	Closing solenoid		
S7	Ready to close contact		
	Off pushbutton	switch off	
F1	1st shunt release „f"		
F2	2nd shunt release „f"		
F3	Undervoltage release „r"		
F8	Delayed undervoltage release „rc"		
T1 to T3	Current transformer	Overcurrent release system	
T4	Current transformer for earth fault/N conductor protection		
A1	Solid sate overcurrent release (evaluating electronics)		
F5	Tripping solenoid		
S11	Tipped signalling contact		
S1 to S4	Auxiliary contacts	Breaker contact status	

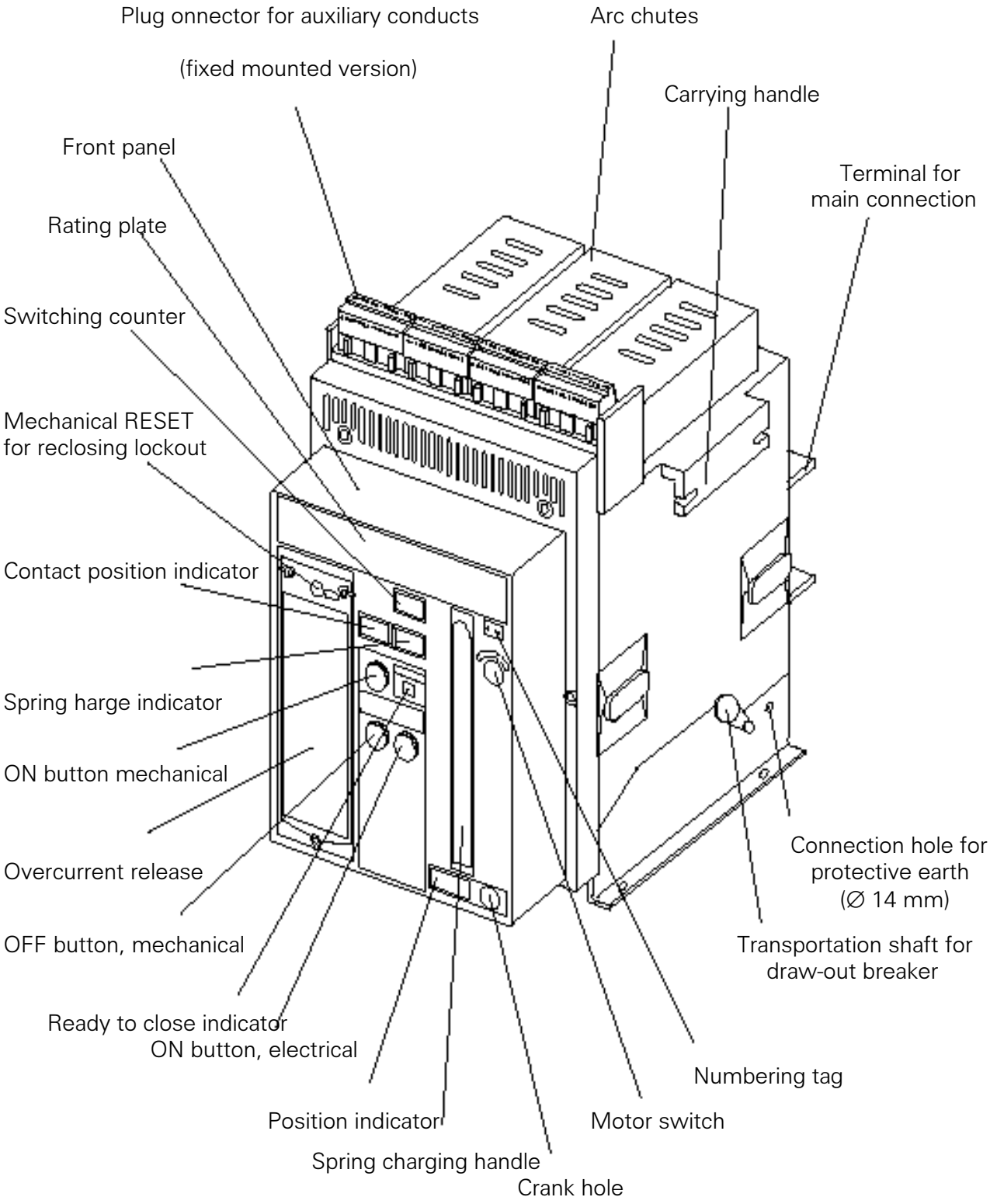
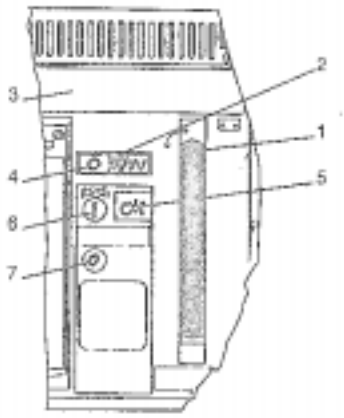
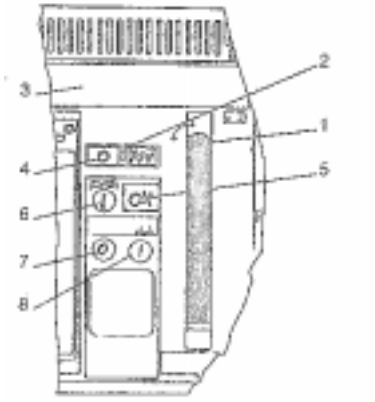
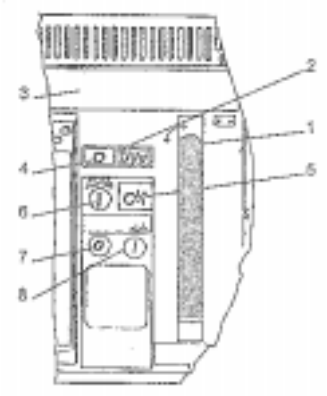


Fig. 2/2 3WN6 draw-out circuit-breaker

2.2. Operating mechanism

Version	Function	Closing (ready to close indicator shows "OK")
Manual operating mechanism with stored-energy feature with mechanical closing. 	By pumping the operating handle (1) several times, the spring energy store is tensioned until the operating handle can be moved without any detectable resistance and the stored energy indicator (2) indicates that the spring energy store is ready for closing If all the conditions are met for closing, the ready-to-close indicator (5) displays "OK".	By pressing the „mechanical ON" pushbutton (6) which operates directly on the storage mechanism.
Manual operating mechanism with stored energy feature with mechanical closing and electrical closing 	By pumping the operating handle (1) several times, the spring energy store is tensioned until the operating handle can be moved without any detectable resistance and the stored energy indicator (2) indicates that the spring energy store is ready for closing. If all the conditions are met for closing, the ready-to-close indicator (5) displays "OK". The stored energy can be released for closing either mechanically or electrically.	1. By pressing the „electrical ON" pushbutton (8). 1. By remote control via closing solenoid (Y1). 1. By pressing the „mechanical ON" pushbutton (6) which operates directly on the storage mechanism. This pushbutton has a sealing cap, because it can override necessary electrical interlockings.
Manual/motorised operating mechanism with stored energy feature with mechanical closing and electrical closing. 	Motorised tensioning: The spring energy store is automatically tensioned by the geared motor as soon as voltage is applied to the auxiliary supply terminals. After closing, the spring energy is automatically tensioned for the next closing operation. Manual tensioning: By pumping the operating handle (1) several times, spring energy store is tensioned until the operating handle can be moved without any detectable resistance and the stored energy indicator (2) indicates that the spring energy the energy store is ready for closing. The manual and motorised operating mechanisms are mechanically decoupled, there is no mutual interference. If all the conditions are met for closing, the ready-to-close indicator (5) displays "OK". The stored energy can be released for closing either mechanically or electrically.	1. By pressing the „electrical ON" pushbutton (8). 1. By remote control via closing solenoid (Y1). 1. By pressing the „mechanical ON" pushbutton (6) which operates directly on the storage mechanism. This pushbutton has a sealing cap, because it can override necessary electrical interlockings.

1 Operating handle
2 Stored energy indicator
3 Front panel of the breaker
4 Switching state indicator
5 Ready-to-close indicator
6 „Mechanical ON" pushbutton
7 „Mechanical OFF" pushbutton
8 „Electrical ON" pushbutton

2.3. Closing

2.3.1. Ready-to-close condition

The 3WN6 circuit-breaker can be closed provided that the following conditions are met:

- Circuit-breaker is open
- stored energy mechanism is charged
- Undervoltage release is energised (if present)
- Shunt release is not energised (if present)
- Closing solenoid is not energised
- OFF pushbutton must not be locked in the OFF position
- Mechanical reclosing lockout is released
- Crank hole of draw-out circuit-breaker is closed
- Mutual mechanical interlocking must not be activated (if present)
- Further interlocks must not be activated (if present)

Not ready to close

Ready to close

Fig. 2/3 Ready-to-close indicator

When all conditions relevant for the version of the circuit-breaker are met, it is ready to close. This state is signalled optically as standard by the ready-to-close indicator in the control panel (as shown in Fig. 2/3) and electrically by the signalling switch S7.
The circuit-breaker must be in the ready-to-close state before closing is possible.

If it is not in the ready-to-close state and any ON command is brought to the breaker, there will be no discharging of the energy storage mechanism and no moving of the contacts.

As a standard every circuit-breaker is supplied with a mechanical „anti-pump-mechanism". A permanent ON-command will not produce any closing of the circuit-breaker after it has tripped or after an OFF-command. However, if the ON-command is connected in series with the ready-to-close signal this will produce a closing of the circuit-breaker whenever the ready-to-close signal appears, even after a tripping of the circuit-breaker.

2.3.2. Locking to prevent closing

Circuit-Breaker can be prevented from closing under general or specific conditions by a range of mechanical and/or electrical locking devices. Depending on the version of circuit-breaker, it can be locked against closing by an individual locking device or a combination of devices.
For mechanical locking, various safety locks, a locking device and mutual mechanical interlocking are available.
Electrical locking can be implemented with either an undervoltage release or, if an uninterrupted power supply is available, with a shunt release that is permanently energised.

"Mechanical ON" button

In its standard form, the mechanically operating ON is a pushbutton. If the breaker is equipped with an electrical closing, the "mechanical ON" pushbutton is covered with a sealing cap. A 3SB1 safety key lock (or other type: CES, BKS, IKON) can also be supplied instead of the standard pushbutton. If the key is removed in the "0" position, it is no longer possible to bypass the electrical ON interlocking circuitry.

"Electrical ON" button

The electrical „operating ON" pushbutton allows the regular electrical ON. External electrical interlocking is easily implemented by series connection with this pushbutton. This button can replace a local control device (located in the cubicle door). A sealing cap or safety lock is available for this pushbutton.

2.4. Switch OFF

The 3WN6 circuit-breaker can be switched off:

Under normal conditions:

- By pressing the OFF pushbutton on the control panel of the breaker
- Via auxiliary releases (all types) by remote control, either direct wiring or via PROFIBUS DP (see communication)

Under fault conditions:

- By tripping signal from the overcurrent release system due to any fault conditions (Overload, earth fault, short circuit, etc.).

"Mechanical OFF" button

In its standard form, the mechanically operating OFF is a pushbutton. An additional sealing cap protects the button from unauthorised use.
A 3SB1 safety key lock (or other type: CES, BKS, IKON) can also be supplied instead of the standard pushbutton. If the key is removed in the "0" position, it can be used to unlock another circuit-breaker (in accordance with a key circulation sequence).

EMERGENCY STOP pushbutton

This mushroom head pushbutton latches in the OFF position when it is operated, and the circuit-breaker cannot be closed again, until the pushbutton has been unlatched by turning the mushroom head.

Locking device to prevent closing

This locking device fitting into the control panel covers the „mechanical ON" button being in the locking position and it retains the „mechanical OFF" button in the depressed position. The locking device can be secured in closed with up to 4 padlocks.

CASTELL, FORTRESS or KIRK KEY lock

The 3WN6 can be prepared for these locking devices with a mounting kit. When a lock is installed, the circuit-breaker is prevented from closing and the "conditions for an isolator" are met in the OFF position. An additional access lock can also be supplied for CASTELL, FORTRESS and KIRK KEY locks with a flap that prevents insertion of the key. The flap can be secured with up to 4 padlocks.

2.5. Auxiliary release

Up to two auxiliary releases can be installed at the same time. Undervoltage and shunt releases are available. The shunt releases are intended for opening under normal conditions. They also feature another function - electrical locking to prevent closing (continuously energised).
The following combinations are possible:

	1	shunt release
or	1	undervoltage release
or	2	shunt release
or +	1 1	shunt release undervoltage release

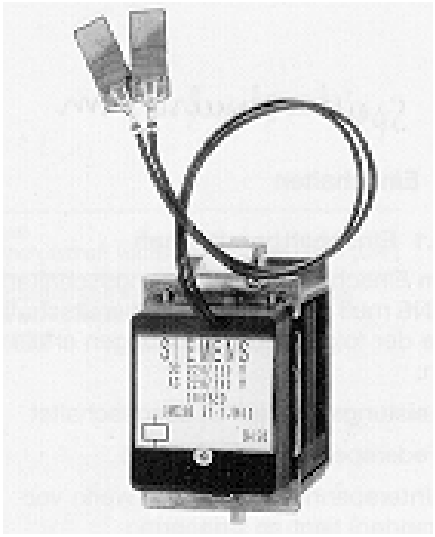


Fig. 2/4 Shunt release "f"

Auxiliary release	Application	Method of operation
Shunt release "f" (F1, F2)	For remote opening of the circuit-breaker and locking to prevent closing	The shunt release is designed for continuous energization. It locks the circuit-breaker against closing and prevents accidental repeat action
Optionally with stored energy device 3WX3156-1J . . . 01	To ensure short term tripping of the circuit-breaker (5 seconds to 5 minutes, depending on the charging level) after interruption of the control voltage.	The control voltage for stored energy device as well as for shunt release must be equal. When the control voltage is applied, the stored energy device recharges automatically.
Undervoltage release "r" (F3)	For remote opening, locking the circuit-breaker, use of the circuit-breaker as EMERGENCY STOP switch in conjunction with a separately fitted EMERGENCY STOP device.	On deenergization (voltage drop), the undervoltage release opens the circuit-breaker. This release can also be switched over from a delay of 0 to 100 ms in order to allow voltage interruptions without tripping.
Undervoltage release with delay "rc" (F8)	For remote opening, locking the circuit-breaker, in case the short time voltage interruption should not cause the circuit-breaker to trip (e.g. during motor starting).	The delay unit integrated in the undervoltage release stores energy for up to 3.2 s for supplying the release. If the voltage interruption lasts longer than the set delay time, the circuit-breaker is tripped. The delay time can be set at the undervoltage release as required to a multiple of 0.1 s between 0.2 and 3.2 s.

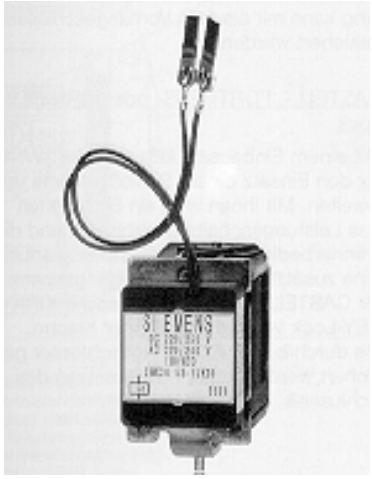


Fig. 2/5
Undervoltage release "r"

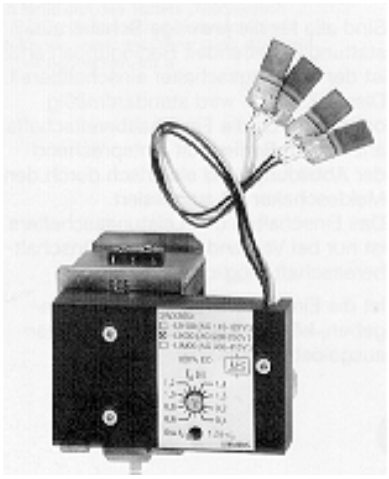
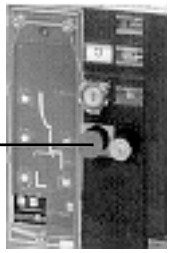
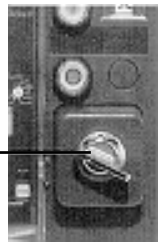
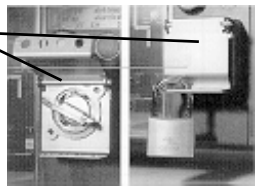
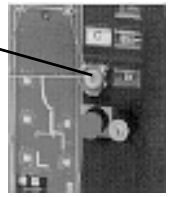
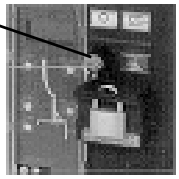
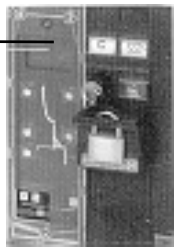


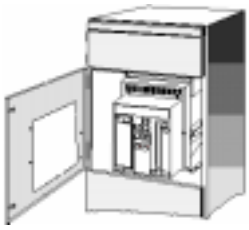
Fig. 2/6
Undervoltage release with delay "rc"

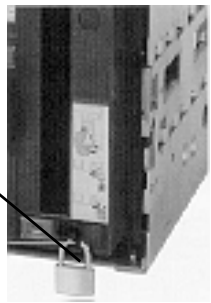
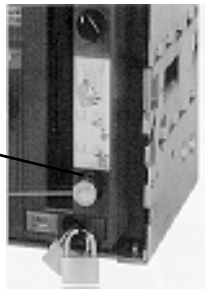
2.6. Opening and locking device

Blocking/locking device mounted on the control panel	Activation of the lock	Effectiveness
Locking device covering the "mechanical OFF" and "electrical ON" buttons 	Up to 4 padlocks prevent access to the buttons for mechanically operated opening and electrically operated closing, with the "mechanical OFF" button locked in the pressed position.	Prevents mechanically and electrically operated closing.
EMERGENCY STOP pushbutton (self-latching) 	Activation by pressing the EMERGENCY STOP button which is fitted in place of the "mechanical OFF" button.	Prevents mechanically and electrically operated closing until the pushbutton is released by turning the EMERGENCY STOP button.
CASTELL or FORTRESS or KIRK KEY lock 	The "mechanical OFF" button is locked in the pressed position. In the "0" position (lock not active), the keys are unremovable. In the "1" position (lock active), the keys are free and can be removed.	Prevents mechanically and electrically operated closing.
Access prevention with locks made by CASTELL, FORTRESS, KIRK KEY 	A covering flap is locked with up to 4 padlocks in front of the lock, to prevent insertion of the key.	Prevents mechanically and electrically operated closing.
Safety lock (CES, BKS, IOKON) instead of the "mechanical OFF" button	Locked Key cannot be removed unless in ON position	Prevents mechanically and electrically operated closing.
Sealing cap covering the "mechanical ON" button 	Sealed	Prevents mechanically operated closing; closing stays possible via "electrical ON" button or remote control.
Safety lock (CES, BKS, IKON) instead of the "mechanical ON" button 	Locked	Prevents mechanically operated closing; closing stays possible via "electrical ON" button or remote control.

Blocking/locking device mounted on the control panel	Activation of the lock	Effectiveness
Sealing cap covering the "electrical ON" button.	Sealed	Prevents electrically operated closing from the control panel, closing is still possible via remote control.
Sealing cap covering the "mechanical OFF" button.	Sealed	Prevents mechanical operated opening at the control panel, opening is still possible via auxiliary release or remote control.
Transparent cover in front of the overcurrent release (standard) 	Sealed	Blocks access to parameter setting areas, the query and test buttons remain accessible.

Electrical closing locks mounted in the circuit-breaker	Activation of the lock	Effectiveness
Undervoltage release	No voltage supplied to the undervoltage release	Prevents mechanically and electrically operated closing.
Shunt release (also implementable as electrical closing lock)	Voltage supplied to the shunt release	Prevents mechanically and electrically operated closing.

Blocking/locking device	Activation of the lock	Effectiveness
Mutual mechanical interlocking 	Activated by the contact positions of the circuit-breakers	Prevents mechanically and electrically operated closing.
Locking device to prevent closing of the cubicle door 	Safety lock (CES, BKS, IKON, O.M.R.). On the front panel of the switchgear cubicle	Prevents mechanically and electrically operated closing via Bowden wire. Only effective for draw-out circuit-breakers in the connected position.

Blocking/locking device	Activation of the lock	Effectiveness
Locking device to prevent movement of the draw-out circuit-breaker (standard) 	The crank hole is blocked by moving the crank hole cover into the closed position. The swivel ring then needs to be opened and locked using one or more padlocks.	Prevents opening of the crank hole and, thus, moving the circuit-breaker in the guide frame.
Safety lock (CES, BKS, IKON, O.M.R.) in the front panel to prevent movement/closing of the draw-out circuit-breaker 	Lock to prevent movement: The key is removed in the "I" position with the crank hole cover blocking the crank hole. Lock to prevent closing: The key is removed in the "I" position with the crank hole cover free of the crank hole.	Prevents opening of the crank hole and, thus, moving the circuit-breaker in the guide frame. Prevents mechanically and electrically operated closing. The circuit-breaker can still be moved.
Locking device (in the control panel) to prevent opening of the cubicle door.	Activated by a lever mechanism that moves into a ring on the inside of the cubicle door that is operated by the draw-out circuit-breaker	Effective in the connected position. When the circuit-breaker is closed, the cubicle door can not be opened (for adjustment purpose, the lock can be opened using a tool).
Locking device to prevent closing of the circuit-breaker when the cubicle door is open	Activated by an additional module that queries the position of the door before closing	Prevents mechanically and electrically operated closing.
Locking device to prevent movement when the cubicle door is open	Activated by a mechanism that prevents the hand crank being attached to the spindle shaft	Prevents attachment of the crank and, thus, moving of the circuit-breaker in the guide frame.
Lock to prevent the draw-out circuit-breaker from being inserted on the guide frame (standard)	Each guide rail is blocked against moving out and locked with padlocks	Prevents the guide rails being drawn out and, thus, insertion of a circuit-breaker in the guide frame.

2.7. Mutual mechanical interlocking

Two or three circuit-breakers can be mechanically interlocked.
For this purpose each circuit-breaker has to be fitted with an interlocking module. While being mounted the interlocking module is set for the type of interlocking required.
Draw-out and fixed mounted circuit-breakers have different but mutually compatible interlocking modules which allows them to be implemented in combination in an interlocking circuit.
Information concerning the interlocking function settings is exchanged via Bowden cables. Draw-out circuit-breakers can only be interlocked when being in a connected position in the guide frame. The circuit-breakers can be mounted side by side or above each other, the distance between them being only determined by the length of the Bowden cable. The Bowden cable of 2 m length (as standard) is delivered with each interlocking module, the minimum bending radius being 100 mm.
The mechanical endurance of the Bowden cable is 10,000 operating cycles. The interlocking module is mounted at the right side of the circuit-breaker (see Fig. 2/7) or guide frame
.

Fig. 2/7 3WN6 circuit-breaker, 4-pole, with interlocking module and Bowden cable

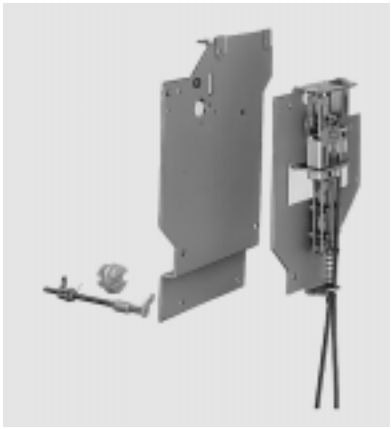
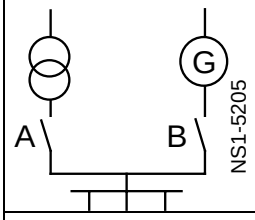
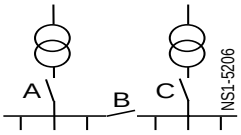
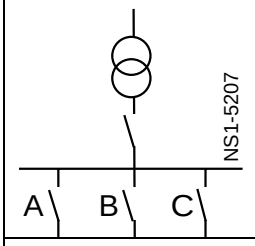
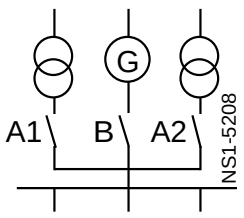


Fig. 2/8 Interlocking module with Bowden cable

Example	Version	Contact positions	Description
	1	A B 0 0 1 0 0 1	2 circuit-breakers against each other: One circuit-breaker can only be switched on if the other is switched off. Each circuit-breaker features one interlocking module and one Bowden cable. No extra Bowden cable necessary.
	2	A B C 0 0 0 1 0 0 0 1 0 0 0 1 1 1 0 0 1 1 1 0 1	3 circuit-breakers against each other: Any two circuit-breakers can be switched on, and the third will be locked. Each circuit-breaker features one interlocking module and one Bowden cable. For each breaker, one extra Bowden cable must be ordered separately.
	3	A B C 0 0 0 1 0 0 0 1 0 0 0 1	3 circuit-breakers against each other: When one circuit-breaker is switched on, the other two cannot be switched on. Each circuit-breaker features one interlocking module and one Bowden cable. For each breaker, one extra Bowden cable must be ordered separately.
	4	A B C 0 0 0 1 0 0 0 0 1 1 0 1 0 1 0	3 circuit-breakers against each other: Two circuit-breakers can be switched on independently of each other, whereas the third can be switched on only when the other two are switched off. When the third circuit-breaker is switched on the other two cannot be switched on. The two circuit-breaker feature one interlocking module and one Bowden cable each. For each breaker, one extra Bowden cable must be ordered separately.

2.8. Overcurrent release system

2.8.1. Construction

The overcurrent release system comprises the following components depending on the version used:

- 3 or 4 current transformers
- Overcurrent release
- Tripping solenoid
- Mechanical reclosing lockout
- Tripped signalling contact

In case of 3 pole circuit-breakers, 3 current transformers are installed internally. If an additional 4th current transformer is installed in the N-conductor, N-conductor overload protection is possible (for overload release version C, D, E, H, J, N and P) as well as earth fault (for version C, E, J and P). Another possibility for earth fault monitoring in a system is to mount a current transformer at the star point of the transformer.

In case of 4-pole circuit-breakers, 4 current transformers (with the exception of version B, V, E and J) are installed internally. This means that N-conductor overload protection and earth fault protection are possible.

Current Transformers

The current transformers have two functions:

- Measured value acquisition (CT's T1, T2, T3 and if applicable, T4, T5, T6)
- Power supply for the overcurrent release (only by CT's T1, T2, T3)

An auxiliary power supply is not essential for the basic functions of the overcurrent release system. Its activation, however, needs the following minimum currents through the main contact system:

- Circuit-breaker without earth fault release:
  Two-phase current:
  0.25 x nominal transformer current
  Three-phase current:
  0.20 x nominal transformer current
- Circuit-breaker with earth fault release:
  0.20 x nominal transformer current

If the solid state overcurrent release is removed the breaker is only permitted to be used when the responding current transformers are removed at the same time. Without the overcurrent release the protecting functions are taken out of service.

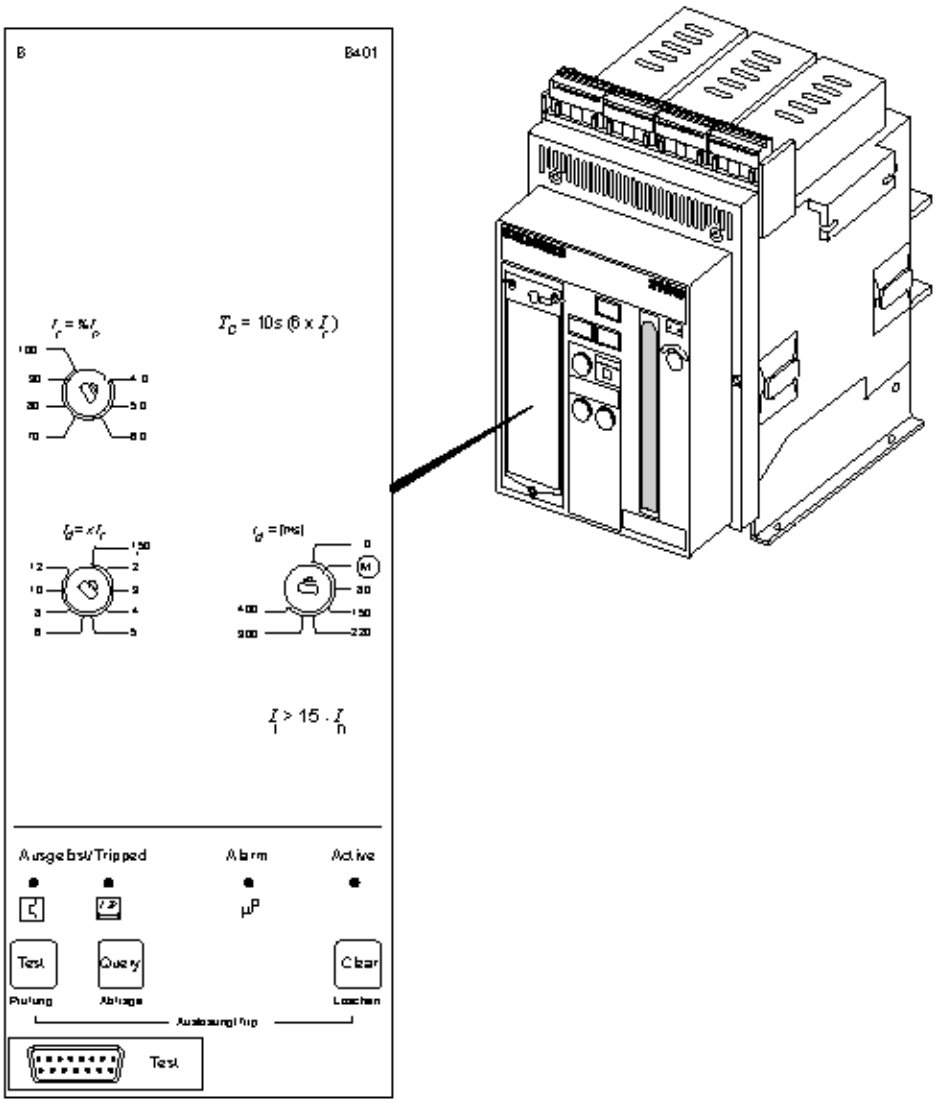


Fig. 2/9 Overcurrent release type B for 3WN6 circuit-breaker

Overcurrent release

Various versions of overcurrent release are available. They are not specific to the size of circuit-breaker and feature:

- Power supply electronics
- Signal conditioning
- Signal evaluation (µprocessor)
- Output level
- Control elements
- Signals and indicators
- Reset and test buttons

The outputs of the overcurrent release are connected to:

- the tripping solenoid

and depending on the version

- The signalling system
- The communication system
- The measurement system

The standard overcurrent release system can be used with supply frequencies of 50, 60, and 400 Hz. Digital signal processing guarantees a high and constant accuracy of the releases.

Harmonics and higher frequencies raise the temperature of the busbars and cables. The harmonics are evaluated appropriately in the overload release ("a" branch).

Working temperature range for the overcurrent release

The characteristic curves and tolerance ranges shown on the following pages are applicable for ambient temperatures of -5 to +55°C. The release can also be operated at circuit-breaker operating temperatures of from -20 to +70°C whereby an extended tolerance band may apply below -5°C and above +55°C,.

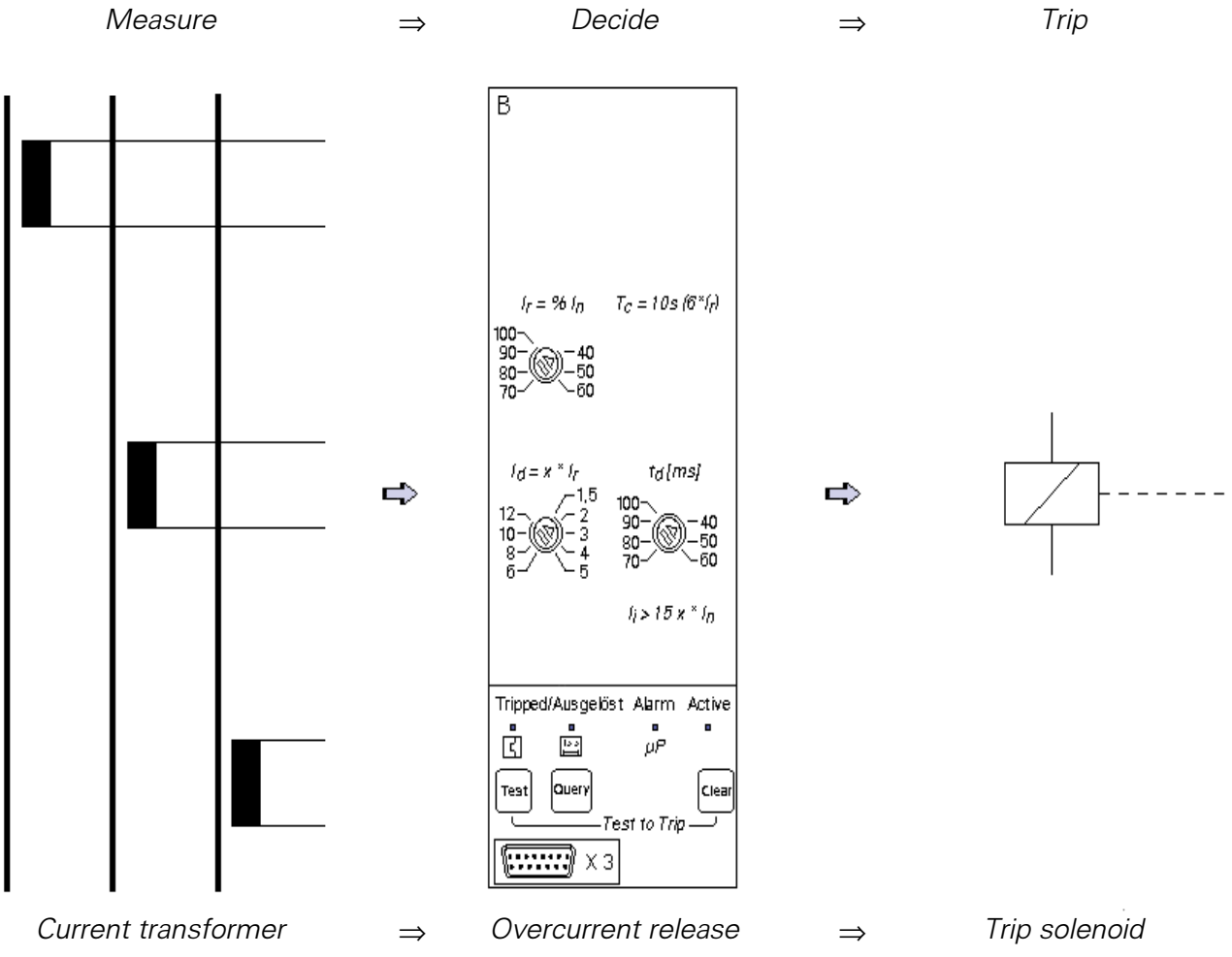


Fig. 2/10 Operating principle for the overcurrent release

2.8.2. Overcurrent release; Functions' overview

	Function	
Basic functions		
Overload protection (2.8.3.1) 	Inverse time overload release "a" for the phases	Setting of the operating current I_r from 40 % to 100 % I_n 5 % grading Grading freely programmable
		Time lag class T_r = opening time at *6 x I*, fixed setting T_r
		"Thermal" memory
		"Phase failure sensitivity" (selecteable)
	for the N-conductor [1])	Setting of the operating current I_N Time lag class T_r of the N-conductor same as of the phases
Short circuit protection (2.8.3.2) 	Short time delay short circuit release „z"	Setting of the response current I_d
		Setting of the delay time t_d
		With I^2 dependent delay, time lag setting t_d = opening time at *12 x I*,
	Instantaneous short circuit release„n"	Setting of the response current I_i
Earth fault protection (2.8.3.3) 	Earth fault release „g" [1])	Setting of the response current I_g
		Setting of the delay time t_g
		With I^2 dependent delay, $I^2 \cdot t_g$ = constant. The I^2 dependent delay applies as far as the set delay time t_g. Thereafter the tripping time is constant = t_g
Display by LCD (2.8.3.4)	Operational current display	
Display by LED (2.8.3.5)	Operating display	"Active" LED flashes when overcurrent release is activated
	Overload display Tripped display	"Active" LED flashes quickly „a"-tripping
		„z/n"- tripping
		„z"- tripping
		„n"- tripping
		„N"- tripping
		„g"- tripping/alarm
	Alarm display	µP-fault
		ϑ, temperature > 85°C
		Phase imbalance > 50 %
		Freely selectable signal, temperature > 85 °C, phase imbalance
Testing (2.8.3.6)	Internal self test with LED display	
	Connection of the test unit to the socket X3	
Basic features		
Signalling contact (1 NO)	Ready to close	Circuit-breaker can be switched on
	Tripping signalling contact	Latching; effective after "a"-, "z"-, "n"-, "g"[2])-, tripping with/without mechanical reclosing lockout
Additional features (2.8.3.7)		
Signalling via optocoupler outputs	Additional functions 1	External 24 V DC - supply for activation/parametrization (current consumption of overcurrent release at an external 24 V DC amounts to 250 mA maximum)
		µP-fault
		ϑ, Temperature > 85°C combined with phase imbalance
	Additional functions 2 as additional functions 1, but plus.....	Leading signal of „a"- tripping (200 ms ahead of tripping) / load shedding
		Load monitoring; response value 50 to 150 % Ir, 1 to 15 s
		„g"-alarm
		ZSS, short time grading control, compatible with 3WN1 and 3WS (2.8.4)
Communication via PROFIBUS-DP (2.8.5)		
Data transmission	Communication module	in combination with additional functions 2 and DP/3WN6-gateway (Order-No.: 3RK10 00-0JC80-0BA1)
	Measurement module	in combination with additional functions 2 and DP/3WN6-gateway (Order-No.: 3RK1000-0JC80-0BA1). Communication (above) plus measurement functions

1) With 3 pole circuit-breaker with asymmetrical phase loading, an additional current transformer is necessary. With 4-pole circuit-breakers, a current transformer in the N-conductor is installed inside the breaker (except overcurrent releases E and F)

2) „g"-tripping occurs in case of "Trip" setting on t_g adjustment dial of the overcurrent release or on the slide switch.

Overcurrent release version 10th position of the order No.	V „zn"	B „azn"	C/G „aznNg"	D „aznN"	E/F „aznNg"	H „aznN" 4)	J/K „aznNg" 4)	N „aznN"	P „aznNn"
		●	●	●	●	●	●	●	●
		10 s	10 s	2 - 30 s	2 - 30 s	2 - 30 s	2 - 30 s	2 - 30 s	2 - 30 s
				●	●	●	●	●	●
		❍	❍	❍	❍	●	●	●	●
		50 or 100 % I_r	50 or 100 % I_r	50 or 100 % I_r	20 - 100 % I_r	20 - 100 % I_n	20 -100 % I_n	20 - 100 % I_n	20 - 100 % I_n
	1.25 -12 x I_r I_r = 40 - 100 % I_n	*1.5 - 12 x I_r*	*1.25 - 12 x I_r*	*1.25 - 12 x I_r*	*1.25 - 12 x I_r*	*0.5 -12 x I_n*	*0.5 - 12 x I_n*	*1.25 x I_r* - 40 kA	*1.25 x I_r - 40 kA*
	0; 20 - 500 ms	0; 20 - 400 ms	0; 20 - 400 ms	20 - 400 ms	20 - 400 ms	20 - 400 ms	20 - 400 ms	20 - 400 ms	20 - 400 ms
				80 - 300 ms	80 - 300 ms	80 - 300 ms	80 - 300 ms	80 - 300 ms	80 - 300 ms
	> 15 x I_n	*> 15 x I_n*	*> 15 x I_n*	*> 1.5 - 12 x I_n* and I_i = oo with setting I_i = oo => $I_{cu} = I_{cs} = I_{cw}$ (lowest value applies)	*> 1.5 - 12 x I_n* and I_i = oo with setting I_i = oo => $I_{cu} = I_{cs} = I_{cw}$ (lowest value applies)	*> 1.5 - 12 x I_n* and I_i = oo with setting I_i = oo => $I_{cu} = I_{cs} = I_{cw}$ (lowest value applies)	*> 1.5 - 12 x I_n* and I_i = oo with setting I_i = oo => $I_{cu} = I_{cs} = I_{cw}$ (lowest value applies)	Size I: to 50 kA Size II: to 65 kA	Size I: to 50 kA Size II: to 65 kA
			20 % - 60 % I_n		20 % - 60 % I_n		20 % I_n - 1200 A		20 % I_n - 1200 A
			100 - 500 ms		100 - 500 ms		100 - 500 ms		100 - 500 ms
					100 - 500 ms		100 - 500 ms		100 - 500 ms
				●	●			●	●
	●	●	●	●	●	●	●	●	●
		●	●	●	●	●	●	●	●
	●	●	●						
				●	●	●	●	●	●
				●	●	●	●	●	●
			●	●	●	●	●	●	●
			●		●		●		●
	●	●	●	●	●	●	●	●	●
								●	●
								●	●
				● ■	● ■	●	●	●	●
	●	●	●	●	●	●	●	●	●
	●	●	●	●	●	●	●	●	●
	●	●	●	●	●	●	●	●	●
	●	●	●	●	●	●	●	●	●
				▲	▲	▲	▲	●	●
				▲	▲	▲	▲	▲	▲
				▲ ▲ ■	▲ ▲ ■	▲ ▲ ■	▲ ▲ ■	▲ ▲	▲ ▲
				▲ ■	▲ ■	▲ ■	▲ ■	▲	▲
				▲ ■	▲ ■	▲ ■	▲ ■	▲	▲
					▲		▲		▲
				▲	▲	▲	▲		▲
				▲	▲	▲	▲	▲	▲
								▲	▲

4) All functions selectable/adjustable by had held unit

● Function as standard
▲ Function at choice (add on price)
■ Function selectable/adjustable with hand held unit
❍ Function active when t_d is set to 20 ms. Available as from 02.97 date of manufacture for overcurrent release "B"

Setting and display panels for overcurrent release

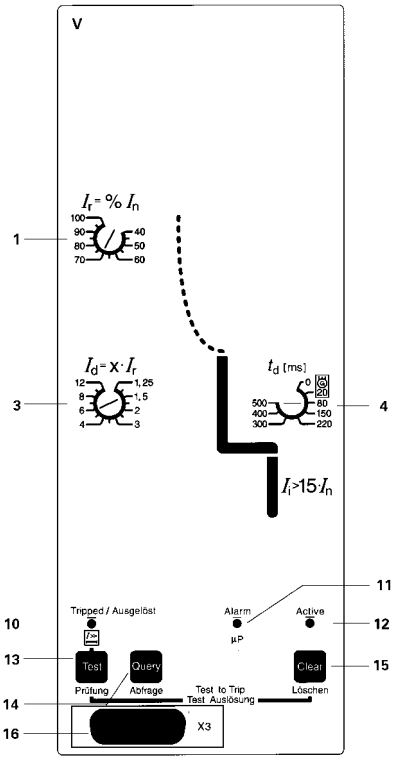


Fig. 2/11
Overcurrent release version V "zn"

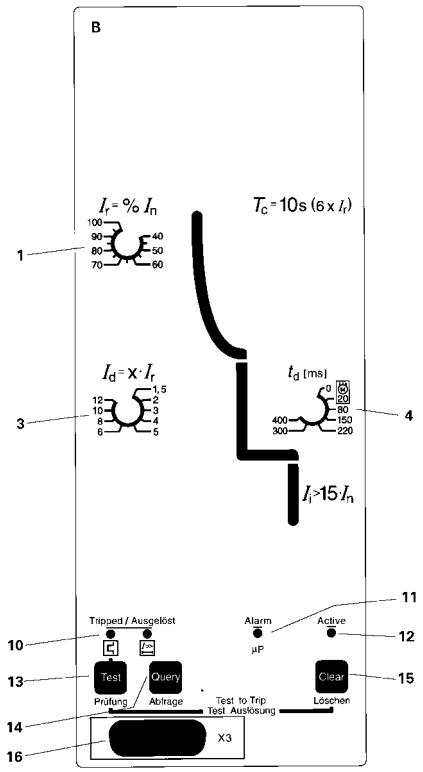


Fig. 2/12
Overcurrent release version B "azn"

Setting of overload release

1 Operating current I_r

Setting of short circuit release

3 Response current I_d of short time delayed short circuit release

4 Delay time t_d

5 Response current I_i of instantaneous short circuit release

Setting of earth fault release

6 Response current I_g

ΣI: Vector summation of phase currents and N-conductor current (only with N-conductor current transformer)

I_n Direct measurement with current transformer at the star point of the transformer

7 Delay time t_g

Alarm: Earth fault is only indicated by LED

Trip: Earth fault is only indicated by LED, circuit-breaker trips

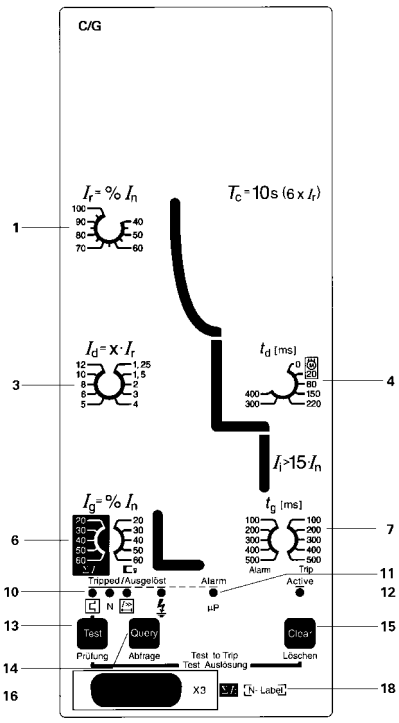


Fig. 2/13
Overcurrent release version C/G "aznNg"

Displays

10 LED-tripped displays

for overload

for short time delay short circuit release

for earth fault

11 Alarm display

μP for microprocessor-fault

12 LED for operating state of overcurrent release. Flashes (with heart beat) when the OCR is ready and in "normal" conditions.

Test functions

13 Button for function "TEST"

14 Query button for displaying the tripping cause

15 Reset button for tripped display

16 Plug socket for testing unit

18 N-Conductor protection 50 % I_N / 100 % I_N. Changeover via jumper at the rear of overcurrent release

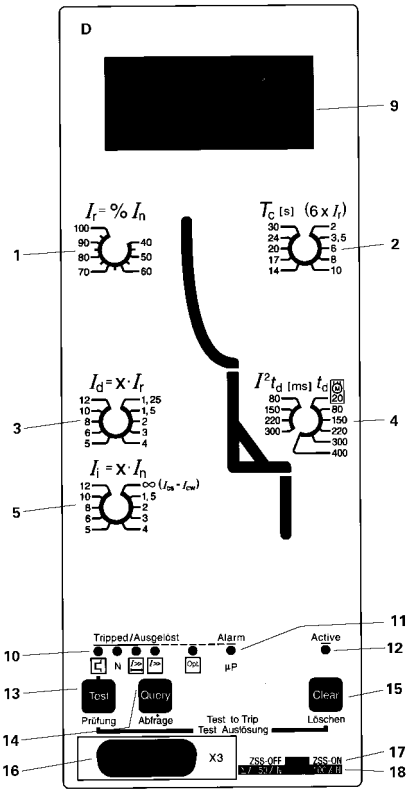


Fig. 2/14
Overcurrent release version D "aznN"

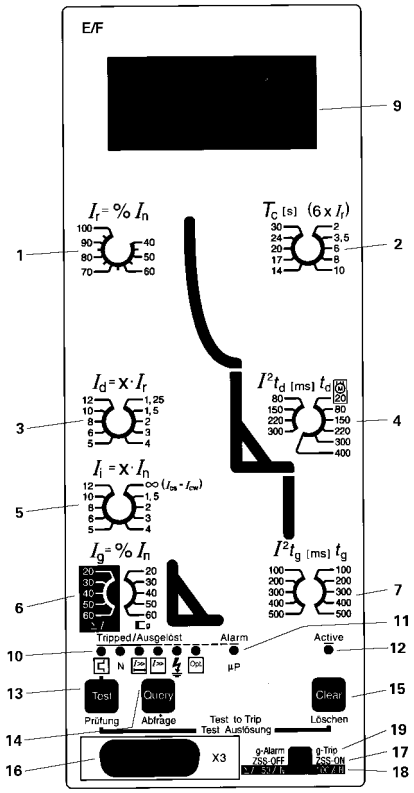


Fig. 2/15
Overcurrent release version E/F "aznNg"

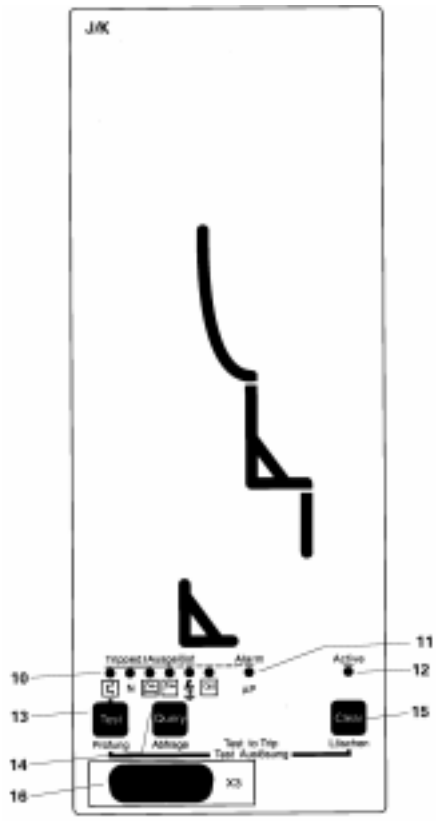


Fig. 2/16
Overcurrent release version J/K "aznNg", version H "aznN". Functions are set using programming unit.

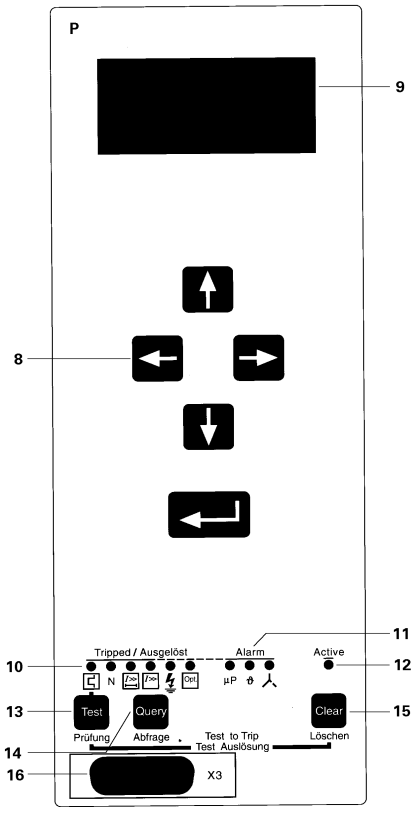


Fig. 2/17
Overcurrent release version P "aznNg", version N "aznN"

Setting of overload release

1 Operating current I_r

2 Time lag class T_c

Setting of short circuit release

3 Response current I_d of short time delayed short circuit release

4 Delay time t_d or time lag t_d of short time delayed short circuit release

5 Response current I_i of instantaneous short circuit release

Setting of earth fault release

6 Response current I_g

ΣI: Vector summation of phase currents and N-conductor current (only with N-conductor current transformer)

I_n Direct measurement with current transformer at the star point of the transformer

7 Delay time t_g or selection of I^2t_g tripping

Settings via control panel

8 All settings via the 4 arrow keys and enter key. Menu assistance via LCD display (9)

Displays

9 LCD display, 2 lines

10 LED-tripped displays for

- overload
- N N-conductor overload
- I >> short time delayed short circuit release
- I >> instantaneous short circuit release
- earth fault
- Opt freely selectable signal

11 Alarm display

- µP for microprocessor-fault
- ϑ for overtemperature
- ⅄ for phase imbalance

12 LED for operating state of overcurrent release. Flashes (with heart beat) when the OCR is ready and in "normal" conditions.

Test functions

13 Button for function "TEST"

14 Query button for displaying the tripping cause

15 Reset button for tripped display

16 Plug socket for testing / programming unit

17 ZSS - short time grading control, selectable

18 N-Conductor protection 50 % I_N / 100 % I_N switch over

19 Earth fault release "g"

Alarm: It is only indicated by LED

Trip: It is indicated by LED, circuit-breaker trips

2.8.2.1. Time current curves and tripping characteristics

These characteristic curves show the reaction of the overcurrent release when it is activated by a current already flowing before the circuit-breaker trips. If overcurrent tripping occurs immediately after closing the circuit-breaker the overcurrent release not yet having been activated, the opening time will be longer by 3 to 10 ms (depending on the overcurrent). In order to ascertain the total opening times of the circuit-breaker, about 15 ms (to allow for arc duration) should be added to the opening times shown.

The characteristic curves and tolerance ranges shown are applicable for ambient temperatures of -5 to +55°C. The releases can also be operated at circuit-breaker operating temperatures from -20 to +70 °C, but an extended tolerance band may apply below -5 or above +55°C.

Tripping characteristics "z"

Opening time

I_d adjustable as multiples of I_r (1.375; 1.5; 1.75; 2; 2.5; 3; 3.5; 4; 6; 7; 8; 10) x I_d not shown

Delay times t_d = 20; 150; 300 and 500 ms not shown

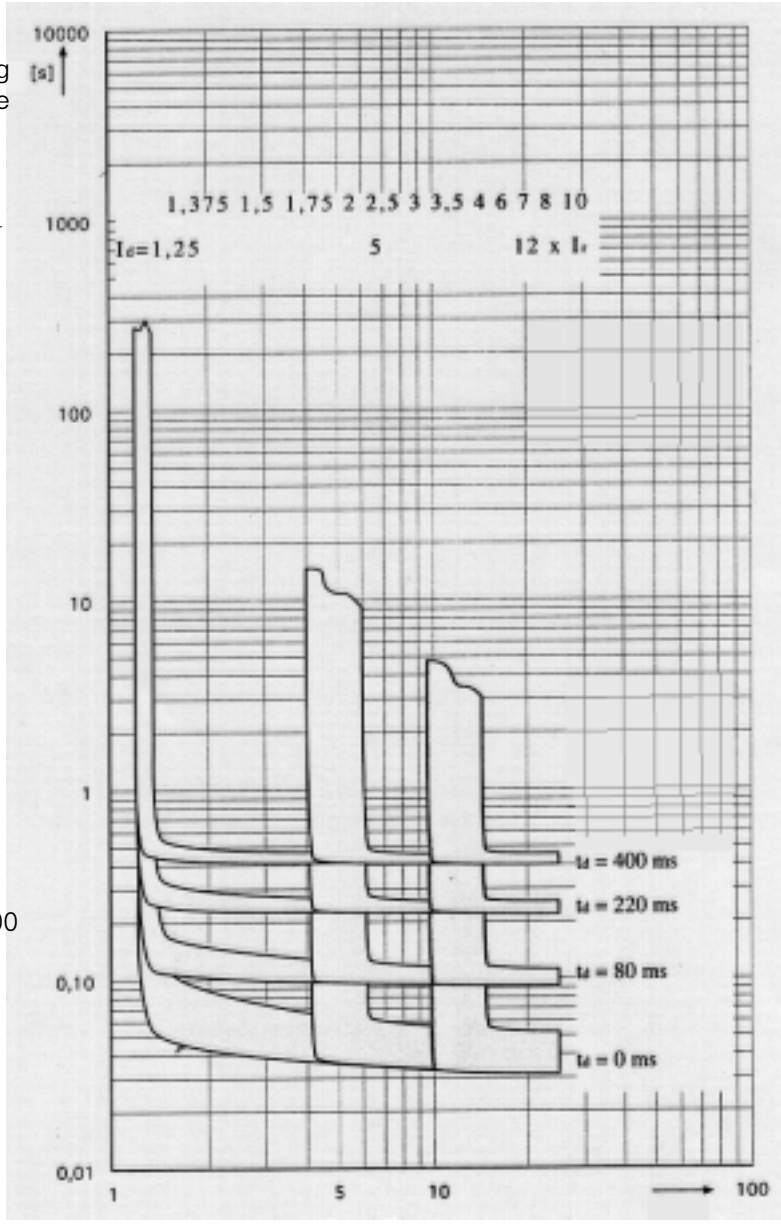


Fig. 2/18 Tripping characteristics of overcurrent release version V "zn"

Short time delayed short-circuit release "z"
I_d Response current (adjustable)
T_d Delay time (adjustable)

Instantaneous short-circuit release "n"
Fixed at > 15 x I_n
See tripping characteristic "n"

Tripping characteristics "a" and "z"

I_d adjustable as multiples of I_r (2; 3; 4; 6; 8; 10) x I_d not shown

Delay times t_d = 20; 150; 300 and 500 ms not shown

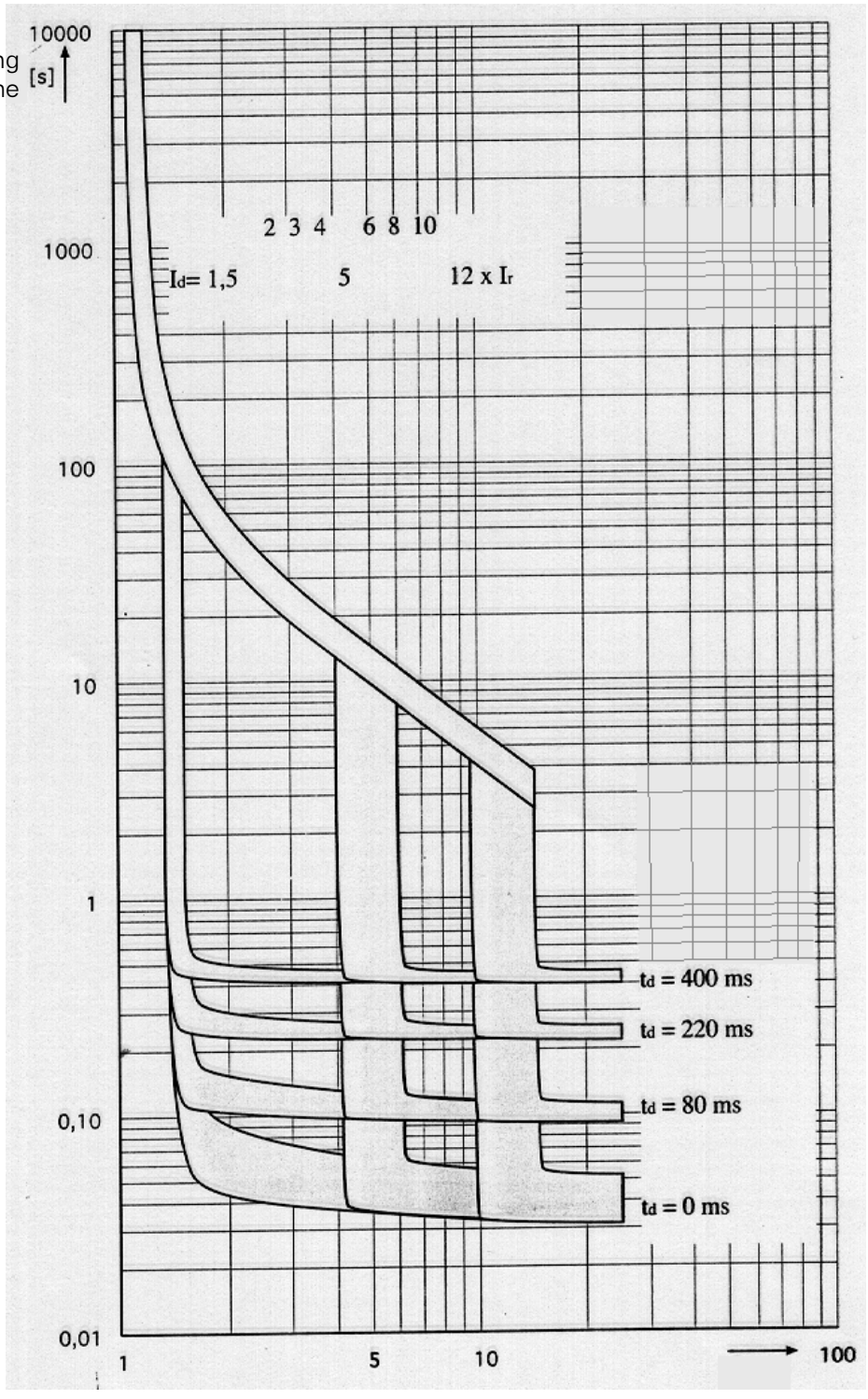
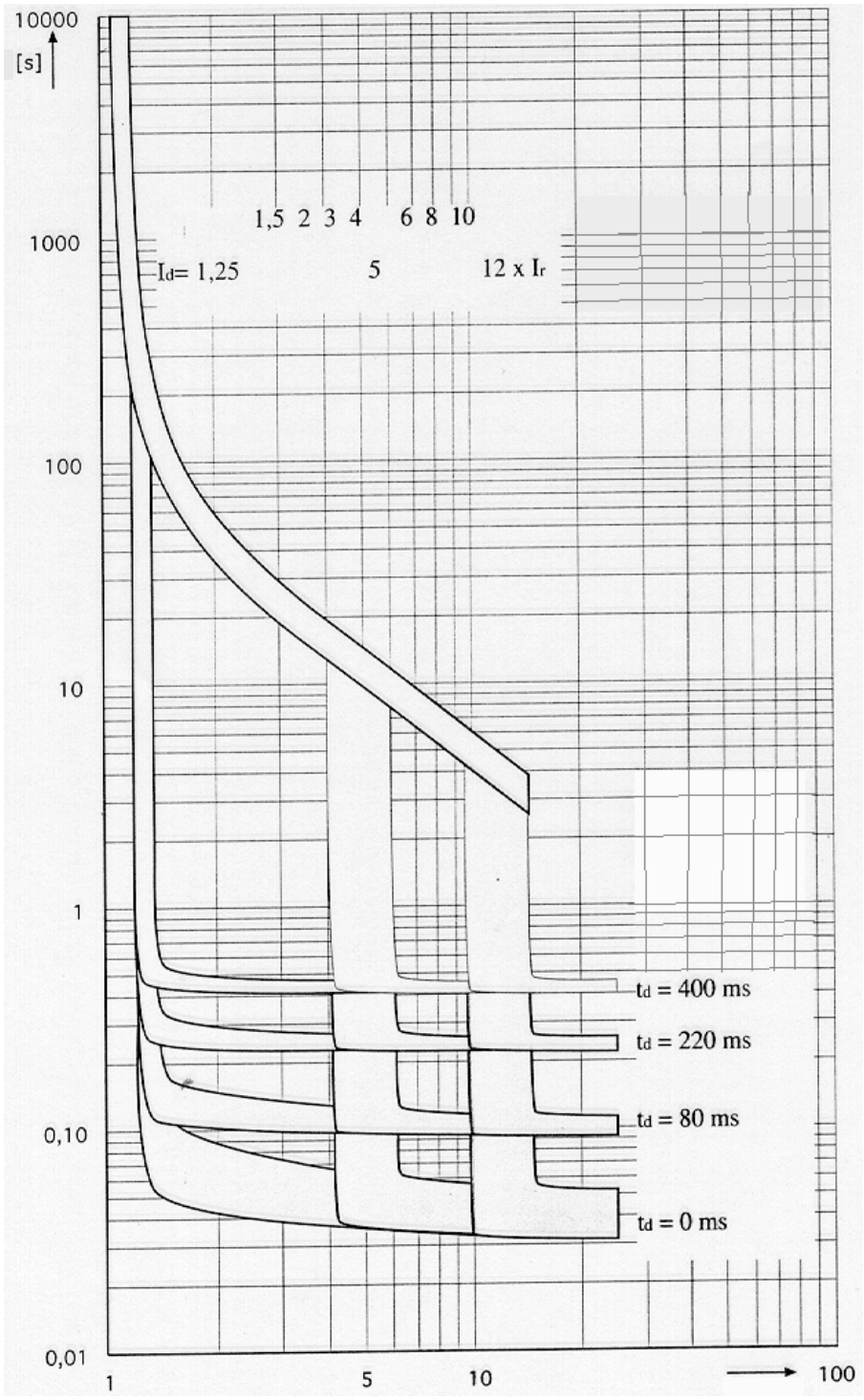


Fig. 2/19 Tripping characteristics of overcurrent release version B "azn"

Inverse time overload release "a"	Short time delayed short-circuit release "z"	Instantaneous short-circuit release "n"
I_r Operating current (adjustable)	I_d Response current (adjustable)	Fixed at > 15 x I_n
T_c Time lag class (fixed at 10s)	t_d Delay time (adjustable)	See tripping characteristic "n"

Tripping characteristics "a" and "z"

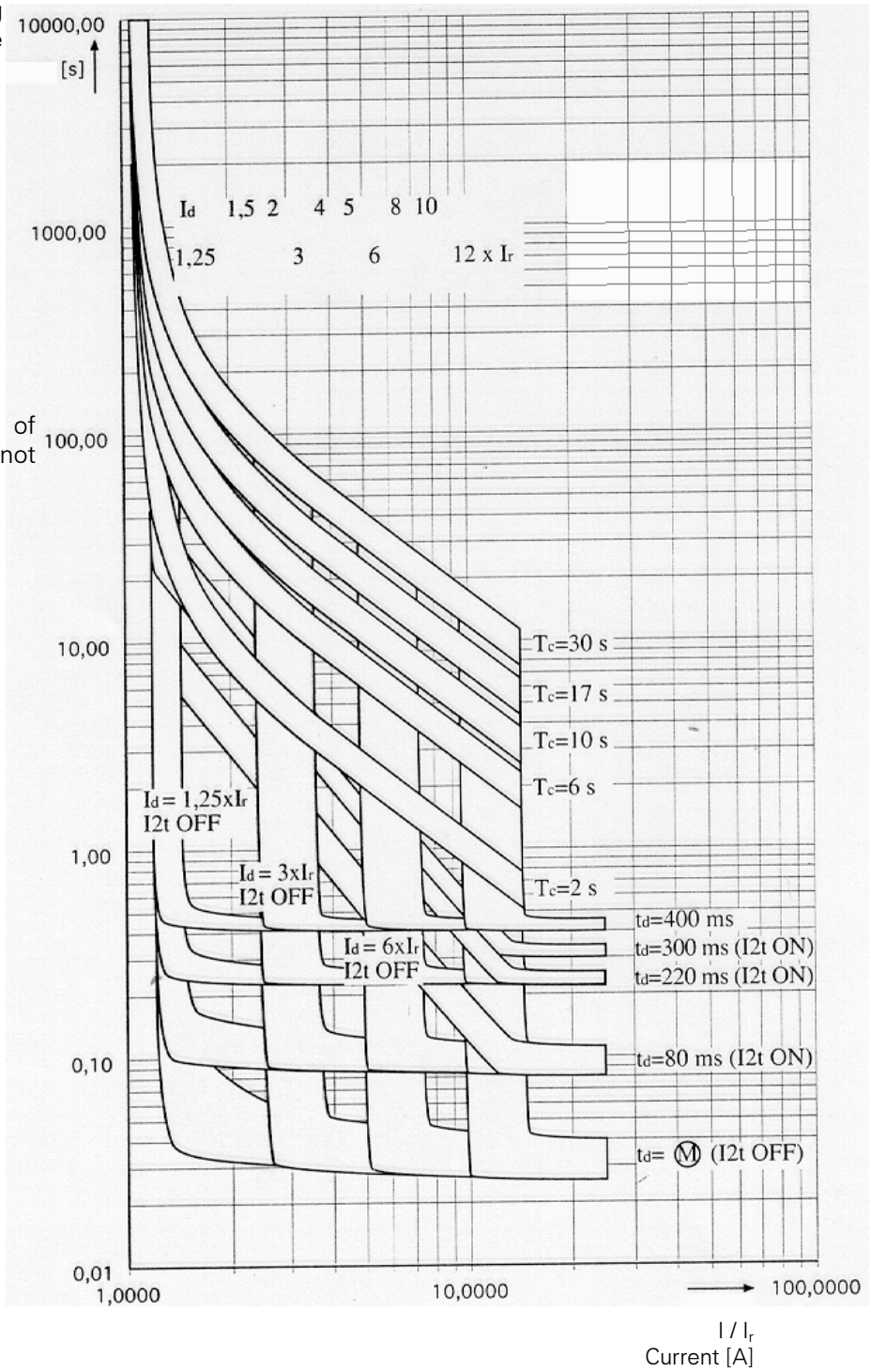


I_d adjustable as multiples of I_r; (1.5; 2; 3; 4; 6; 8; 10) x I_d not shown

Fig. 2/20 Tripping characteristics of overcurrent release version C/G "aznNg"

Inverse time overload release "a"; "N"	Short time delayed short-circuit release "z"	Instantaneous short-circuit release "n"	Earth fault "g" adjustable
I_r Operating current (adjustable)	I_d Response current (adjustable)	Fixed at > 15 x I_n	See tripping characteristic "g"
T_c Time lag class (fixed at 10s)	t_d Delay time (adjustable)	See tripping characteristic "n"	

Tripping characteristics "a" and "z"



I_d adjustable as multiples of I_r (1.5; 2; 4; 5; 8; 10) x I_d not shown

Fig. 2/21 Tripping characteristics of overcurrent release versions D "aznN" and E/F "aznNg"

Inverse time overload release "a"; "N"
I_r Operating current (adjustable)
T_c Time lag class (fixed at 10s)

Short time delayed short-circuit release "z";
I_d Response current (adjustable)
t_d Delay time (adjustable)
with delay dependent on I^2t = constant
I_d Response current (adjustable)
t_d Time lag = opening time at 12 x I_r

Instantaneous short-circuit release "n"
adjustable
See tripping characteristic "n"

Earth fault "g"
adjustable
See tripping characteristic "g"

Tripping characteristics "n"

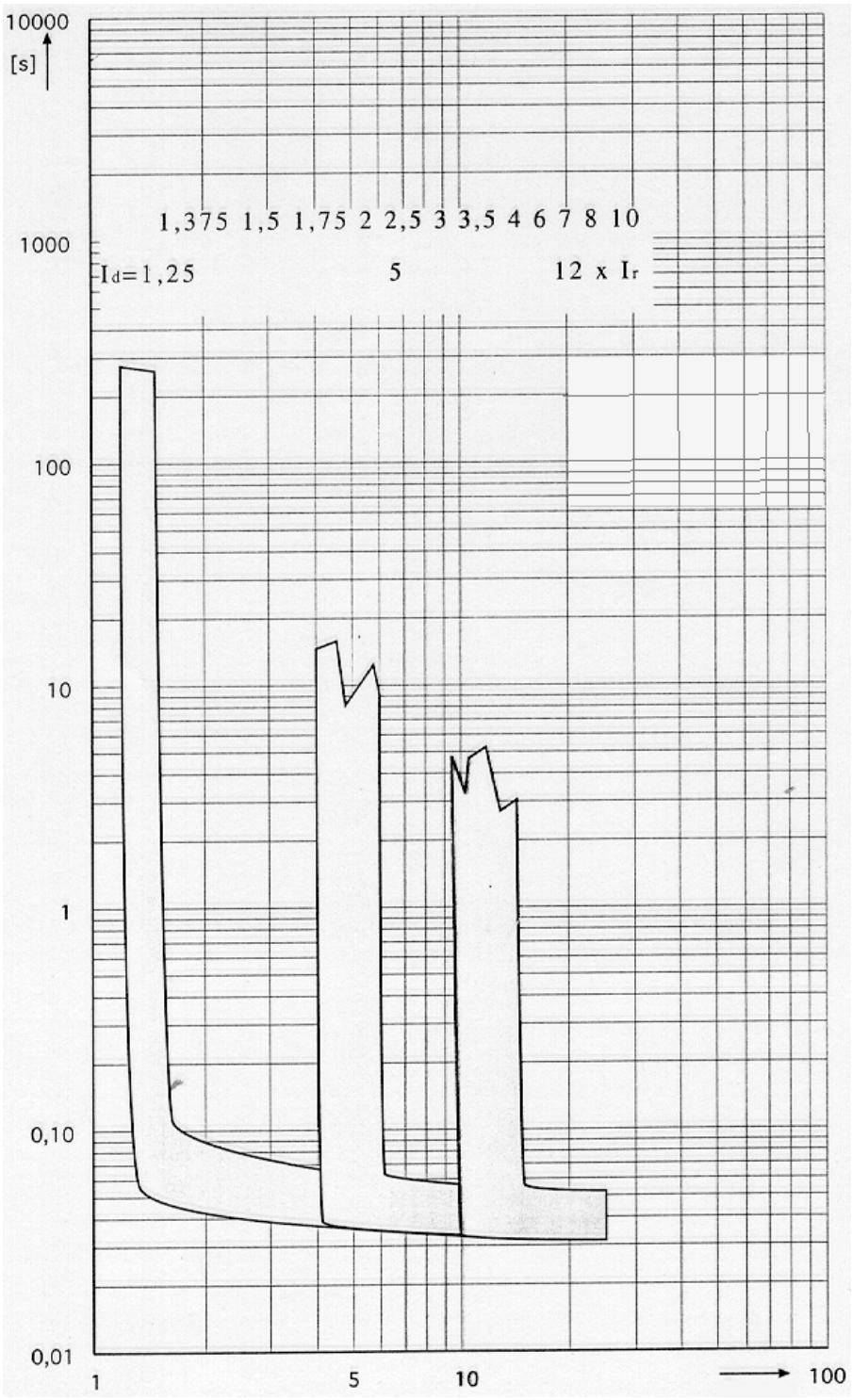


Fig. 2/22 Tripping characteristics of overcurrent release versions V, B, C/G, D and E/F

I_n Current transformer primary rated current

Instantaneous short-circuit release "n"

I_i Response current adjustable (versions D and E/F) up to 12 x I_n; > 15 x I_n causes instantaneous tripping (all versions)

In versions D and E/F, opening at > 15 x I_n can be deactivated by setting $I_i = \infty$

Tripping characteristics "g"

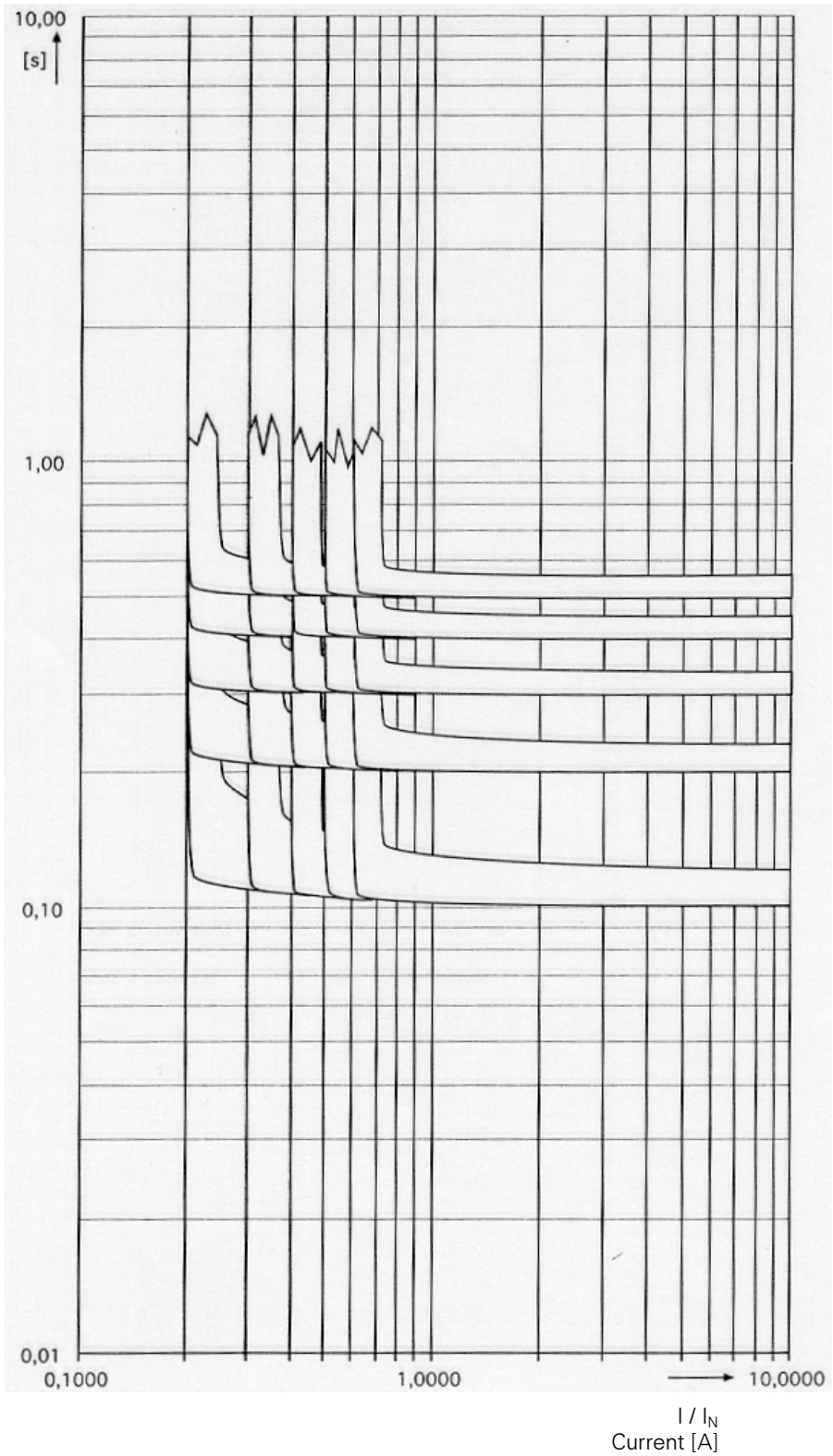


Fig. 2/23 Tripping characteristics of overcurrent release version C/G

Earth fault release "g"
Ig Response current (adjustable) I_n Current transformer primary rated current
tg Delay time (adjustable)

Tripping characteristics "g"

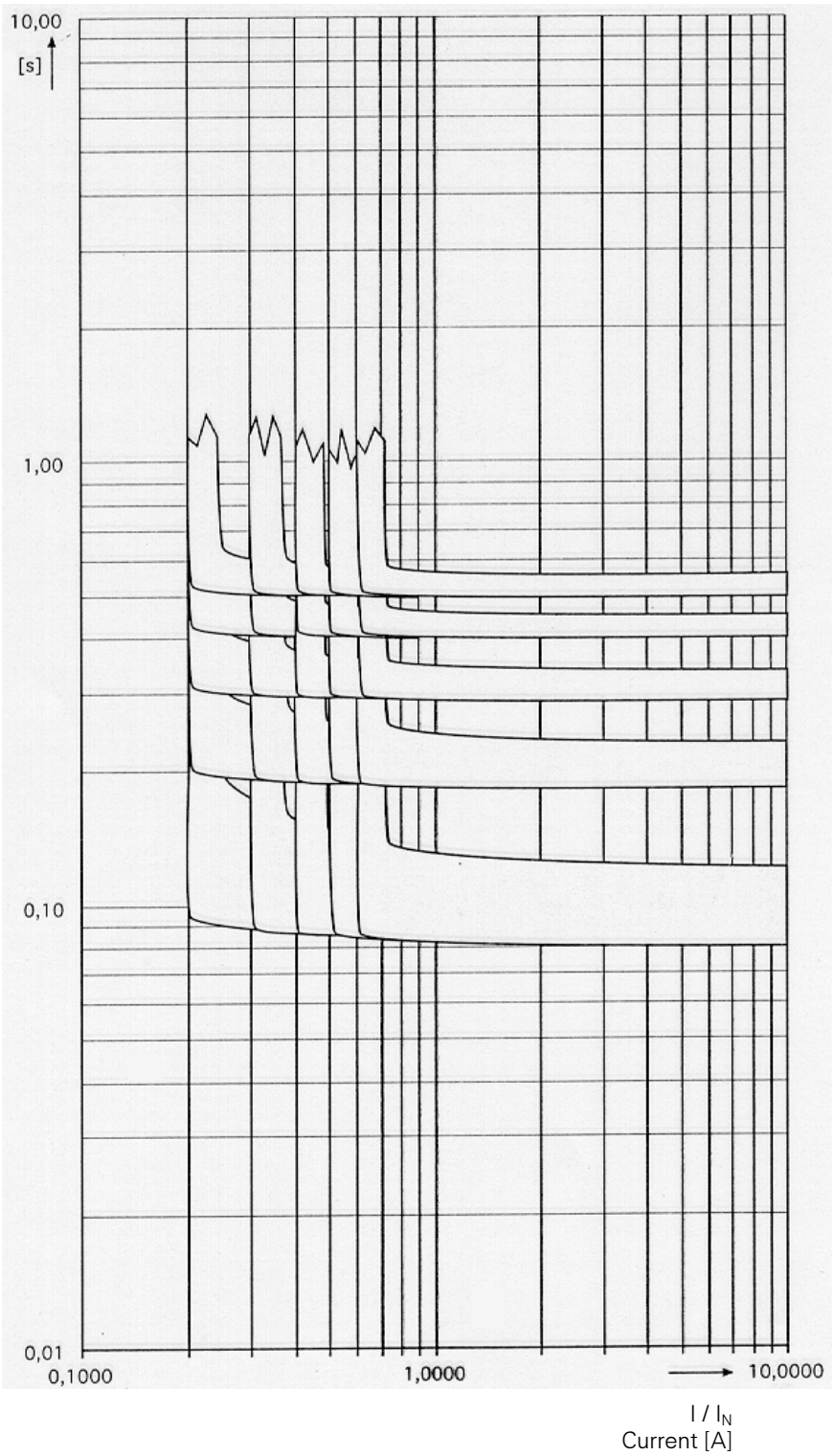


Fig. 2/24 Tripping characteristics of overcurrent release version E/F

Earth fault release "g"
Ig Response current (adjustable) *I_n* Current transformer primary rated current
tg Delay time (adjustable)

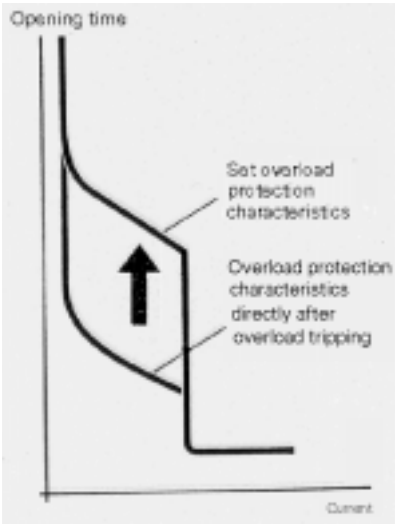


Fig. 2/25
Current time curve before and after overload "with memory"

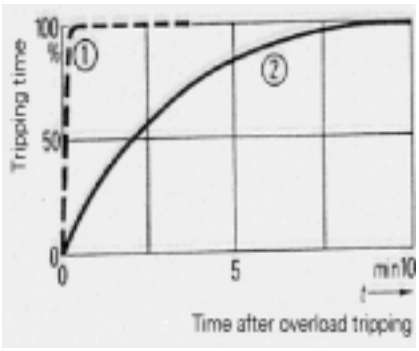


Fig. 2/26
Release time response following overload tripping
1 "no memory"
2 "with memory"

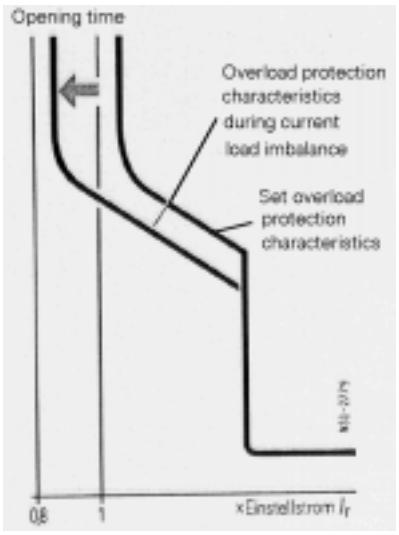


Fig. 2/27
Current time curve before and after asymmetrical current loading (>50%)

2.8.3. Functions of the overcurrent release

See also section "Overcurrent release, Functions' overview - 2.8.2

2.8.3.1. Overload protection Inverse time overload release "a"

All overcurrent releases (except version V) have overload protection as a standard feature to protect loads and lines against overloading.

In contrast to conventional Bi-metal releases the tripping characteristic is not influenced by the breaker's own rising temperature (electronically overcurrent release). This makes it possible, e.g. to restart a motor without any restrictions by the circuit-breaker.

• Thermal memory
(overload memory)
The overcurrent release versions D, E/F, H, J/K, N and P have a "thermal memory". In the case of N and P, this memory can be switched off. In contrast to Bi-metal releases that prevent closing of the circuit-breaker until they have cooled down, reclosing is possible immediately after overload tripping with a solid state release (without reclosing lock out). The time lag response of the solid state release with a switched on thermal memory is so quick following tripping that a new overload (also motor starting) is detected and leads to tripping within the shortest possible time. After an interval of at least 10 minutes following overload tripping, the solid state release operates in accordance with its set overload protection characteristics (Fig. 2/26). This prevents the load (e.g. motor) from being fed with more power than it is able to consume immediately after overload tripping.
However, if the "no memory" mode is selected, the full response time in accordance with the set characteristics is effective immediately after overload shutdown (Fig. 2/26). This permits, for example, motor restarting without a significant delay.

• Phase failure sensitivity
The overcurrent release versions B, C/G, D and E/F allow the delay time to be set to 20 ms (motor symbol) to prevent tripping as a result of inrush current peak during motor starting. When this setting is selected phase failure sensitivity is also switched on.

In overcurrent release versions H, J/K, N and P, the phase failure sensitivity can be selected independently of the set delay time t_d. The LED for phase imbalance exists in Versions N and P. The "phase failure" signal is available via optocoupler outputs in overcurrent releases version D, E/F, H, J/K, N and P with additional functions 2.
The "Phase failure sensitivity" function protects for example a 3-phase motor from overheating while running on 2-phases only. If the operating current of the lowest loaded phase falls to below 50% of the load current in the highest loaded phase, the set current I_r is reduced to 80% automatically (Fig. 2/27).

When the values for the three phase currents differ less than 50%, the breaker returns to the original setting of I_r.

• N-conductor overload protection
The overcurrent release versions C/G, D, E/F H, J/K, N and P provide thermal overload protection for the N conductor. A reduced N conductor cross-section can be taken into account by setting the release appropriately.

In case of 3 pole circuit-breakers, an additional 4th current transformer has to be installed in the N conductor of the system.

In case of 4-pole circuit-breakers, a 4th current transformer is mounted internally (except for overcurrent release version E and J). In case of overcurrent releases E and J, an additional current transformer has to be installed in the N conductor of the system.

Setting the N conductor overload protection (100% or 50% of the set current I_r)
In overcurrent release versions D, C/G and E/F, a selection switch is provided for this purpose on the front panel of the overcurrent release; in version C/G, there is a wire jumper on the rear side of the release to select the necessary adjustment. In version H, J/K, N and P the overload protection for the N conductor is set using the hand held unit or (version N and P) via the control panel.

• Other functions
It is possible to prevent tripping of the circuit-breaker with the help of an alarm signal (see "load monitoring" and "load shedding" signals; chapter 2.8.3.7) followed by switching off certain loads. If thyristor controllers (e.g. frequency converters) are connected downstream, they can be shut down by the alarm signal "leading overload release".

2.8.3.2. Short-circuit protection

To protect systems and loads in case of a short-circuit, all overcurrent releases (solid state) offer short-circuit protection. There are two types: instantaneous "n" and short time delay "z" short-circuit protection.

Instantaneous short-circuit release "n"
The instantaneous short-circuit release is set permanently to >15 x I_n in versions B, C/G and V.

In overcurrent release versions D, E/F, H and J/K, lower response values can be set for the short-circuit release. With the selector switch n to the position marked "∞", the instantaneous short-circuit release function is deactivated.

On system planning, it must be taken into account that in this case, the short time delayed short-circuit release is responsible for short-circuit protection. The rating of the circuit-breaker for the short-circuit case depends on the rated short time withstand current I_{cw} for the circuit-breaker if this is lower than the rated ultimate short-circuit breaking capacity I_{cu} for the circuit-breaker. This is necessary because the circuit-breaker must be able to withstand the short-circuit until the maximum delay time has elapsed without incurring any damage.

This means that fully discriminating systems can be implemented up to the rated short time withstand current I_{cw} i.e. up to 50 kA for size I or up to 65 kA for size II.

The response values for the "n" release versions N and P are set in absolute current units up to the rated short time withstand current I_{cw} using a menu. If the short-circuit currents are greater than 50 kA (size I), or 65 kA (size II), the circuit-breaker is released instantaneously.

Short time delayed short-circuit release "z"
The low setting for delay time t_d (e.g. 20 ms) can be used for example for single motor branches because this minimal delay time prevent tripping as a result of inrush current peaks on motor starting. This makes it possible to set the response current I_d for the "z" release to a lower value (below the inrush current on motor starting) to get a more effective short-circuit protection. In contrast, the instantaneous short-circuit release "n" would have to be set to a value higher than the inrush current on motor starting.

For time discriminating short-circuit protection, "z" releases functioning differently are available.

Short time delay short-circuit release with current independent delay
(for all overcurrent releases)
For time discriminating short-circuit protection, a release is used for time grading that has a constant delay time, i.e. independent of the level of short-circuit current.

Short time delayed short-circuit release with I^2 dependent delay
($I^2 x t$ = constant)
The releases D, E/F, H, J/K, N and P offer the choice between current independent or current dependent short-circuit release.
The I^2 dependent delay of the "z" releases provides better discrimination to downstream fuses. Apart from this, it offers optimum protection for cables, conductors and busbars.
The I^2 dependent delay is only effective as far as to the point of intersection of the I^2 characteristic with the respective set value for delay time t_d. In the case of higher currents, the tripping delay is current independent.

2.8.3.3. Earth fault protection

Earth fault release "g"
The earth fault release "g" detects fault currents which flow through earth and could for example cause fires in the system. The earth fault is detected when the earth fault current exceeds the set response value I_g for the duration of the set delay time t_g. Several circuit-breakers connected in series can be made time discriminative by adjusting the delay times. The response of the release can be selected as "only indicate earth fault by LED" or "earth fault trips circuit-breaker". The delay time having elapsed and "g"-alarm having been selected nothing but the LED is activated until the fault is cleared. When "g-trip" is selected and an earth fault happens the circuit-breaker will trip when the time delay t_g has elapsed.
The cause of tripping is displayed on the overcurrent release, when the query button is pressed.
If the overcurrent release is equipped with the additional function 2 ("g" Alarm; in versions E/F, J/K, and P), it is possible to obtain shutdown via a shunt release after an important process has been completed (see "circuit examples" chapter 4.7)

The following measuring methods can be used to detect N-conductor and earth fault currents.

1. Earth fault detection in symmetrically loaded systems

The three phase currents are evaluated following vectorial summation (Fig. 2/28)

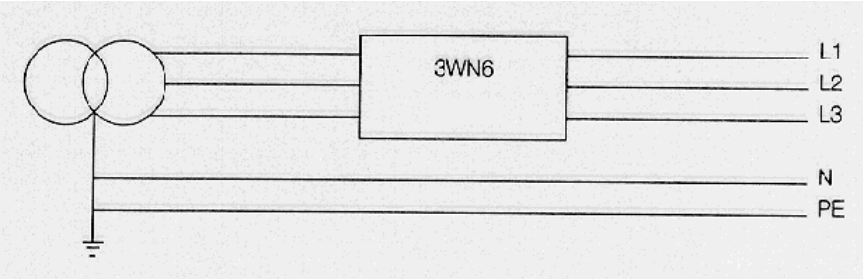


Fig. 2/28
3 pole circuit-breaker in symmetrically loaded systems

2. Summation with current transformer in the N-conductor

The N-conductor current is measured directly and is evaluated for N-conductor overload protection. The overcurrent release calculates the earth fault current by vectorial summation of the three phase currents and the N-conductor current. This version can be used in TN-S systems.

a) 3-pole circuit-breaker (Fig. 2/29)

b) 4-pole circuit-breakers have the 4th current transformer integrated in the N-conductor.

c) Overcurrent release versions E and J need to have the 4th current transformer annexed by mounting it externally either on the incoming or outgoing side.

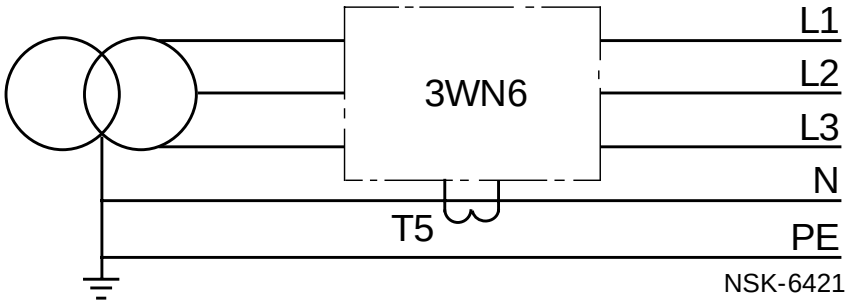


Fig. 2/29
3 pole circuit-breaker in asymmetrically loaded systems

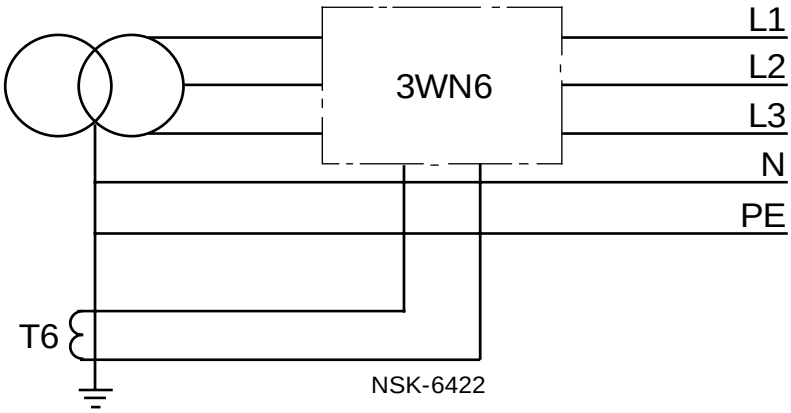


Fig. 2/30
3 pole circuit-breaker with current transformer at the earthed star point of the transformer

3. Direct detection of the earth fault current via current transformer at the earthed star point of the transformer (Fig. 2/30 and 2/31)

The current transformer is installed directly at the earthed star point of the transformer. This version can be used in TN-C or TN-C-S systems.

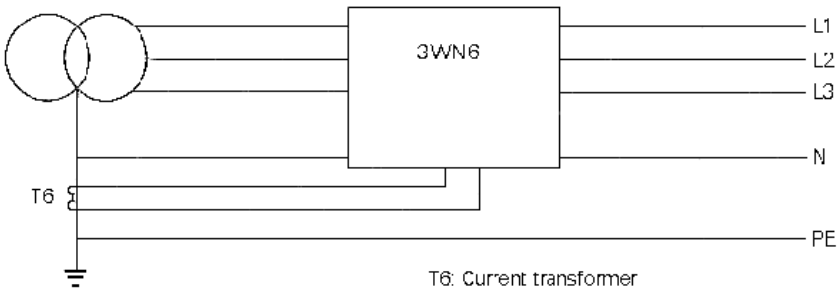


Fig. 2/31
4 pole circuit-breaker with current transformer at the earthed star point of the transformer

Possible settings of the earth fault release

Different function modes can be set for the earth fault release:

a) Earth fault protection with current independent delay
The value of "t_g" (delay time for earth fault function) is set on the overcurrent release. If an earth fault current keeps flowing when the selected time runs out the release causes an alarm signal or trips the circuit-breaker (according to the adjustment selected - "alarm/tripping")
Through delay time:
- an earth fault current that is only momentarily occurring can be bridged
- Several circuit-breakers in series can be graded time discriminative, as well in this function.

b) Earth fault protection with I^2 dependent delay ($I^2 \times t = const.$)
The I^2 dependent delay is only effective as far as to the point of intersection with the respective set value for delay time t_g. For higher currents, the constant tripping delay t_g becomes effective again.

c) Earth fault protection with "short time grading control" (ZSS)
This additional function is linked to the "ZSS" function for the short time delay release "z". The "ZSS" function for earth fault protection operates similar to the "ZSS" function for short-circuit protection. By switching on the function selection switch (ZSS OFF / ZSS ON), the delay time t_g for earth fault protection is reduced to 100 ms for a current independent delay or 50 ms for an I^2 dependent delay, irrespective of the value set on the scale.

2.8.3.4. LCD operational current display

The overcurrent release version D, E/F, J/K, N and P features a two-line LCD operational current display.

The releases D and E/F have an accuracy of +/- 5% and the following values can be displayed:
Line 1:
- Indication of the phase having the highest loaded the moment and the r.m.s. value of the current flowing through.

Line 2:, alternating:
- Currents in the main conductive paths L1, L2, L3
- N-conductor current
- Earth fault current

One of these values can be selected by using the hand held unit. This value is then continuously displayed on the overcurrent release with its current value.

The overcurrent releases N and P have an accuracy of +/- 5% as standard, +/- 3% as option (measurement module needs to be calibrated):

Line 2, selectable via menu:
- Phase sequence
- Lowest r.m.s. value of currents that flowed in one of the 3 phases during the last 15 minutes
- Highest r.m.s. value of currents that flowed in one of the 3 phases during the last 15 minutes

In the versions with measurement module and voltage transformers, it is additionally displayed in the second line (as running text):
- The three phase voltages L1-N, L2-N, L3-N
- Lowest one of the values of the 3 phase voltages measured during the last 15 minutes.
- Highest one of the values of the 3 phase voltages measured during the last 15 minutes.
- Current frequency
- Lowest one of the values of the frequency measured during the last 15 minutes.
- Highest one of the values of the frequency measured during the last 15 minutes.
- Power factor (cos Φ)
- Apparent power
- Reactive power
- Active power

As to this overcurrent release one of this values can be selected as continuous current value by the hand held unit or the key pad of the overcurrent release. The maximum and minimum current values can be reset by pressing the "Clear" button.

2.8.3.5. Electronically displays and signals of tripping and/or alarms

Each overcurrent release is equipped with a display, as standard, which makes it possible to query and display the cause of an overcurrent trip locally. The sealable transparent cover in front of an overcurrent release provides protection against unauthorised alteration of the parameter settings. Openings in this cover allow access to the "Query" button in order to display the cause of tripping and to the "Test" button to initiate a self-test. In overcurrent release versions N and P, the arrow keys for selecting the phases of current displaying and for displaying the parameter settings are still accessible. The latest cause of a tripping can be interrogated by pressing the "Query" button and can be cleared with the "Clear" button. If it is not cleared, the cause will be replaced by the next tripping.

The power required for displaying the cause of tripping is stored in the overcurrent release for at least 48 hours after a tripping occurs. The overcurrent release must have been activated for at least 10 minutes for the energy to be stored. An additional, protected current supply or a battery module therefore are not required.
Malfunctions of the overcurrent release are indicated by a red alarm LED.
Depending on the functional scope the following displays are available

Fig. 2/32
Displays on the overcurrent release

on the overcurrent release.

- Operational display
  If the load current is lower than or is equal to the set operational current of the overcurrent release it is indicated by the green flashing LED "Active" (approx. heart beat). If the load current exceeds the set operational current it is indicated by the fast flashing green LED "Active".

- Overload
  "a" tripping
  Versions B, C/G, D, E/F, H, J/K, N and P

- N-conductor overload
  "N" tripping
  Versions C/G, D, E/F, H, J/K, N and P
- Short-circuit
  "z/n" tripping
  Versions V, B, C/G

  "z" tripping
  Versions D, E/F, H, J/K, N und P

  "n" tripping
  Versions D, E/F, H, J/K, N und P

- Earth fault
  "g" trip/alarm
  Versions C/G, E/F, J/K and P

Additional to the displays for the cause of tripping, the solid state overcurrent releases dispose of alarm displays for the folowing faults always depending on the versions:

- Microprocessor (µP)
  (all versions)

  If a microprocessor fault occurs, the alarm is activated; the red LED "µP" on the overcurrent release shines. The signal can also be transmitted via an optocoupler if the circuit-breaker is equipped with additional function 1 or 2. This alarm indicates that the overload protection functions are not currently active. An internal bypass circuit, however, guarantees short-circuit protection.

  The tripping response of the bypass circuit varies for different overcurrent release versions:

  Release versions B, C/G and V:
  Instantaneous tripping of the circuit-breaker at $I_k > 15 \times I_n$.

  Release versions D, E/F, H and J/K:
  With I_i set between $1.25 \times I_N$ and $12 \times I_n$ => Instantaneous tripping of the breaker at $I_k > 15 \times I_n$.

  With I_i set to ∞ => Tripping of the circuit breaker delayed by 460 ms at $I_k > 15 \times I_n$.

  Release versions N and P:
  Instantaneous tripping at $I_k \geq I_{cw}$ (50 kA for size I, 65 kA for size II)

  When the fault disappears, e.g. following reclosing, the LED stops shining and the overcurrent release takes over its normal protection function.

- Overtemperature in the overcurrent release (ϑ)
  (Versions N and P)

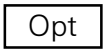
  If the temperature of the overcurrent release exceeds the limit value of 85°C, an overtemperature fault is indicated by a LED and alternatively signalled via optocoupler if required (additional functions 1 or 2).

- Phase imbalance > 50 % (⅄)

  When this function is activated, in the event of phase imbalance, the signal is output on the same output as the overtemperature signal.

  This function is activated using a separate manual operating device with overcurrent release versions D, E/F, H and J/K, and in the case of versions N and P it is also possible via the menu assisted control panel on the release.

  If the difference between the operational current of the phase loaded at the lowest level and the one loaded at the highest level more than 50%, this is signalled by a LED.

- Freely selectable display 

  (Versions D, E/F, H, J/K, N and P)

  The function "phase imbalance" and/or "temperature alarm" can be assigned to the signal "Opt". The signal can simply activate a display, or it can be additionally parameterized with tripping. Parameterization is carried out with the hand held unit. In case of overcurrent releases N and P, parametrization can also be carried out using the key pad on the release.

Tripped signalling contact
All overcurrent release versions are equipped as standard with a group signalling contact (S11 as "NO"). This contact is activated in the event of the following types of tripping:
– Overload "a"
– Short-circuit "z" and/or "n"
– Earth fault "g" when this function is set to trip (versions C/G, E/F, J/K, and P).

After trippings of this kind the red "RESET" button signals the tripping by being in one level with the control panel. Since the reset button is only accessible by removing the sealable transparent cover of the overcurrent release it is protected from unauthorised use. There is a dent in the transparent cover, for the customer to drill through in order to allow resetting without removing the seal. The tripped signal remains active until the "RESET" button is pressed again (see "Mechanical reclosing lockout", Chapter 2.10). While the tripped signal stays active, the circuit-breaker can still be closed if it is equipped with an automatic mechanical reset device.

2.8.3.6. Functional test

Internal selftest
Every overcurrent release includes a selftest and an integrated test function that can be activated by pressing the "Test" button. A test causing the tripping of the circuit-breaker can be started by pressing the "Test" and "Clear" buttons simultanuously. In this test, the tripping solenoid is energised and the internal wiring and connecting cable are checked. Tripping activates the tripped signalling contact and the mechanical reclosing lockout which must be reset on completion of the test.
The test is possible if the load current is greater than 40% I_N or if the overcurrent release is connected to an auxiliary power supply. The overcurrent release signals ist normal status with the LED "Active" flashing (heartbeat).

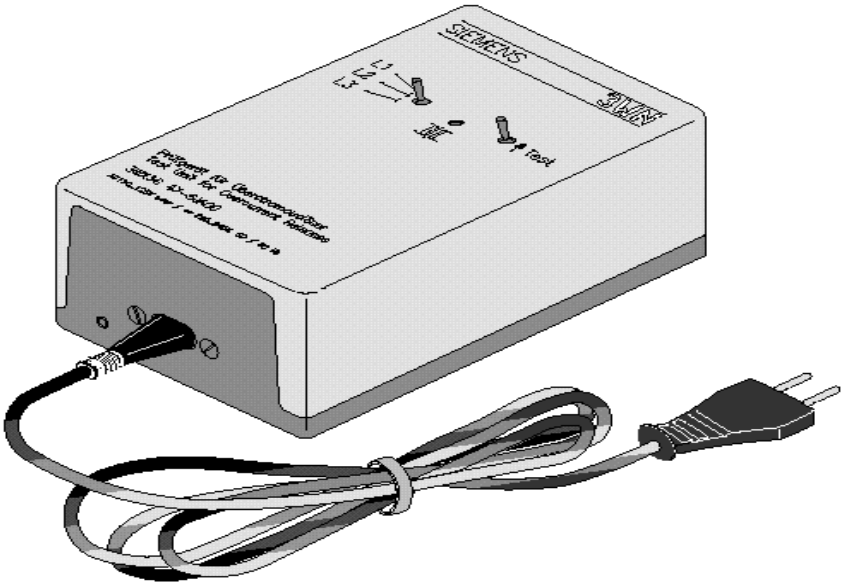


Fig. 2/33 Function testing unit 3WX3647-5JA00

Function testing unit
A test unit (fig. 2/33) is available for external function testing of the overcurrent release (versions V, B; C/G, D, E/F, H and J/K). It is suitable for AC voltages of 230V or 115V (adjustable). The test unit is connected to the overcurrent release by the enclosed cable to the socket X3. In order to have access to this socket on the circuit-breaker the flap in the transparent cover has to be opened, the seal possibly attached by the customer removed and the cover unscrewed. The test socket can be made generally accessible for test purposes by breaking off the bar in the transparent cover. For testing, the function testing unit generates a current 5 times as high as the rated current on the secondary side of the current transformer to simulate an overcurrent The phase selection switch on the test unit can be used to check each phase separately for continuity of the transformer. Apart from this, the functioning of the overcurrent release and the tripping solenoid can also be tested by the test current. This causes a tripping of the circuit-breaker by the testing current.
The test unit 3WX3647-5JA00 can be used for the overcurrent releases of the circuit-breaker 3WN6 as well as for the circuit-breakers 3WN1/5 and 3WS1.

2.8.3.7. Additional functions

Versions D, E/F, H, J/K, N and P of the electronical overcurrent release can be equipped with the additional functions 1 or 2. The additional functions are signals, that are given via optocoupler for external evaluation. The optocoupler are contact free optical relays with galvanic isolation.

For explanation of the different function please refer to chapter 2.8.3.5

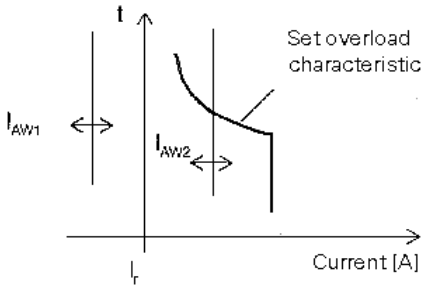


Fig. 2/34 Load monitoring and load shedding

The overcurrent release with additional function 1 or 2 can also be supplied by an external 24 V DC power supply. In this case it can operate without the need of an minimum load current.

- Microporcessor fault (µP)
  Additional functions 1 or 2 (see chapter 2.3.8.5).

- Overtemperature in over-current release (ϑ)
  Additional functions 1 or 2 (see chapter 2.3.8.5).

- Phase imbalance > 50 % (⅄)
  Additional functions 1 or 2 (see chapter 2.3.8.5).

- Leading signal "a"-release/ load shedding
  Additional function 2.

  This signal occurs 200 ms before an overload tripping. It can be use shut down down stream thyristor controllers. Instead of using this function it is possible to switch over to the function load shedding.
  Switchover as well as parameterization of the response values are carried out using the manual programming unit (versions D, E/F, H, J/K, N and P) or the key pad of the overcurrent release (versions N and P). The response value I_{AW2} can be set within the range 50 to 150 % of I_r (I_r = set current) with a delay of 1 to 15 seconds before the output I_{AW2} signals exceeding of the limit.
  The signal from this limit comparator can be used to disconnect a load that has little effect on continuity of the process (e.g. ventilation) or to switch it to a low current consumption. This can prevent interruption of the process which would result from tripping of the circuit-breaker.

- Load monitoring
  Additional function 2.

  The load monitoring function can be adjusted by selecting the response value for load connection I_{AW1} (see load shedding) within the range 50 to 150 % of I_r (I_r = set current). Via the response values I_{AW1} and I_{AW2} can be graded which in turn can be delayed by the joint delay time $t_{d.AW}$ selected between 1 to 15 seconds. If, however, the overload current falls below the response value before time delay has elapsed, no signal is given. If the time delay has elapsed and the load current still exists the load monitoring output is activated.

- Earth fault alarm ("g" alarm)
  (Versions E/F, J/K and P)
  Additional function 2.

  When the response value for the earthfault release "g has been exceeded and the delay time t_g has elapsed, the earth fault LED shines and an alarm signal is given via optocoupler. The earth fault release must be set to "Alarm" for this purpose. The circuit-breaker does not trip with the function "g"-Alarm. This allows important processes to be completed before shut down via shunt release. (see chapter 4.7 Breaker examples)

- Short time delay grading control (ZSS)
  Additional function 2.

  System loading can be minimized in the event of a short-circuit current with several grading levels; the time delay proceding tripping can be reduced to a minimum using short time delay grading control ZSS (see chapter 2.8.4). The circuit-breakers are interconnected via wires. The mode of operation is fully compatible with the ZSS function for 3WN1/5 and 3WS1 circuit-breakers.

2.8.3.8. Selecting overcurrent releases for motor and generator circuit-breakers

Motor branches

A range of overcurrent release versions with specific functions and settings are provided for optimum protection of inductive loads.

Overload protection

- Adjustable time lag class T_c for the "a" release
  (Versions D, E/F, H, J/K, N and P)
  The time lag class T_c specifies the opening time at 6 times the operating current I_r. In accordance with the mechanical inertia of the motor load, the characteristic can be adjusted for normal duty up to heavy duty motor starting.
  The following values can be selected for time lag using a rotating switch on overcurrent releases D and E/F (T_c '= 2, 3.5, 6, 8, 10, 14, 17, 20, 24, 30 s. In case of overcurrent release H, J/K, N and P, the time lag class can be set to integer values between 2 s and 30 s.

- Thermal memory
  (Versions D, E/F, H; J/K, N and P)
  On reclosing following overload tripping the overload characteristic is reduced for 10 minutes in order to reduce the opening time in the event of another overload. Preheating of equipment due to overload is taken into account by this function. If the thermal memory is switched off (version N and P), the motor can be started immediately after overload tripping with full load.

- Phase failure sensitivity
  (see also "Overload protection")
  When the r.m.s. values of the operating currents in the three phases differ by more than 50 %, the set operating current I_r is reduced automatically to 80 % of the set value. This protects the motor windings in the heavily loaded phases. This function can only be used for three phase AC motors. It is not suitable for thyristor controlled drives.

Short-circuit protection

- Inrush insensitivity for 20 ms
  The short time delay short-circuit releases have a time delay set to 20 ms which prevents tripping as a result of current peaks on motor starting (inrush currents; surge of the first current half wave). The tripping value for the instantaneuous short-circuit release therefore has to be set to a value higher than the motor inrush current. Requirements for short-circuit protection and discrimination can therefore still be met despite high inrush currents.

- Settings
  Depending on the version of overcurrent release, the following operating values for the short-circuit protection of motor branches are adjustable and can be set directly on the device:
  – Tripping current for the short time delay short-circuit release I_d (all versions)
  – Delay time for the short time delay short-circuit t_d (all versions)
  – With I^2 dependent delay, time lag setting t_d = opening time at $12 \times I_r$ (version D, E/F, H, J/K, N and P)
  – Tripping current for the instantaneous short-circuit release I_i (versions D, E/F, H, J/K, N and P)

Generator circuit-breaker

The overcurrent release V is specially designed for generator protection. This only has a short-circuit release "zn" that can be adjusted in 16 steps in the range between 1.25 x I_r (set value) up to 12 x I_r .
In applications which also require overload protection, any other overcurrent release can be used.

Overload protection

- Adjustable time-lag class T_c for the thermal chasracteristic
  (versions D, E/F, H, J/K, N and P)
  In accordance with the thermal overload cabapility of the generator, the characteristics can be adjusted to suit the protection requirements.

- Thermal memory
  (versions D, E/F, H, J/K, N and P)
  Following overload tripping, a cooling time of 10 minutes is simulated during which the opening time is reduced to take account of the preheating of the generator windings.

- Alarm signal "Phase imbalance > 50%"
  (see "Overload protection")
  In the event of imbalanced loading of the generator (differences between the operating currents of more than 50%), the tripping current I_r is automatically reduced to 80% of its set value (with the setting t_d = 20ms or in version H, J/K, N and P for any delay time).
  Note: Generators can generally withstand asymmetrcal loads, therefore tripping is undesirable.

Short-circuit protection

- Adjustment of the short time delay short-circuit release to low tripping values
  (versions V, B, C/G, D, E/F, H, J/K, N and P)
  The releases can be set for low tripping values starting from 1.25 x I_r (version B: 1.5 x I_r),to prevent heavy loading on the generator windings.

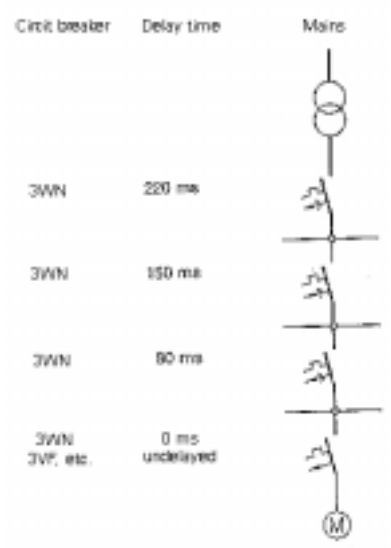


Fig. 2/35 Delay times to be set for the "z" release without "ZSS" (example)

- I^2 dependent delay for short time delay short-circuit releas
  (versions D, E/F, H, J/K, N and P)
  The releases can be switched over from current independent to I^2 dependent delay (I^2 x t_d = *constant*).This provides better discrimination to downstream fuses.

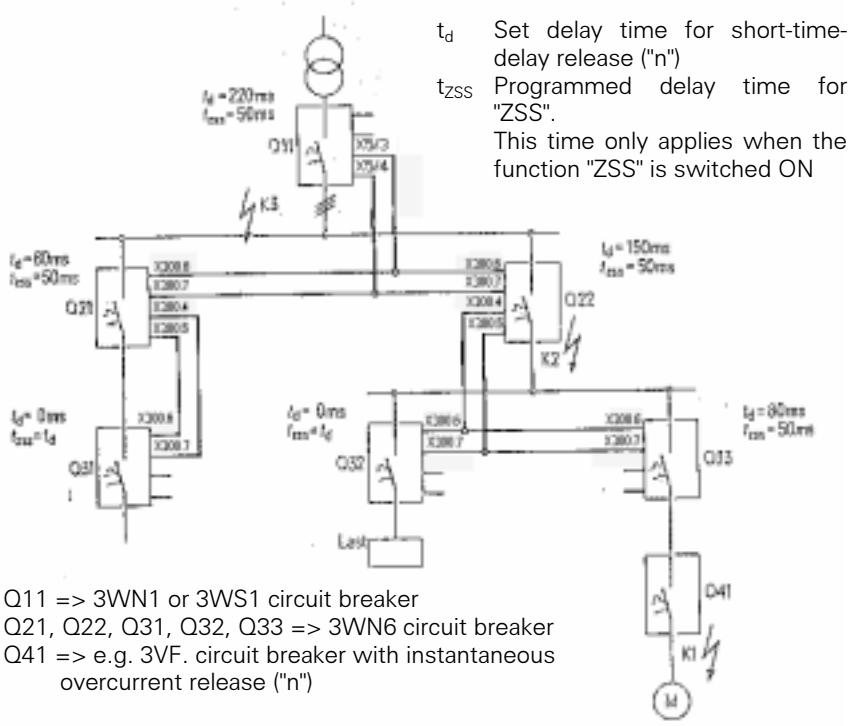
2.8.4. Short-circuit protection with "short-time grading control" (ZSS)

2.8.4.1. General description

(for overcurrent releases version D, E/F, H, J/K, N and P)

The short time grading control (ZSS) is only possible if circuit-breakers 3W. are arranged in several grading levels. It offers full selectivity under the utmost litle delay t_{ZSS} = 50 ms, independent from the number of grading levels and the place of the short-circuit in the distribution system. The advantage of the "ZSS" becomes all the more important, the more grading levels are existing in wide spread systems and the longer the thus necessary delay times for the usual time grading would become.

Shorter response time due to "ZSS" considerably reduce the loading and damage in the switchgear installation.



t_d Set delay time for short-time-delay release ("n")

t_{ZSS} Programmed delay time for "ZSS".
This time only applies when the function "ZSS" is switched ON

Q11 => 3WN1 or 3WS1 circuit breaker
Q21, Q22, Q31, Q32, Q33 => 3WN6 circuit breaker
Q41 => e.g. 3VF. circuit breaker with instantaneous overcurrent release ("n")

Operation of the "ZSS"

If "ZSS" is set in a distribution system that comprises several grading levels, in the event of a short-circuit; each circuit-breaker affected by the short-circuit interrogates the next circuit-breaker downstream to find out if the short-circuit also occurs at the following grading level:

– If the short-circuit also occurs at the downstream grading level, the respective upstream switch delays its release to allow the circuit-breaker immediately in front of the short-circuit enough time to interrupt the short-circuit.

– If the breaker for the downstream grading level signals no short-circuit, i.e. the short-circuit lies between the two circuit grading levels in question, the upstream breaker will trip after the fixed delay time t_{ZSS} of 50 ms has elapsed.

For the grading control discribed, the overcurrent releases in the circuit-breakers involved must be linked using communication lines.
The example in fig. 2/36 shows that the delay times of the "z" release are adjusted as follows:
Circuit-breaker Q31 + Q32: 0ms
Circuit-breaker Q21 + Q33: 80ms
Circuit-breaker Q22: 150ms
Circuit-breaker Q11: 220ms

Assumption: Q22 does not work.

A short-circuit current at K2 causes the overload releases of Q22 and Q11 to react. Q22 signals a short-circuit current from Q11 on and thus prevents Q11 from tripping. Since Q32 and Q33 do not signal a short-circuit current Q22 should switch off the short-circuit current after 50 ms. If Q22 does not switch off the short-circuit current Q11 trips despite the continuous short-circuit signal of Q22 after the set delay time of t_d = 220 ms.
In case discrimination is not partially or completely necessary within a distribution system if a circuit-breaker trips, instead of the usual time grading either the grading of groups of several circuit-breakers in series can be formed (the discrimination only exists from group to group in case of a fault) or a uniform delay time t_d ("z"-branch) for all circuit-breakers can be adjusted (no discrimination is existing in case of a fault).

Safety
In order to secure a short-circuit tripping by all means, when a fault occurs (e.g. broken wire on the signal cable in between the circuit-breakers) the upstream circuit-breaker trips.

The blocking signal caused by the "ZSS" is active only the set delay time t_d ("z" branch) has elapsed.
If the discrimination shall be fully guaranteed also in case of such a fault although using the "ZSS"-system the delay times of the "z" release have to be adjusted as with the usual time grading.
The maximum length of the "ZSS"-signal cable is 300 m. Recommend type of signal cable is: screened MSR-cable LSYCY (2x0.75 mm²) Manufacturer Siemens or comparable (see also 4.5.3)

2.8.4.2. Examples for"short-time grading control" (ZSS)

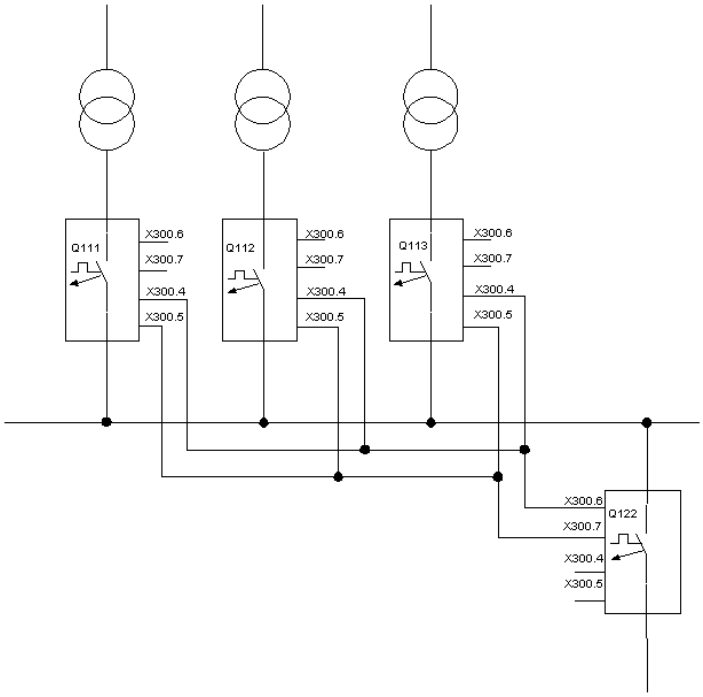


Fig. 2/37
Several circuit-breakers connected parallel (max. 3) their signal inputs for the "ZSS" have to be connected parallel.

Corresponding terminals

3WN6	3WN1 / 3WS1
X300.4	X5.3
X300.5	X5.4
X300.6	X5.1
X300.7	X5.2

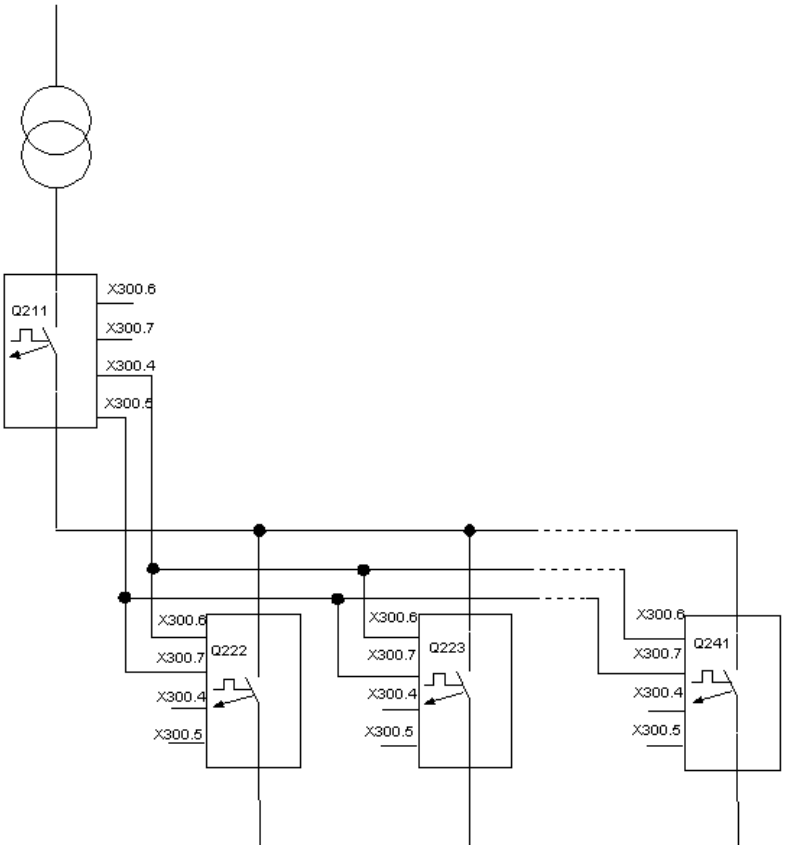
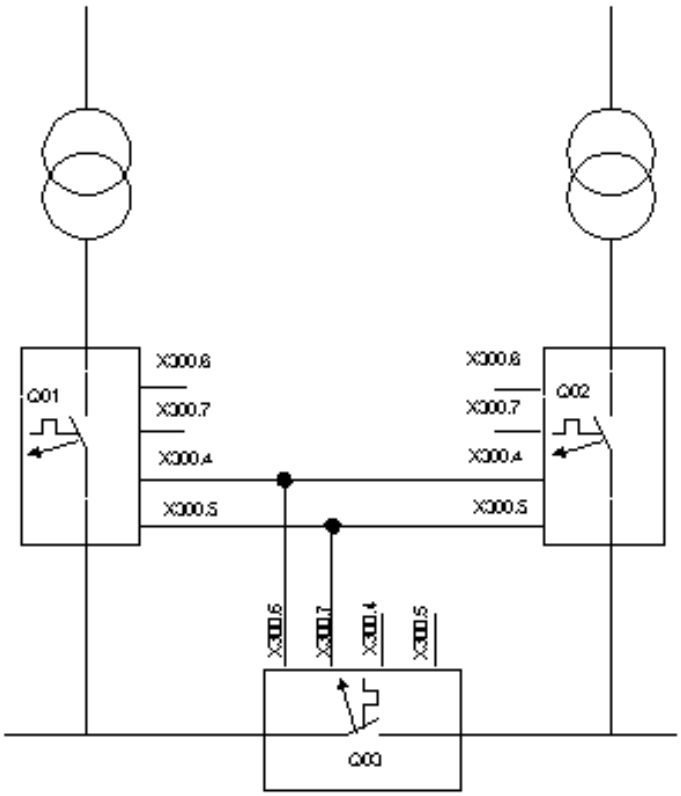
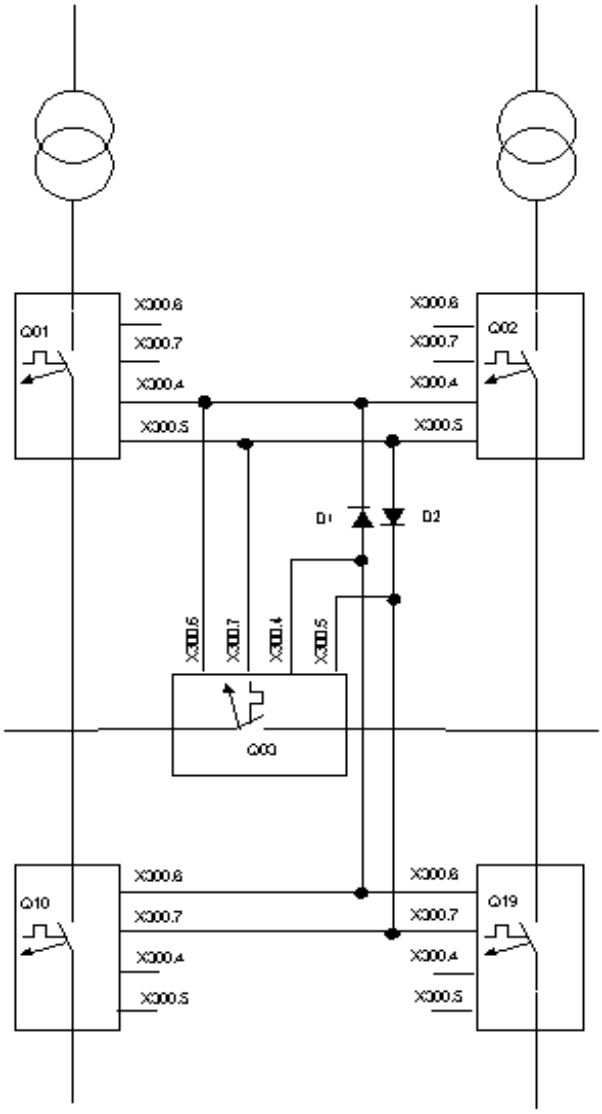


Fig. 2/38
Several downstream circuit-breakers connected parallel (max. 10) their signal outputs for the "ZSS" are connected parallel.



c) Fig. 2/39
Combination of 2 incoming circuit-breakers (Q01, Q02) and
1 coupling circuit-breaker

d) Fig. 2/40
Combination of 2 incoming circuit-breakers (Q01, Q02), 1 coupling circuit-breaker (Q03) and several outgoing circuit-breakers (Q19 ... Q19). Diodes of type 1N4007, mounted on a diode frame with screw connections.



2.8.5. Communication via PROFIBUS-DP

For more details see handbook Communication (see section 11)

PROFIBUS

The PROFIBUS is a standardized independent of any specific manufacturer field bus system which can be linked to most of the programmable controllers of the leading manufacturers. The PROFIBUS is also produced by Siemens under the name SINEC L2.

Up to 127 nodes can be brought together in one bus segment. Distances of up to 9.6 km can be bridged with copper conductors and more than 100 km with fibre optic cable. With the optical link modules (OLM), tree, star and ring structures can be constructed in addition to the familiar linear bus networks. Even redundant cabling is no longer a problem.

PROFIBUS-DP

The PROFIBUS-DP (Decentralised Peripherals) is particularly used for switchgear with high communication requirements, e.g. transmission of analogue actual values and at the same time with the fastest reaction times (max. 12 Mbit/s baude rate). It also connects individual AS-I segments. The typical configuration for PROFIBUS-DP are mono-master systems (in which only one bus master communicates with the bus nodes).

Advantages of communication-capable switchgear

Bus systems can be used to implement simple data exchange between low voltage switching devices, e.g. between 3WN6 circuit-breakers and Plc's. Apart from remote control of the circuit-breaker contact position, measured values, signals and diagnostic data can be fetched by the automation level via the bus. This makes early detection and correction of system faults possible and therefore increases system availability. The now easy transfer of values for the current allows, for example, power management for a total system. Multicore control cables are replaced by a two wire cable. This means considerable savings in wiring costs, i.e. the costs for control cables, installation and testing. The bus system used is the PROFIBUS DP.

Communication principle

The 3WN6 circuit-breaker is connected to the PROFIBUS-DP via the DP/3WN6 interface (previously named DP/RS485) This translates the signals sent to and from the circuit-breaker into the PROFIBUS-DP protocol. For this purpose the solid state overcurrent release of the circuit-breaker has to be fitted with an additional communication module (Z=F01). This makes it possible to operate and control the circuit-breaker (if correspondingly equipped with closing and tripping solenoid and motorised spring charging mechanism) and it can easily be included into visualization systems such as COROS® MMI (brand Siemens).

One DP/3WN6 interface module is required for each communication-capable circuit-breaker.

Circuit-breaker equipment

The circuit-breaker 3WN6 is communication-capable when it is equipped with an overcurrent release version D, E/F, H, J/K, N or P with additional function 2 as well as with a communication module (Z=F01 see chapter 2.8.2 "Function overview"). The signals generated by the circuit-breaker (breaker closed, stored energy mechanism charged, draw-out circuit-breaker in connected/disconnected position, etc.) are detected via micro switches for further processing in the communication module.

Installation of the DP/3WN6 interface module

The DP/3WN6 interface module comes in a compact 70mm housing for mounting on a 35 mm DIN rail. The units can be installed in a row immediately adjoining each other. The interface module is connected to the circuit-breaker via the enclosed connecting cable (3m length). The plug socket on the module is a SUB-D socket.

Operation

The DP/3WN6 interface module is connected to the 3WN6 circuit-breaker via a point-to-point link. This connection is matched to the special ambient conditions (e.g. high currents, loop contacts in the draw-out version) of the circuit-breaker. Conversion to the PROFIBUS-DP protocol takes place inside the interface module. A data transmission rate of up to 12 Mbit/s is possible with the PROFIBUS-DP.

Before setting it to work it is merely necessary to pre-set the PROFIBUS-DP address by two rotary switches on the interface module. The baud rate and other bus parameters are specified in advance by the master unit - the interface module automatically

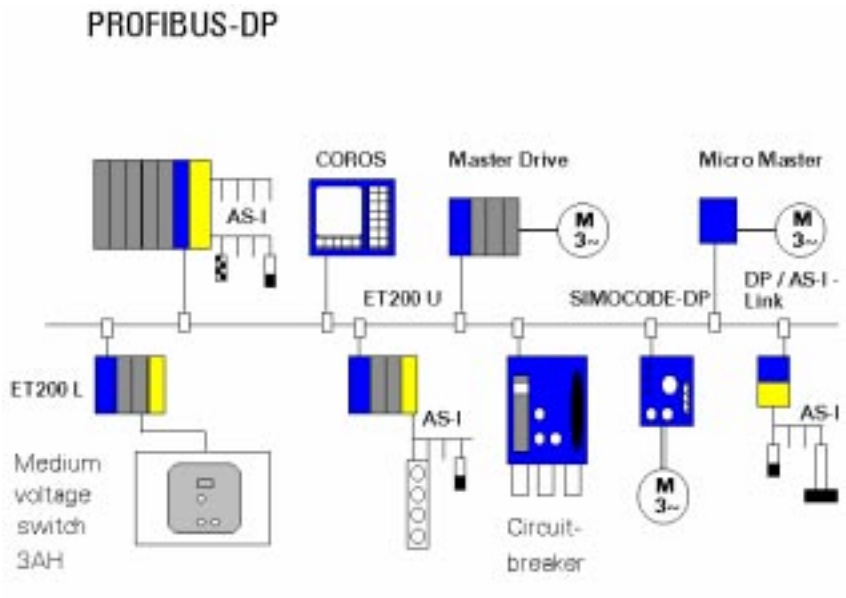


Fig. 2/41 Examples for the communication

adapts itself to this specification. The communication link to the circuit-breaker is established automatically after the supply voltage has been connected. The overcurrent release is activated by this supply voltage (in the draw-out version in the test and the connected position). If the draw-out circuit-breaker is in the disconnect position, this is detected by a separate micro switch in the guide frame and signalled to the operational bus interface module for further processing. In this manner, the availability of the bus node "3WN6 circuit-breaker" is guaranteed.

LEDs on the interface

The interfaces to the circuit-breaker and to the PROFIBUS-DP are continuously monitored by the interface module and the status signalled by two Duo LEDs (green and red).

Parameterization from the host level (PLC)

The PROFIBUS-DP node "DP/3WN6" is configured by using the parameterization software for distributed I/O, COM ET200. This parameterization and service program simplifies the task of parameterization in the circuit-breaker.

Useful data on the bus

a) The following data are available

1. Measured values (with communication module Z=F01)
– Actual value for current in the highest loaded phase *)
– Currents in phases L1, L2, L3
– Min/Max. currents of the last 15 minutes
– Current in the N-conductor (in 3-pole circuit-breakers, an external current transformer has to be installed in the N-conductor)
– Earth-fault current (releases E/F, J/K, and P), for earth fault detection see chapter 2.8.3.3)
– Direction of rotation of phase currents (version N and P)

–

1. Event messages
– Overcurrent release grouped signal *)
– Cause of the last trip ("a", "z", "n", "g", "N")
– Fault grouped signal *)
– µP fault
– Alarm grouped Signal
– Temperature alarm
– Phase imbalance
– Load shedding *)
– Load connection
– Leading signal for overload trip
– Overload

1. Operating states
– Breaker closed/opened *)
– Ready to close (all closing conditions fulfilled = "OK") *)
– Stored energy mechanism charged *)
– Undervoltage release energised
– Shunt release energized (= breaker closing is blocked)
– Position (connected/test/disconnected) of draw-out circuit-breaker
– Testing overcurrent release

1. Remote control
– Close circuit-breaker *)
(Breaker equipment: Operating mechanism with electrical stored energy drive for 24V DC or an additional coupling device for conversion to e.g. 230V AC)
– Open circuit-breaker / lock circuit-breaker against closing *)
(Breaker equipment: Shunt release "f" for 24V DC or an additional coupling device for conversion to e.g. 230V AC)

1. Reading configuration data
– Settings of the overcurrent release

b) In addition to the data using the communication module (a) the following data of the measurement module are available (The measurement module includes the function of the communication module plus further functions) and is marked in the order number by adding Z = F05 (Z = F01 is not necessary)

1. Measured values
– Active power
– Reactive power
– Apparent power
– Power factor
– Frequency
– Voltages

1. Settings of the following
– Phase imbalance - Voltage
– Direction of power flow
– Overfrequency
– Underfrequency
– Overvoltage
– Undervoltage

All data marked *) are transmitted cyclically. The other data are transmitted as required, i.e. it must be requested by the programmable controller.

2.8.6. Manual operating device

The manual operating device is connected via a connecting cable and a plug-in adapter to the overcurrent release of the 3WN6 breaker (connected to socket X3). A 24V DC power supply unit can be connected to the adapter for activating the release. This manual operating device can also be used to parameterize and operate the 3UF5 motor protection and control unit with communication capability (SIMOCODE DP).
The manual operating device is used with 3WN6 overcurrent release versions D, E/F, H, J/K, N and P (see section 2.8.2 "function overview") to switch on functions and response values (e.g. in versions N, P, H and J/K for load shedding). In addition, the overcurrent release versions N and P permit complete parameterization of the protection functions. The settings can be read out and saved temporarily in the parameterization unit. The saved parameter record can be adapted for another circuit-breaker and loaded into its overcurrent release.

2.9. Circuit-Breaker as load interrupters

A special version of circuit-breaker is intended for use as a load interrupter. The load interrupters are constructed without the overcurrent release system and thus do not have any protective function in the system. The types and accessories can be selected corresponding to the circuit-breaker.

2.10. Mechanical reclosing lockout

The circuit-breakers are equipped with a mechanical reclosing lockout as standard. It is activated when the circuit-breaker trips due to:

- Overload "a"
- Short circuit "z" and "n"
- Earth-fault "g" when the earth fault release "g" (in versions C/G, E/F, J/K, and P is set to "Trip"

The circuit-breaker can only be reclosed once the red "RESET" button has been pressed. This button signals tripping by being in one level with the control panel.

Since the button is only accessible by removing the sealable transparent cover of the overcurrent release, it is protected from unauthorised use.
There is a dent in the transparent cover, which enables the customer to drill through to allow resetting without removing the seal.
The reclosing lockout has a mechanical effect on the readiness to close:
When the reclosing lock out is in the locked state, the conditions for readiness to close are not fulfilled. It is therefore not possible to close the circuit-breaker. If the circuit-breaker must be ready to close again immediately after it has tripped, an automatic mechanical reset device is available which, however, does not reset the electrical signal of the tripped signalling contact. The tripped signal must then be cancelled by pressing the reset button.

3. Versions

3.1. Fixed mounted circuit-breakers

3.1.1. Mounting

The fixed-mounted circuit-breakers can either be mounted on horizontal fixing brackets in the switch gear cubicle (see figure 3/1) or to a vertical mounting surface using the support brackets available as accessories (see figure 3/2). The through-holes and supplied non-removable nuts are used for screw-mounting.

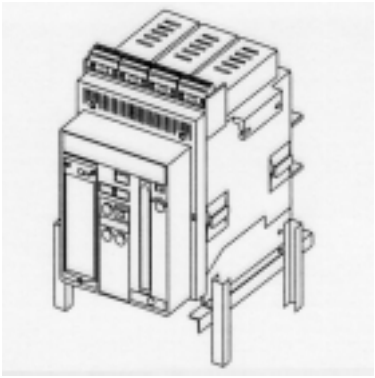


Fig. 3/1 Circuit-breaker mounted on a horizontal support

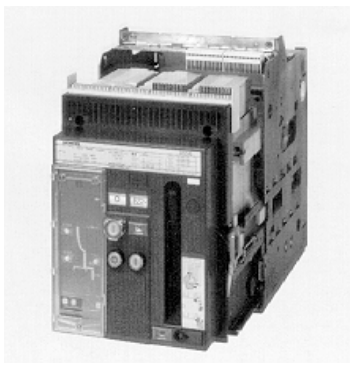


Fig. 3/2 3WN6 draw-out circuit-breaker

Connections

The main connections are arranged horizontally on the rear AS STANDARD: The following connection types are also available, if required:

- Single-hole mounting accessible from the front
- Double-hole mounting accessible from the front (holes to DIN 43673 for connection busbars)
- With additional adapters for vertical connection to busbars
- or accessible from the front

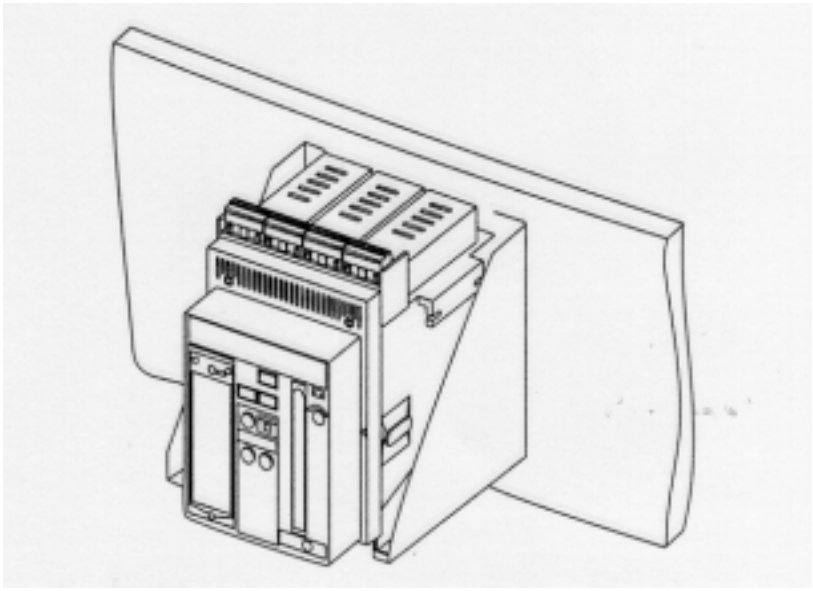


Fig. 3/3 Circuit-breaker mounted on a vertical support (in this case the use of front accessible busbar connections advised).

3.1.2. Blocking device

In order to protect the operating personnel and switchgear, the fixed-mounted circuit-breakers can be equipped with a blocking device which prevents the cubicle door from being opened when the circuit-breaker is closed. The blocking device can be released for adjustment and testing using a tool. When the cubicle door is closed, the blocking device becomes effective again automatically.

3.2. Draw-out circuit-breakers

The draw-out version comprises:

- Draw-out circuit-breaker
- Guide frame
  - with auxiliary draw-out connector
  - with main connections
    - horizontal (standard)
    - or accessible from the front (single-hole)
    - (double-hole)
    - or vertical

  and optionally with
  - position signalling switch
  - shutter (two part)
  - blocking and interlocking module
- Door sealing frame or edge protection
- Coding system

3.2.1. Guide frame

The guide frame is mounted horizontally. The through holes in the lower traverses are used for screw mounting (see figure 3/4)

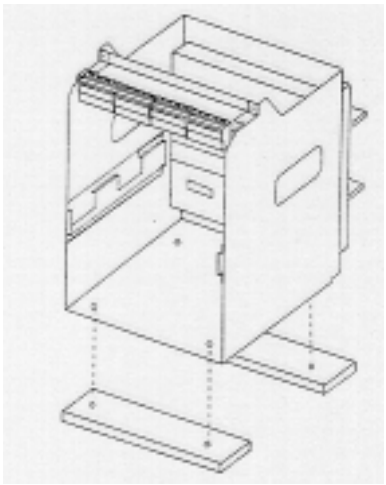


Fig. 3/4. Mounting the guide frame

3.2.2. Circuit-breaker positions in the guide frame

There are three positions behind the closed cubicle door for draw-out circuit-breakers in the cubicle (see table 3/1)

The circuit-breaker is moved between the three positions with a crank handle. The disconnected, test and connected positions are achieved when the circuit-breaker is moved in accordance with the position indicator in the transparent cover on the control panel. It does not latch in place. The circuit-breaker is placed in the connected and disconnected position by moving it as far as to the stop.
A mechanical interlock ensures that the circuit-breaker is switched off before moving. Neither can the circuit-breaker be switched on in an intermediate position between the defined positions (see also readiness to close).
In the disconnected position, the main and auxiliary circuits of the draw-out circuit-breaker comply with the "Conditions for an isolator" (with visible contact gap).

	Connected position	Test position	Disconnected position
Main circuit	Closed	Open	Open
Auxiliary circuit	Closed	Closed	Open
Shutter	Open	Closed	Closed

Table 3/1

Maintenance position

With the door open, the circuit-breaker can be moved into the maintenance position by drawing it out on the guide rails. The circuit-breaker is also inserted into and removed from the guide frame in this position.

Signalling of the circuit-breaker position in the guide frame

Apart from optical indication of the position of the circuit-breaker in the guide frame by coloured marks in the transparent cover on the control panel, position signalling switches are also available for remote signalling, which are operated by the draw-out circuit-breaker itself, resulting in a remote signal showing the presence of the circuit-breaker in the guide frame. The position signalling switch can be used for interlocking circuits with other protective devices.

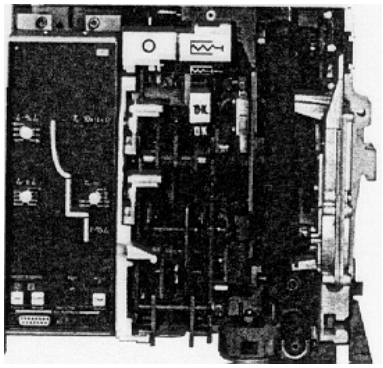
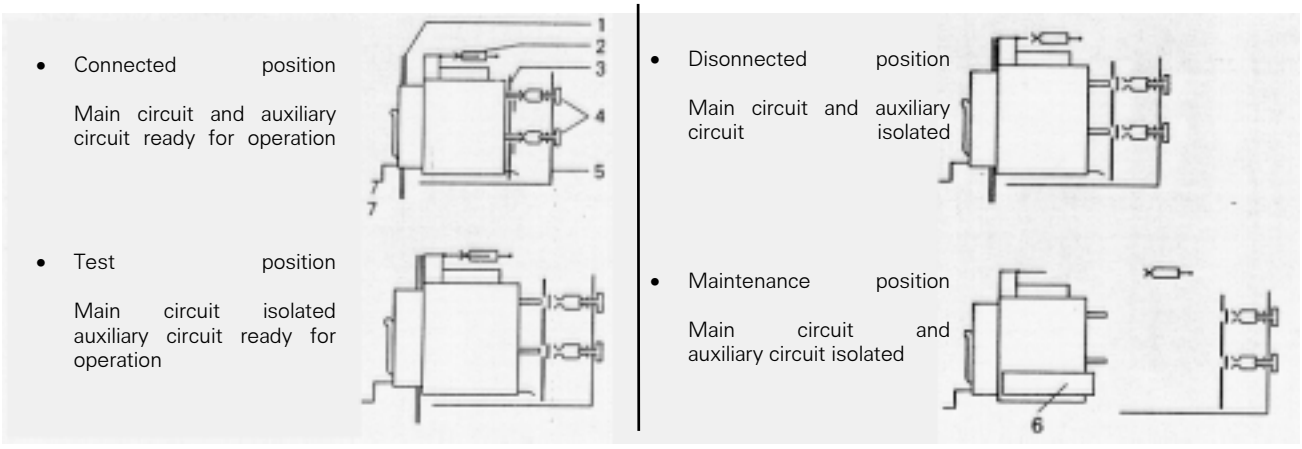


Fig. 3/5 Draw-out mechanism with the control panel removed



1 Door
2 Auxiliary connector
3 Shutter
4 Main plug-in contact
5 Guide frame
6 Guide rails
7 Crank handle

Fig. 3/6 Circuit-breaker positions in the guide frame

3.2.3. Position signalling switches

The different version of position signalling switches vary in the number of signalling contacts for the respective circuit-breaker position in the guide frame and in their type of connection (exact contact layout and position indicated see chapter 6).

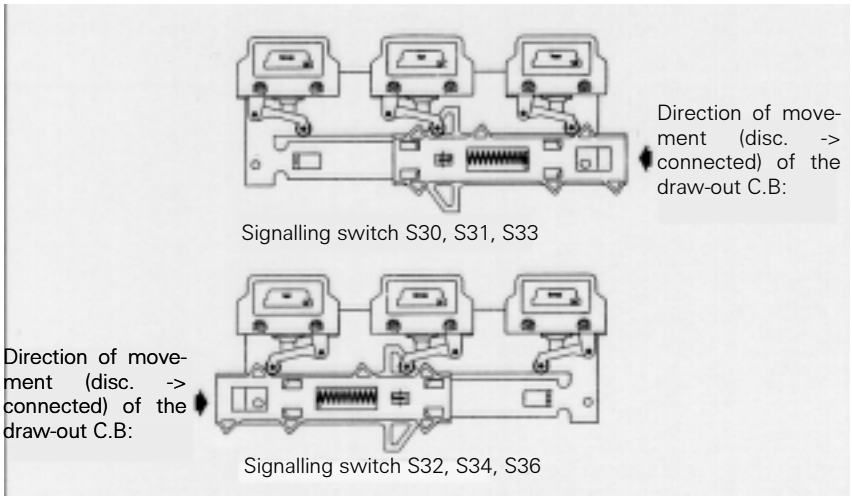


Fig. 3/7 Position signalling switches as module

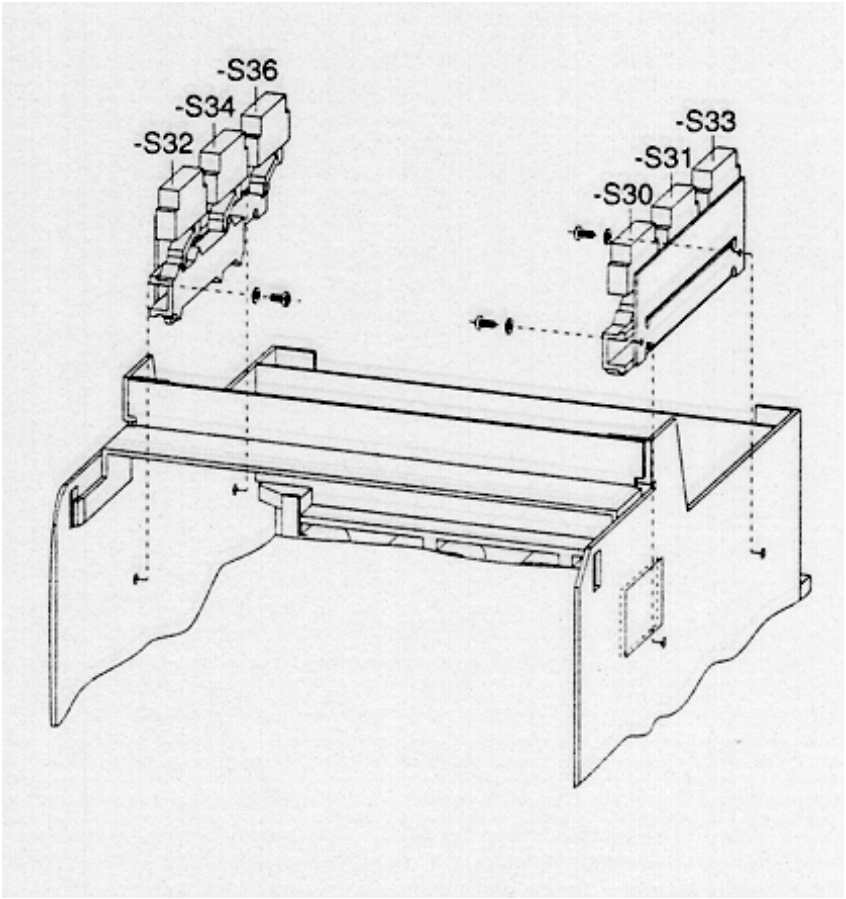


Fig. 3/8 Mounting of the position signalling switches

3.2.4. Shutter

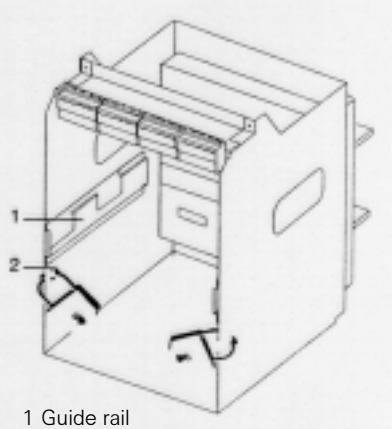
Protective mechanism against touching of current-carrying draw-out contacts

Inadvertent touching of the current carrying disconnected contacts is prevented by a two part shutter made from insulation material that is located in the rear section of the guide frame. It is operated by the circuit-breaker itself. The openings are closed or opened by insulating material slides in accordance with the position of the switch in the guide frame. When the draw-out circuit-breaker is moved into position, the shutter is not opened until the connected position has almost been reached.

As soon as the circuit-breaker is moved out of the connected position, the shutter is closed again. When the circuit-breaker has been removed from the guide frame, various shutter positions can be obtained using the guide rails on each side and locked with padlocks (see Fig. 3/11).

- Top and bottom opening closed
- Top closed, bottom open
- Top open, bottom closed
- Top and bottom opening open

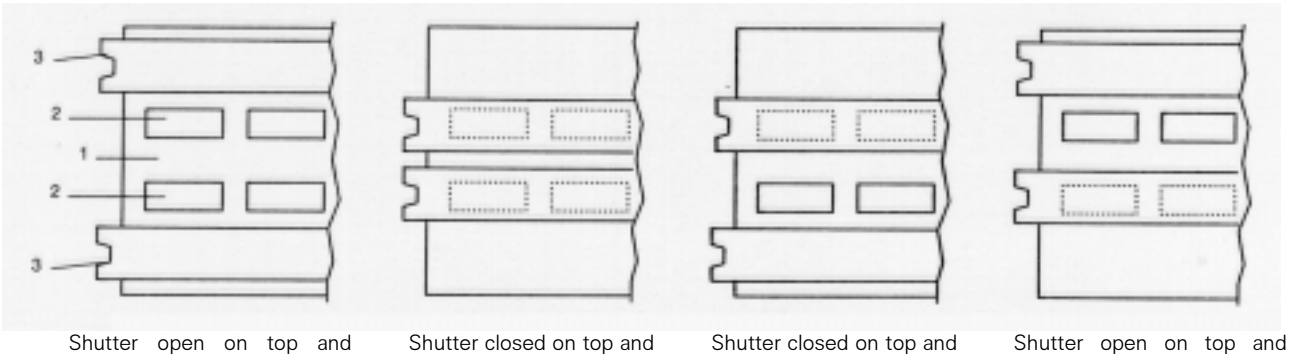
The top and bottom connections can be freely defined as the incoming or outgoing sides.



1 Guide rail
2 Stopping the guide rail by sliding the guid rail in

Fig. 3/9 Locking the shutter in place

1 Guide frame 2 Main connecting contacts of the guide frame 3 Shutter: cover composed of insulation material



Shutter open on top and bottom
(as in the connected position)

Shutter closed on top and buttom
(as in the test and disconnected positions, ore made by padlocks)

Shutter closed on top and open on bottom
(made by padlocks)

Shutter open on top and closed on bottom
(made by padlocks)

Fig. 3/10 Shutter positions that can be locked with padlocks

3.2.5. Coding system

In order to prevent circuit-breakers of the same size but different equipment from being inadvertently interchanged with a cubicle, circuit-breaker and guide frames can be fitted with a coding system. This is supplied in kit form and allows coding of up to 35 circuit-breakers.

The draw-out circuit-breakers are factory fitted with rated current coding which prevents a circuit-breaker from being inserted in a guide frame of different current rating.

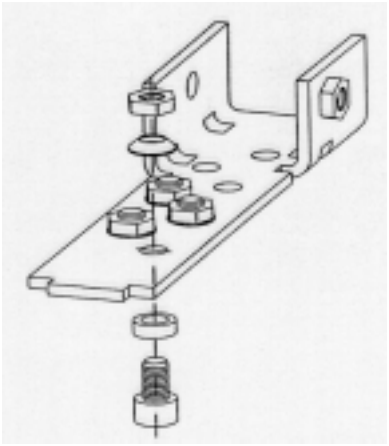


Fig. 3/11 Coding mechanism on the draw-out circuit-breaker

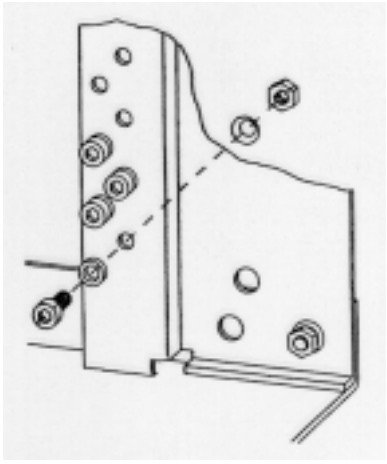
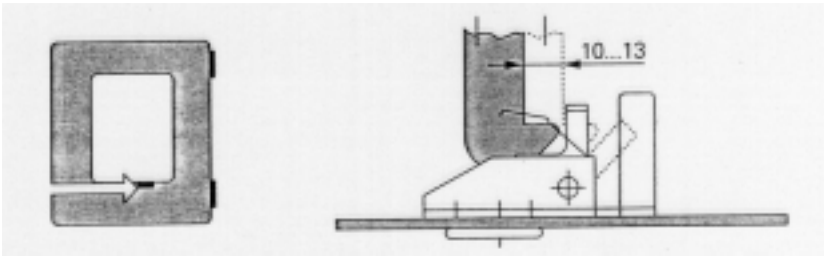


Fig. 3/12 Coding elements on the traverse of the guide frame

3.2.6. Interlocks

A blocking device prevents the cubicle door from being opened when the circuit-breaker is in the connected position. A hook attached to the guide frame latches into a ring on the inside of the cubicle door. The blocking device can be released for adjustment and testing.



The circuit-breaker can be prevented from being moved out of the connected, test or disconnected position inside the guide frame as standard by locking the closed crank hole with one or more padlocks (depending on the diameter of the shackle).

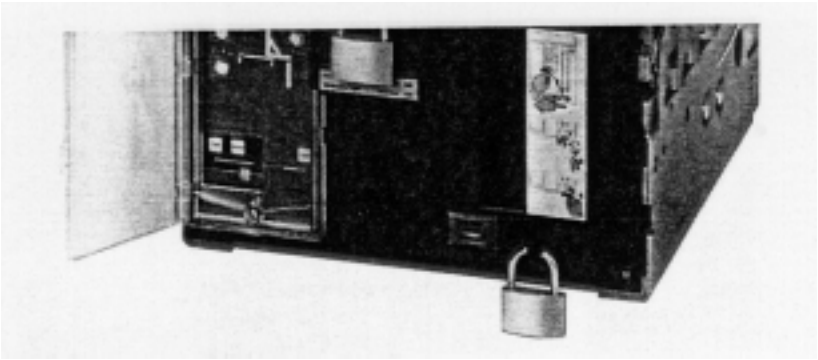


Fig. 3/14 Blocked crank hole locked with a padlock

3.3. Main connections for fixed mounted and draw-out circuit-breaker

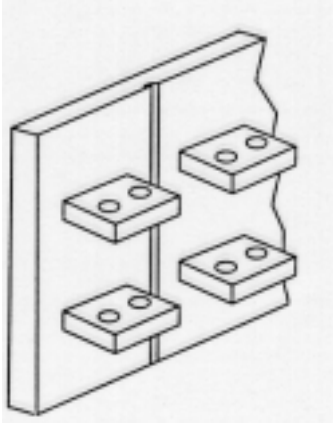
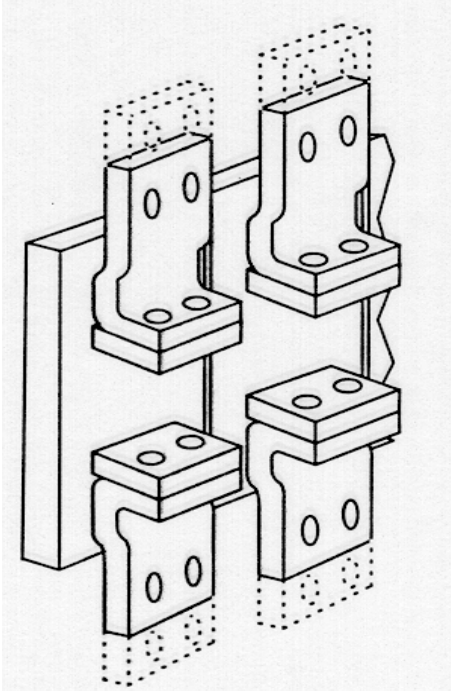
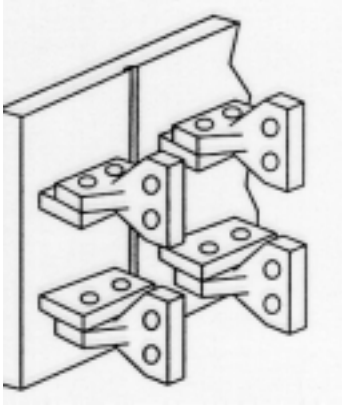
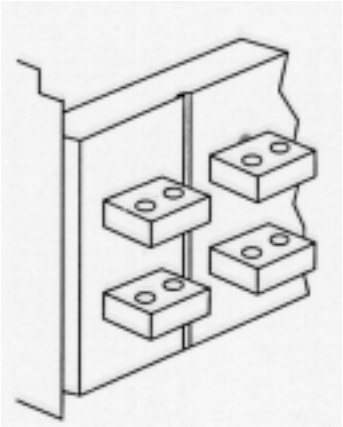
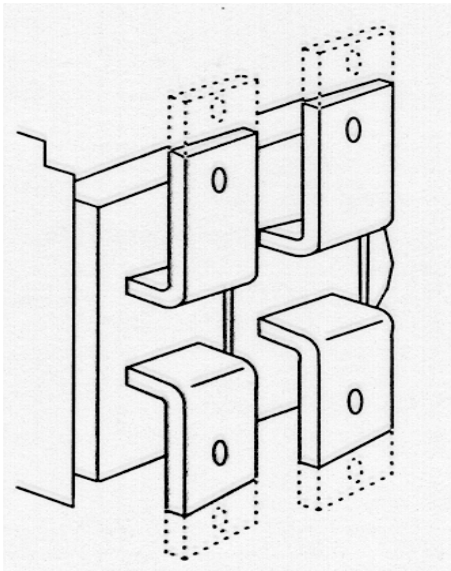
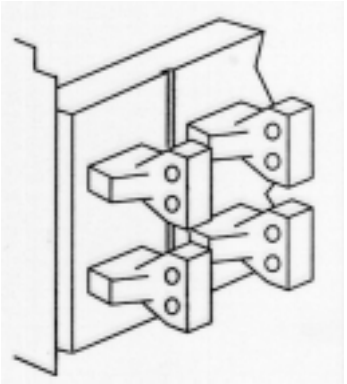
	Horizontal connection (standard)	Front connection With single or double hole for connections acc. to DIN 43 673 (double holes shown dotted)	Vertical connection
Fixed mounted circuit-breaker			 Vertical connection elements can be supplied as accessories
Guide frame			

Fig. 3/15 Mains connections, mixed types are available

3.4. Auxiliary connections

3.4.1. Auxiliary and signalling contacts

Auxiliary contacts related to main contact position

The 3WN6 circuit-breakers can be equipped with 3 types of auxiliary contacts to switch on the main contact. The standard type contains an auxiliary contact block comprising two NO and two NC contacts, but by fitting an additional block, a total of two NO, two NC and two changeover contacts are available as auxiliary contacts. An auxiliary contact block comprising 4 NO contacts is also available as an accessory, which means, that 6 NO and two NC contacts are also available.
These auxiliary contacts are operated in accordance with the switching state of the circuit-breaker.

Signalling contacts
A grouped signal for overload, short-circuit and (depending on the settings and version of the overcurrent release) also earth-fault tripping is output via the tripped signalling contact S11 fitted as standard.

Apart from this, every circuit-breaker is factory fitted with a mechanical reclosing lockout, that is activated following overload, short-circuit and earth-fault tripping. The mechanical reclosing lockout as well as the tripped signals are visually perceptible by the protruding red reset button on the control panel and remain active until this button is pressed

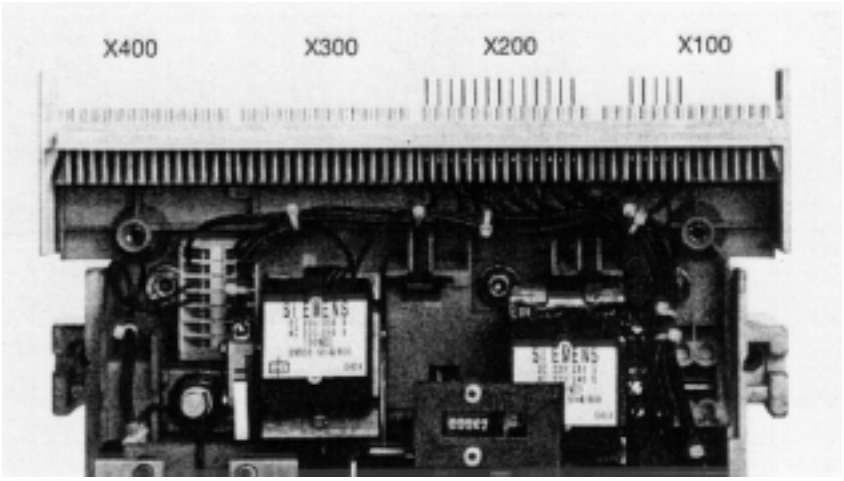


Fig. 3/16 Auxiliary connections

If the circuit-breaker must be ready to close again immediately after it has tripped, an automatic mechanical reset device is available which, however, does not reset the electrical signal of the tripped signalling contact S11. The tripped signal must be cancelled by pressing the reset button.
It is also possible to determine the cause of the tripping via the solid state overcurrent release (see section 2.8 "Overcurrent release system").

3.4.2. Auxiliary connections

The auxiliary connections for the 3WN6 circuit-breaker are brought to a horizontal contact blade block, in the top section behind the control panel. This contact blade is subdivided into 4 segments (X100 ... X400) that each comprises 14 contacts.

3.4.2.1. Fixed mounted version

For fixed mounted circuit-breakers, depending on the version, up to four 14-pole hand connectors are provided for connecting the auxiliary wires. These hand connectors have coding pins to prevent them from being interchanged by mistake on the circuit-breaker.

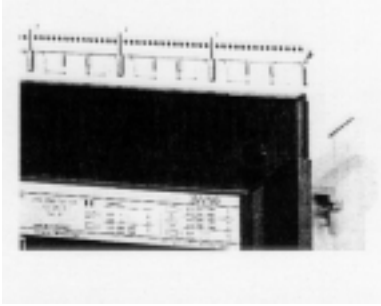


Fig. 3/17 Fixed mounted circuit-breaker with hand connectors

3.4.2.2. Draw-out version

The guide frames of the draw-out version are equipped with auxiliary draw-out connectors. Depending on the version of the circuit-breaker, up to four 14-pole connectors are mounted on the top edge of the guide frame.

3.4.3. Determining the required number of auxiliary connectors

The required number of auxiliary contacts depends on:

- Type of operating mechanism
- Overcurrent releases with/without additional functions with/without current transformers
- Type and number of auxiliary releases
- Number of auxiliary contact blocks

a	First auxiliary connector, for standard signals, always required	1
b	Operating mechanism	
b1	manual operating mechanism with stored energy device with mechanical closing	0
b2	manual operating mechanism with stored energy device with mechanical and electrical closing	+1
b3	manual/motorised operating mechanism with stored energy device with mechanical and electrical closing	+1
c	Overcurrent release	
c1	with basic functions	+0
c2	with additional functions 1 or 2	+2
	Connection of external current transformers for N-conductor overload protection and for earth fault protection	
c3	current transformer on N-conductor (needed for three pole circuit-breakers if c2 not selected)	+1
c4	current transformer at the star point of the transformer (needed for three pole circuit-breakers if c2 not selected)	+1
d	Auxiliary releases	
d1	with/without 1st auxiliary release (shunt release "f", F1; Undervoltage release "r", F3)	+0
d2	1st auxiliary release (delayed undervoltage release "rc", F8) needed if b2 or b3 not selected	+1
d3	1st and 2nd auxiliary release (shunt release "f", F2; needed if b2 or b3 or d3 not selected)	+1
e	Auxiliary contacts	
e1	1st auxiliary contact block 2NO + 2NC	+0
e2	1st and 2nd auxiliary contact block 2NO + 2NC + 2 CO (needed if b2 or b3 or d3 not selected)	+1
f	Communication module / Measurement module	
f1	without Communication or measurement module	+0
f2	with Communication or measurement module (needed if c2 or c3 or c4 not selected)	+2
g	Total number of auxiliary connectors (maximum of 4)	

The basic equipment for every circuit-breaker includes the auxiliary connector X200. On retrofitting accessories or rearranging equipment it is important to check whether any auxiliary connectors required have already been supplied or require to be ordered.
If draw-out circuit-breakers and guide frames are ordered separately, the number of draw-out connectors must be specified on ordering the guide frame (see also 3.4.3)
For the terminal assignment please refer to chapter 6.

3.5. Short-circuiting and earthing devices for 3WN6

Applications

Relocateable, positively driven short-circuiting and earthing devices are installed in isolated electrical system components in order to ensure safe isolation from supply in the work area by short-circuiting the input side of the main conductive paths.

Earthing drawers and switches are a simple and effective means of earthing. They are simply installed instead of the relevant draw-out circuit-breaker in the guide frame. This ensures that these devices are first connected to the earth conductor and then to the components which are to be earthed.

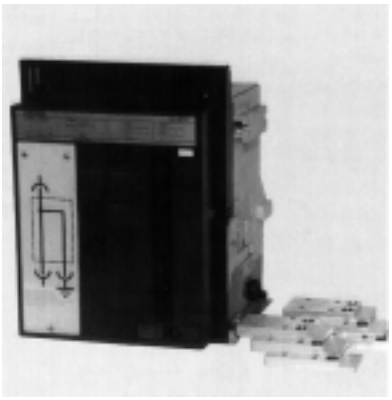


Fig. 3/19 Short-circuit and earthing drawer

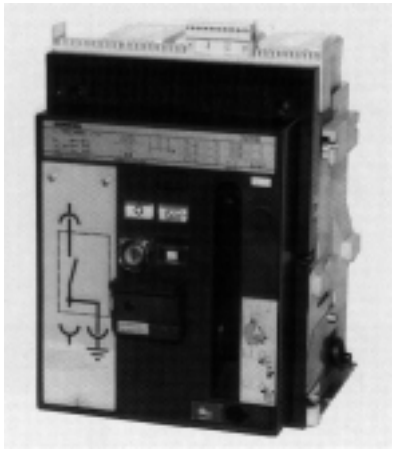


Fig. 3/20 Short-circuit and earthing draw-out circuit-breaker

Construction

The earthing contact is fitted to the side of the circuit-breaker and the connection with the guide frame is made automatically when the circuit-breaker is moved into position.

Transient current for earthing contact	15 kA (500ms)
Rated operating voltage	690 V
Standards	DIN VDE 0683

Short-circuit and earthing draw-out circuit-breakers

This version comprises a complete circuit-breaker with conductive paths, operating mechanism and accessories as required. The contact blades can be bridged either above or below.
This version offers additional protection of the operating personnel because, provided that the appropriate operating mechanism is selected, short-circuiting can also be carried out by remote control of the energy store.
The short-circuiting and earthing circuit-breaker can be equipped with operating mechanisms and auxiliary releases as in the case of the 3WN6 circuit-breaker.
The short-circuiting and earthing circuit-breakers have no solid state overcurrent releases for overload or short-circuit protection. An interlocking mechanism that covers the "mechanical OFF" and the "electrical ON" buttons is supplied as standard. In contrast to the 3WN6 circuit-breaker, in this case the interlocking mechanism does not hold down the "mechanical OFF" button. It simply prevents the circuit-breaker from being switched off inappropriately.

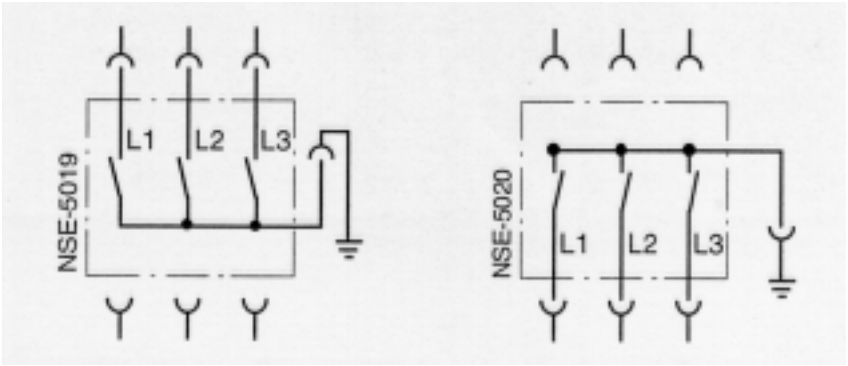


Fig. 3/21 3-pole circuit-breaker version

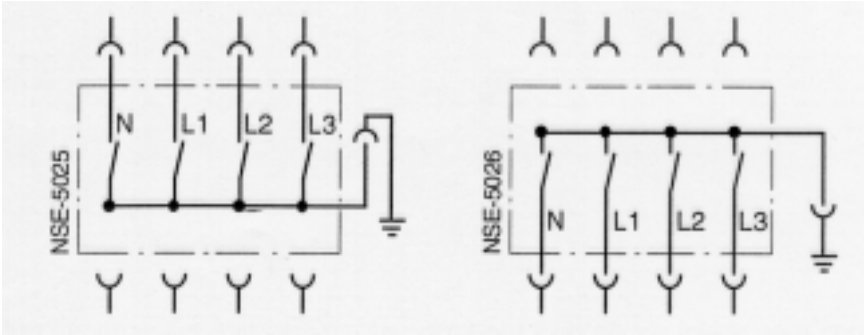


Fig 3/22 4-pole circuit-breaker version

Short-circuiting and earthing drawer
The short-circuiting and earthing drawer comprises the circuit-breaker housing with contact blades that are connected to the short-circuit bridge.

The short-circuit bridges are fitted above and/or below in accordance to the version. The earthing and short-circuiting connections are established by moving the device into position along the guide rails.

To ensure safe usage it is a must to check the parts which will be shortened and/or earthed to be free of voltage. It is therefore recommended that the drawer is only cranked into position with the cubicle door closed

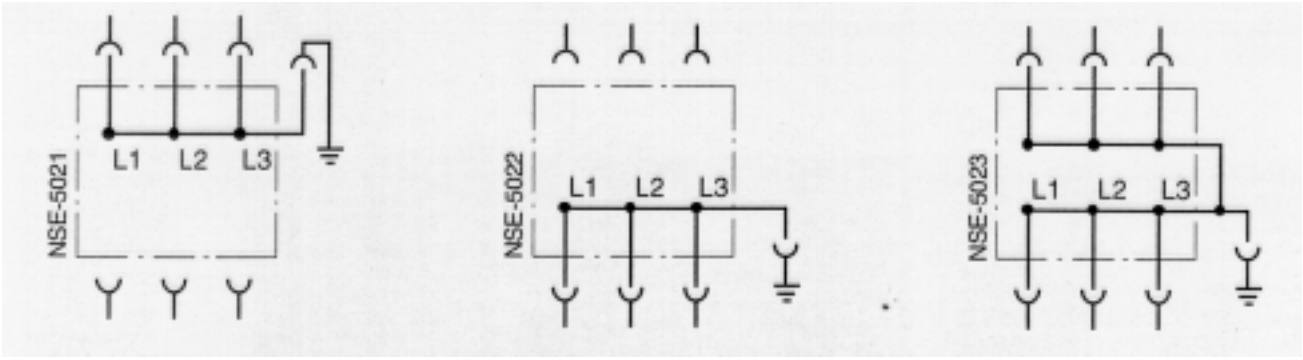


Fig. 3/23 3-pole draw-out version

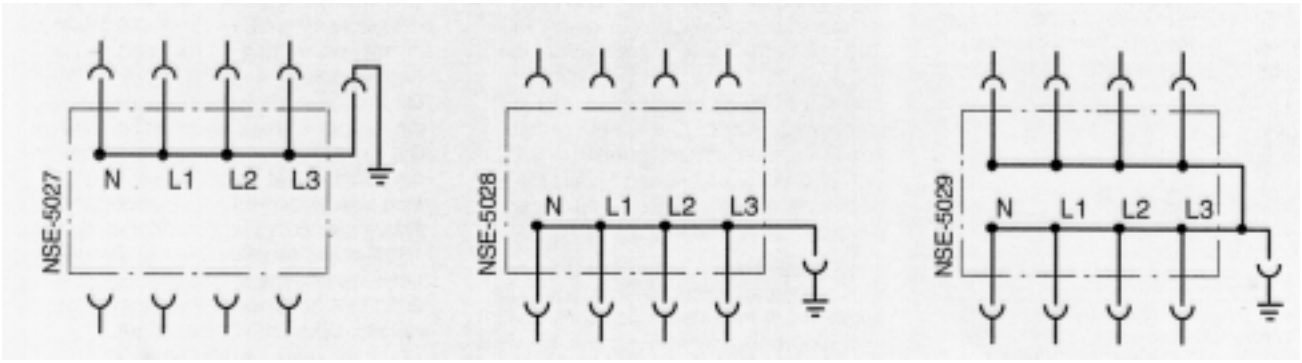


Fig. 3/24 4-pole draw-out version

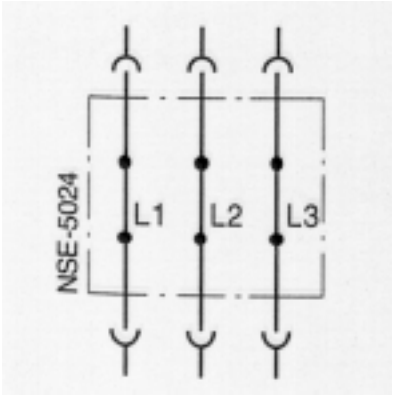


Fig. 3/25 3-pole version short-circuiting drawer

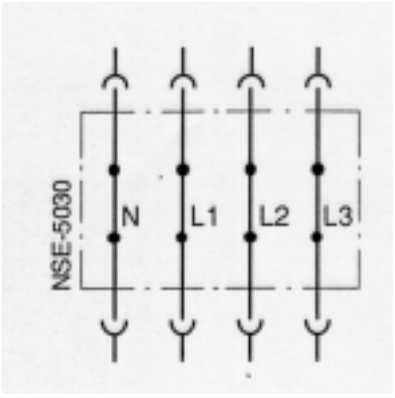


Fig. 3/26 4-pole version short-circuiting drawer

4. Planning and installation

4.1. Circuit-breaker selection

Circuit-Breaker are an important component of electrical systems responsible for power distribution (see Fig. 4/1). For low voltage supply networks in the nominal current range from 10 to 6300 A, Siemens offers a wide range of circuit-breakers giving the engineer planning an energy distribution system the possibility to "draw on lavish resources". Taking a 400 V power distribution system as the criteria for selecting circuit-breakers is demonstrated.
The optimum circuit-breaker for any application is selected from the Siemens range as in this example.

- 3WN circuit-breaker (Fig. 4/2a+b)
  The high short-circuit withstand current supports time grading with up to six grading levels. Two circuit-breaker series (3WN6 with medium breaking capacity of 80 kA, and 3WN1 with high breaking capacity up to 100 kA) are available as 3- and 4-pole circuit-breakers for rated currents up to 6300 A and for rated voltages up to 1000V. They can be supplied as fixed-mounted or draw-out circuit-breakers.

- 3WS circuit-breaker (Fig. 4/2c)
  The 3WS vacuum circuit-breaker is an interesting alternative to the 3WN circuit-breaker. Siemens is the first and only supplier of vacuum circuit-breakers for low voltage systems world-wide. They where developed on the basis of many years of experience in medium voltage technology.

  The making/breaking process takes place in a hermetically sealed vacuum tube to prevent the environment being affected by the short-circuit breaking crack and by the switching gas deposits with insulation reducing. Another important advantage of the 3WS circuit-breaker is that following serious short-circuit breaking, inspection and possible replacement of the contacts or arcing chambers is not necessary. The 3WS withstands short-circuiting up to 30 times without incurring damage. The system only remains shut down for as long as it takes to clear the cause of the short-circuit. Thus the vacuum circuit-breaker contributes to improving system availability. It is available in two sizes for rated currents from 630 A up to 2500 A with a breaking capacity of 50 kA and rated voltages of up to 1000 V in fixed mounted and draw-out versions. The 3WS is suitable for time discrimination to its maximum breaking capacity.

- 3VF compact circuit-breaker (Fig. 4/2 d)
  The most important characteristics of the 3VF circuit-breakers are their compact size and current limiting function. They can be supplied in three sizes with breaking capacity from 35 kA to 100 kA and rated currents up to 2000 A.

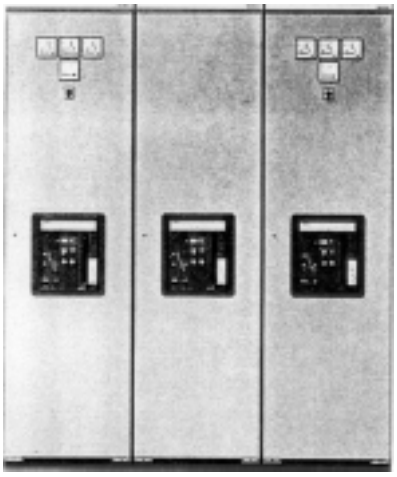


Fig. 4/1
Siemens offers a wide range of circuit-breakers for safe power distribution, e.g. the 3WN6 series shown here.

On the safe side with KUBSplus

Fig. 4/3 shows the schematic circuit diagram for the 400 V power distribution system mentioned (Fig. 4/1) whereby particular attention is paid to circuit-breakers Q1, Q2 and Q7. The starting point for selecting circuit-breaker Q1 is the rated current of the transformer. In the case of circuit-breakers Q2 and Q7 it is the load currents in the branches, whereby 600 A is assumed for Q2 and 180 A for Q7. The selected transformer has a power rating of 2000 kVA and delivers a maximum short-circuit current of approximately 45 kA.

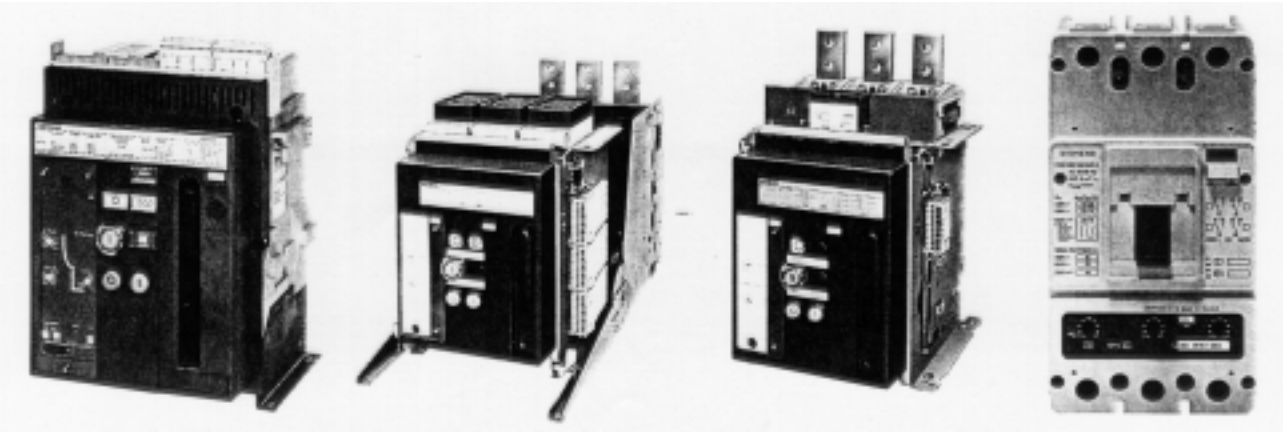


Fig. 4/2a-d A wide range of circuit-breakers (3WN6, 3WN1, 3WS1, 3VF) guarantees the right circuit-breaker in the right location. With the 3WS circuit-breaker, the most reliable, low maintenance and hard wearing switching principle, the vacuum technique, is now also available for low voltage systems.

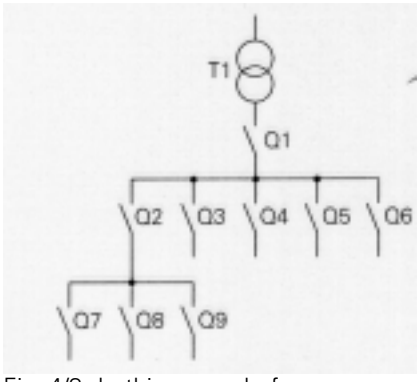


Fig. 4/3 In this example for a power distribution system, circuit-breakers Q1 and Q2 have to be selected correctly

On the basis of these data, the compact circuit-breaker 3VF (630A) can be selected from catalogue NS K for Q2, and the compact circuit-breaker 3VF4 (180A) can be selected for Q7 with breaking capacities of 65 kA and 40 kA respectively. When a circuit-breaker is selected according to the rated current, the ambient temperature expected under operating conditions has to be taken into account. Selection is particularly easy using the PC program KUBSplus (short-circuit calculation and circuit-breaker selection). The above selection is confirmed by a check carried out with this program. The program is shown in Fig. 4/4a.

Current or time discrimination?

Discrimination means that in case of a fault in a distribution system, only the branch containing the fault is interrupted, the remaining branches maintain the power supply. For this reason only the "lowest" circuit-breaker carrying the short-circuit current opens, when circuit-breakers are connected in series, There exists two types of discrimination:
- current discrimination and
- time discrimination.

Current graded discrimination

2 circuit-breakers are selective when the response value of the upstream circuit-breaker is greater than the maximum short-circuit current at the location of the down stream circuit-breaker.

Time graded discrimination

2 circuit-breakers are selective when the upstream circuit-breaker uses a short time delayed short-circuit current. Which must be delayed as long as the downstream circuit-breaker needs to clear the short-circuit. The grading time distance is 70 ms as minimum according to standard rules.

The limit of discrimination:

Is this value of the current above which a current grading control is possible.

The selection and calculation procedure carried out with KUBSplus now shows, however, that the discrimination limit between the two selected circuit-breakers is as low as 6 kA. It is only based on the current discrimination. The probability of the current level exceeding 6 kA in the event of a short-circuit is extremely high considering the output level of the selected transformer.
In order to increase the discrimination limit, a 3WN6 is now selected for the preliminary circuit-breaker Q1. As can be seen from Fig. 4/4b (from KUBSplus), the discrimination limit has now been raised to 15 kA.

The discrimination, however is, still inadequate, so the time discriminating aspects of the 3WN circuit-breakers have to be taken into account since the 3WN circuit-breakers are able to carry the full short-circuit for a short time as far as their maximum breaking capacity, if a short-circuit happens tripping can be delayed briefly in order to wait for short-circuit tripping of the downstream circuit-breaker.

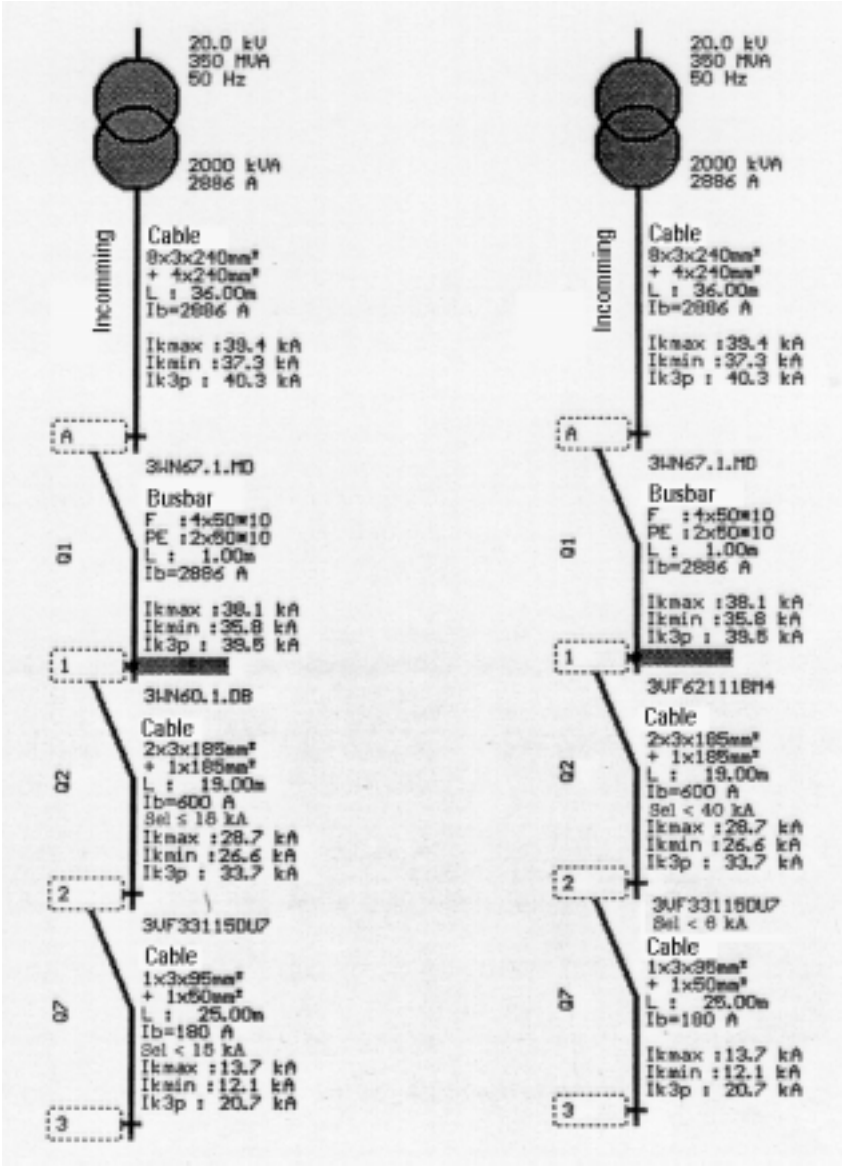


Fig. 4/4 The PC program KUBSplus makes planning transparent

Time-delayed grading control

As can be seen from the above example, current grading is only possible to a limited extent. The advantages of time discrimination are particularly apparent in the case of multi level distribution systems in which several circuit-breakers are connected in series.
In applications of this type, the delay times for a circuit-breaker are set to a maximum of 500 ms longer than of the downstream circuit-breaker. However, this may signify that if a short-circuit is located immediately downstream of the infeed circuit-breaker, the short-circuit current flows for this period of time.
The result will be considerable loading on the system due to heat or arcing.

The requirement for a significantly reduced delay time while maintaining full discrimination over the entire short-circuit range is fulfilled by "short time grading control" (ZSS).

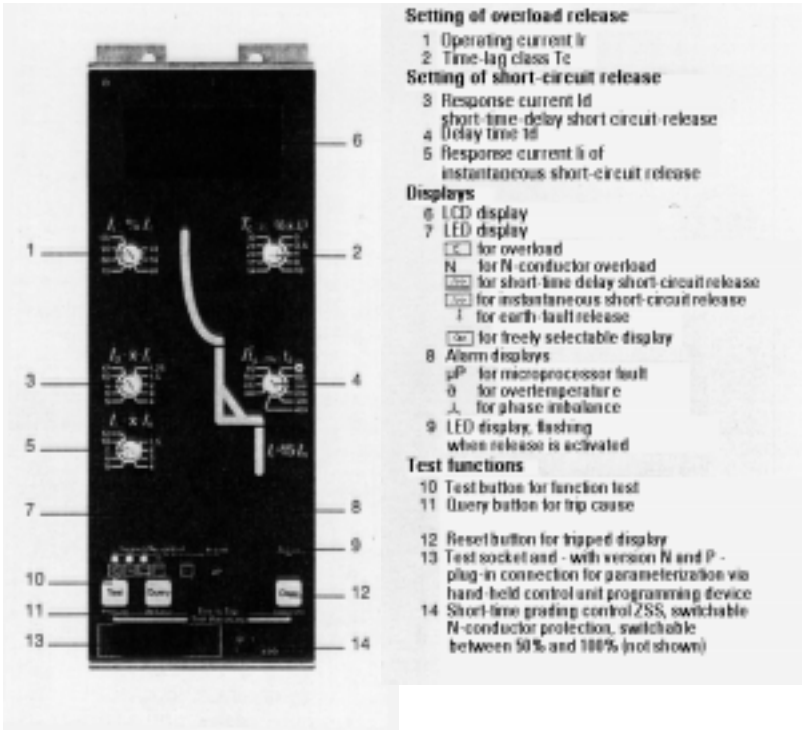


Fig. 4/5 Overcurrent release version D "aznN"

Correct selection and setting

Multi-functional overcurrent releases are available for the circuit-breakers that have to be set in accordance with the application. An overcurrent release of the "aznN" type is shown in Fig. 4/5 for the 3WN6 circuit-breaker.
If we stay with the example of the power distribution system in Fig. 3/4, assuming that the branch containing the 3WN6 and the 3VF circuit-breakers should operate with full discrimination, the following selection results:

- 3WN60 .1-1DD . . - circuit-breaker for rated current I_n = 630 A
- 3VF4211-2BK41 circuit-breaker for rated current I_n = 200 A

In case of the 3WN6, the rated current for the branch is assumed to be 600 A, therefore the factor that has to be set for the inverse time delay overcurrent release "a" (rotary switch 1 - see Fig. 4/5) is as follows:

I/I_n = 600A / 630A = 0.95

The selected overcurrent release also allows different time lag classes to be set for thermal overload protection. For protection of the system in this example, T_c = 10s is selected (by rotary switch 2 - see Fig. 4/5)
The response value for the short time delay short-circuit release "z" must be set to a value larger than the overcurrents that occur during normal operation.
Such values occur when either a large load is switched on or several smaller loads simultaneously. An adjustment factor of 4 is selected (rotary switch 3 - see Fig. 4/5). The result is a response value of

I_d = 4 x I_r = 4 x 600A = 2400 A

The delay time t_d is set to 80 ms (rotary switch 4 - see Fig. 4/5)

The "z" release will therefore only initiate tripping when a short-circuit current greater than 2400A flows for longer than 80 ms. The instantaneous short-circuit release "n" is set to I_i = ∞ (rotary switch 5 - see Fig. 4/5). This ensures full discrimination as far as to the highest short-circuit current.

In case of the 3VF, an operating current of 180A is assumed.
The factor to be set for the inverse time-delay overcurrent release "a" is as follows:

I_r/I_n = 180A / 200A = 0.9

For system protection, the value for the instantaneous short-circuit release "n" is usually set to a factor between 5 and 10 times the rated current. If it is set to a factor of 8, the response current is as follows:

I_i = 8 x I_r = 8 x 200A = 1600A

The accessories must also be appropriate

In today's system engineering. remote operator control and monitoring of switching devices are particularly important. Motor drives are available for this purpose, some with an energy store (useful for synchronisation tasks, etc.).

Shunt releases or undervoltage releases can be implemented for breaking and an undervoltage release in conjunction with an appropriate push-button can be implemented as an EMERGENCY STOP device.

4.2. Derating of the operational current

A derating of the operational current of the circuit-breakers can be necessary, if their surrounding temperature exceeds +55°C.

4.2.1. Surrounding temperature and rated operational current

The following table shows the relation between the surrounding temperature and the rated operational current of the 3WN6 circuit-breaker in accordance to the following items:

- Type of circuit-breaker (fixed mounted or draw-out type)
- Type of connection (horizontal or vertical busbar)
- Surrounding temperature of the circuit-breaker

This table applies only for copper.

Example

Points given:
3WN65, draw-out type with vertical busbar connection (rear side)
Surrounding temperature = 60°C

Solution:
The above mentioned circuit-breaker can carry its nominal rated current of 2000 A. Necessary busbar system: 2x100x10

3WN6 - selection table according to different types, way of connection and surrounding temperature

			3WN60	3WN61	3WN62	3WN63	3WN64	3WN65	3WN66	3WN67
Type	Way of connection	T_{surr}	Maximum operational current [A]							
Draw-out	Front or rear connection by horizontal busbars	30°C	630	800	1000	1250	1600	2000	2500	3190
		40°C	630	800	1000	1250	1600	2000	2500	3010
		50°C	630	800	1000	1250	1600	2000	2500	2830
		60°C	630	800	1000	1170	1600	2000	2390	2590
		70°C	630	800	980	1052	1500	1980	2130	2350
	Busbar cross section		1x40x10	1x60x10	1x60x10	2x40x10	2x60x10	2x100x10	2x100x10	3x100x10
	Vertical rear connection by busbars	30°C	630	800	1000	1250	1600	2000	2500	3200
		40°C	630	800	1000	1250	1600	2000	2500	3200
		50°C	630	800	1000	1250	1600	2000	2500	3070
		60°C	630	800	1000	1250	1600	2000	2500	2860
		70°C	630	800	1000	1140	1540	1920	2340	2650
	Busbar cross section		1x40x10	1x60x10	1x60x10	2x40x10	2x60x10	2x100x10	2x100x10	3x100x10
Fixed mounted	Front connection by busbars	30°C	630	800	1000	1250	1600	2000	2500	3200
		40°C	630	800	1000	1250	1600	2000	2500	3200
		50°C	630	800	1000	1250	1600	2000	2500	3020
		60°C	630	800	1000	1250	1560	2000	2500	2760
		70°C	630	800	960	1130	1410	1890	2300	2500
	Busbar cross section		1x40x10	1x60x10	1x60x10	2x40x10	2x60x10	2x100x10	2x100x10	3x100x10

Transfer resistance per pole

Fixed mounted circuit-breaker

Nominal rated current	Transfer resistance per pole
630 A	22 µΩ
800 A	22 µΩ
1000 A	22 µΩ
1250 A	16 µΩ
1600 A	16 µΩ
2000 A	11 µΩ
2500 A	11 µΩ
3200 A	10 µΩ

Draw-out circuit-breaker

Nominal rated current	Transfer resistance per pole
630 A	47 µΩ
800 A	47 µΩ
1000 A	47 µΩ
1250 A	35 µΩ
1600 A	35 µΩ
2000 A	20 µΩ
2500 A	19 µΩ
3200 A	17 µΩ

Note: This does not give any indication about the conduct erosion of the main contacts or of the circuit-breaker itself.

4.2.2. Mounting into a cubicle

Rated operational current in accordance with the way of mounting the circuit-breakers

The values in the following tables have resulted from tests and calculation. It is only an aid for planning the switch boards, but they cannot replace the own experience and checking of the planning engineer. All values are related to the types of cubicles according to the Fig. 4/6a and 4/6b.

Starting parameters:

- Cubicle dimensions (see Fig. 4/6a and 4/6b)
- Mounting of the circuit-breaker on carrying rails
- Type of the installed circuit-breaker
- Way of connection to the main busbars
- Draw-out circuit-breakers
- Surrounding temperature of the cubicle T_A.

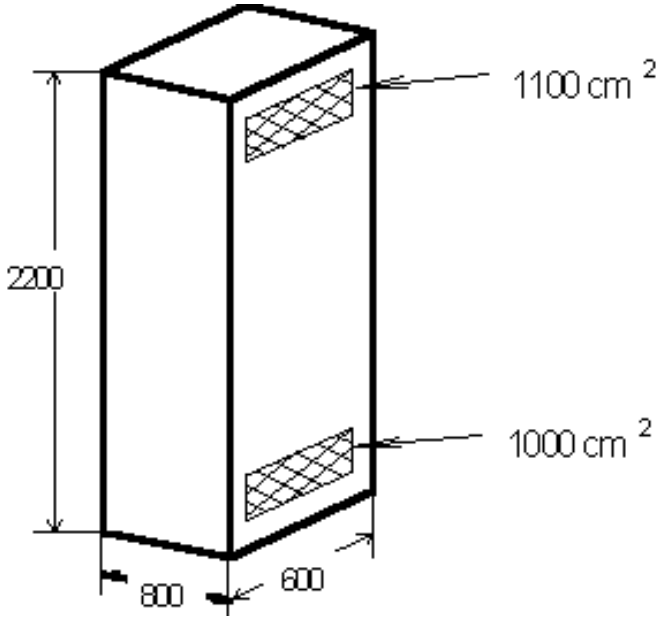


Fig. 4/6a Cubicle with ventilating slots (up to IP 42)

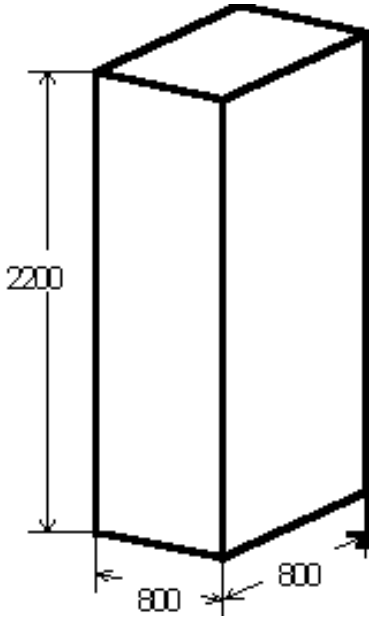


Fig. 4/6b Cubicle without ventilating slots (up to IP 54)

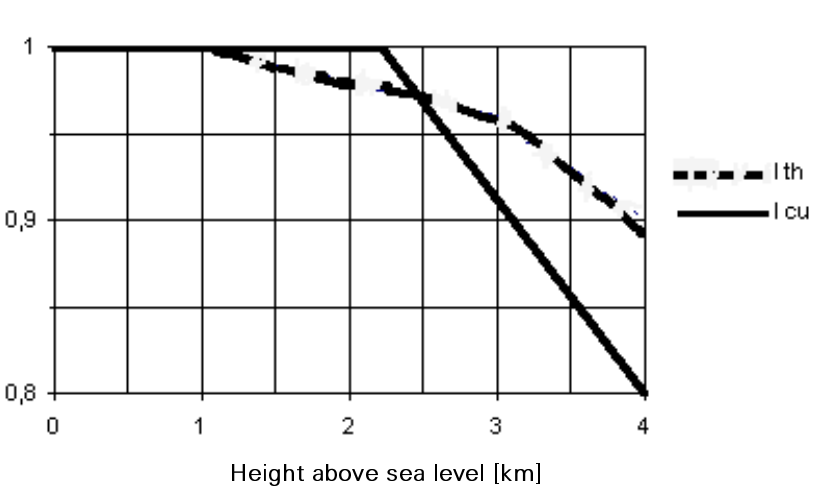
Operational rated current for mounting into a cubicle with copper busbar system

Busbar cross section 3WN60 (630 A): 1x40x10 3WN61 (800 A): 1x60x10 3WN62 (1000 A): 1x60x10		3WN60 630 A				3WN61 800 A				3WN62 1000 A			
		One Breaker Front connect.	One Breaker Vertical-connect.	Two Breakers Vertical-connect.	Three Breakers Vertical-connect.	One Breaker Front connect.	One Breaker Vertical-connect.	Two Breakers Vertical-connect.	Three Breakers Vertical-connect.	One Breakers Front connect.	One Breakers Vertical-connect.	Two Breakers Vertical-connect.	Three Breakers Vertical-connect.
Cubicle with ventilation													
	30°C	630 A	630 A	630 A 630 A 630 A	630 A 630 A 630 A	800 A	800 A	800 A 800 A 800 A	800 A 800 A 800 A	1000 A	1000 A	1000 A 1000 A 1000 A	1000 A 1000 A 1000 A
	40°C	630 A	630 A	630 A 630 A 630 A	630 A 630 A 630 A	800 A	800 A	800 A 800 A 800 A	800 A 800 A 800 A	1000 A	1000 A	1000 A 1000 A 1000 A	1000 A 1000 A 1000 A
	50°C	630 A	630 A	630 A 630 A 630 A	630 A 630 A 630 A	800 A	800 A	800 A 800 A 800 A	800 A 800 A 800 A	1000 A	1000 A	1000 A 1000 A 1000 A	1000 A 1000 A 1000 A
Cubicle without ventilation													
	30°C	630 A	630 A	630 A 630 A 630 A	630 A 630 A 630 A	800 A	800 A	800 A 800 A 800 A	800 A 800 A 800 A	1000 A	1000 A	1000 A 1000 A 1000 A	950 A 950 A 950 A
	40°C	630 A	630 A	630 A 630 A 630 A	630 A 630 A 630 A	800 A	800 A	800 A 800 A 800 A	750 A 750 A 750 A	1000 A	1000 A	1000 A 1000 A 1000 A	790 A 790 A 790 A
	50°C	630 A	630 A	630 A 630 A 630 A	620 A 620 A 620 A	800 A	800 A	800 A 800 A 800 A	620 A 620 A 620 A	1000 A	1000 A	870 A 870 A 870 A	- - -

Busbar cross section: 3WN63 (1250 A): 2x40x10 3WN64 (1600 A): 2x60x10		3WN63 1250 A				3WN64 1600 A			
		One Breaker Front connect.	One Breaker Vertical-connect.	Two Breakers Vertical-connect.	Three Breakers Vertical-connect.	One Breaker Front connect.	One Breaker Vertical-connect.	Two Breakers Vertical-connect.	Three Breakers Vertical-connect.
Cubicle with ventilation									
	30°C	1250 A	1250 A	1250 A 1250 A 1250 A	1250 A 1250 A 1250 A	1600 A	1600 A	1600 A 1600 A 1600 A	1600 A 1600 A 1600 A
	40°C	1250 A	1250 A	1250 A 1250 A 1250 A	1250 A 1250 A 1250 A	1600 A	1600 A	1600 A 1600 A 1600 A	1350 A 1560 A 1600 A
	50°C	1250 A	1250 A	1250 A 1250 A 1250 A	1250 A 1250 A 1250 A	1600 A	1600 A	1350 A 1600 A 1600 A	1250 A 1250 A 1600 A
Cubicle without ventilation									
	30°C	1250 A	1250 A	1250 A 1250 A 1250 A	1100 A 1100 A 1100 A	1600 A	1600 A	1290 A 1600 A 1600 A	1200 A 1200 A 1200 A
	40°C	1250 A	1250 A	1250 A 1250 A 1250 A	950 A 950 A 950 A	1600 A	1600 A	1250 A 1250 A 1250 A	1000 A 1000 A 1000 A
	50°C	1250 A	1250 A	1050 A 1050 A 1050 A	720 A 720 A 720 A	1200 A	1300 A	1150 A 1150 A 1150 A	- - -

Busbar cross section: 3WN65 (2000 A): 2x100x10 3WN66 (2500 A): 2x100x10 3WN67 (3200 A): 3x100x10		3WN65 2000 A				3WN66 2500 A				3WN67 3200 A			
		One Breaker Front connect.	One Breaker Vertical-connect.	Two Breakers Vertical-connect.	Three Breakers Vertical-connect.	One Breaker Front connect.	One Breaker Vertical-connect.	Two Breakers Vertical-connect.	Three Breakers Vertical-connect.	One Breaker Front connect.	One Breaker Vertical-connect.	Two Breakers Vertical-connect.	Three Breakers Vertical-connect.
Cubicle with ventilation													
	30°C	2000 A	2000 A	2000 A 2000 A 2000 A	2000 A 2000 A 2000 A	2500 A	2500 A	2500 A 800 A 800 A	800 A 800 A 800 A	3190 A	3200 A	2890 A 3200 A	2350 A 2890 A 3200 A
	40°C	2000 A	2000 A	2000 A 2000 A 2000 A	1950 A 1950 A 2000 A	2500 A	2500 A	2450 A 2500 A	2100 A 2300 A 2500 A	3010 A	3200 A	2350 A 3200 A	2250 A 2300 A 2400 A
	50°C	2000 A	2000 A	1920 A 2000 A	1680 A 1680 A 1680 A	2500 A	2500 A	2370 A 2370 A	1650 A 1850 A 2000 A	2830 A	3070 A	2440 A 2440 A	1760 A 1950 A 2000 A
Cubicle without ventilation													
	30°C	2000 A	2000 A	1900 A 2000 A	1550 A 1550 A 1550 A	2500 A	2500 A	2300 A 2300 A	- - -	2490 A	2800 A	2450 A 2450 A	- - -
	40°C	1870 A	2000 A	1800 A 1800 A	1250 A 1250 A 1250 A	2020 A	2200 A	1900 A 1900 A	- - -	2270 A	2370 A	2100 A 2100 A	- - -
	50°C	1720 A	1900 A	1400 A 1400 A	- - -	1870 A	1950 A	1430 A 1430 A	- - -	1950 A	2200 A	1600 A 1600 A	- - -

Factors for the reduction above 1000 m over sea level



The opposite illustration shows the reducing factors for I_{th} / I_{cu} in relation to the height at which the circuit-breakers are used. The nominal rated current of the circuit-breakers needs to be multiplied by this factor. The result shows the nominal rated current in the height where the circuit-breaker is used.

4.3. Safety clearances

4.3.1. Fixed mounted and draw-out version

Protective measures against switching gases

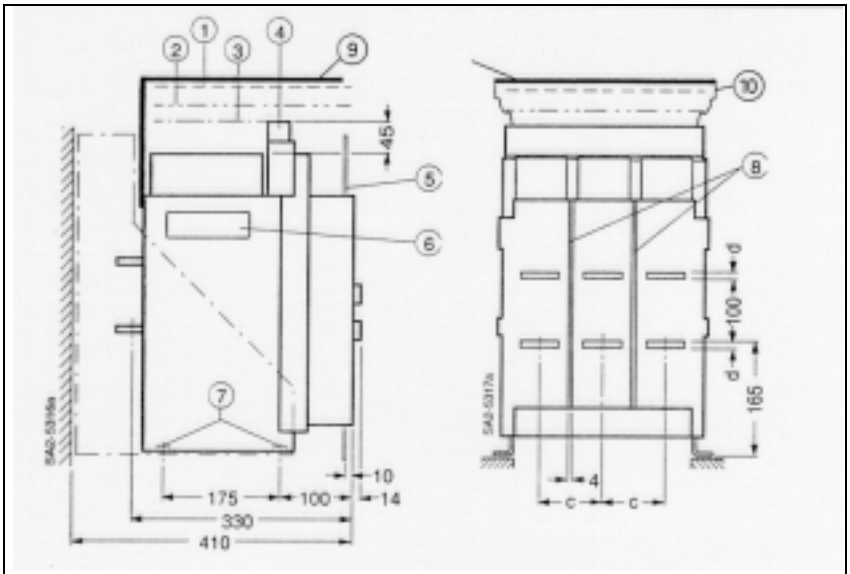
With the 3WN6 circuit-breaker due to the special construction of the arcing chute, an additional enclosure for restricting the arcing space is no longer necessary. A safety clearance extending beyond the maximum circuit-breaker dimensions does not have to be provided towards the neighbouring earthed components above the circuit-breaker. (For more details please refer to the following sections).

Control panel

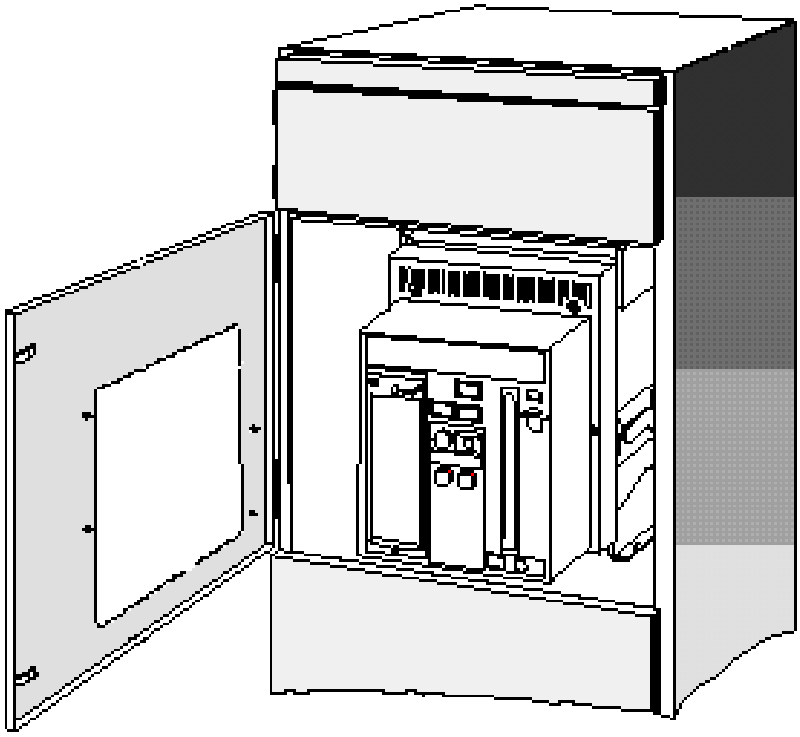
The control panel of the circuit-breaker protrudes through a cut-out in the cubicle door. This means that all switches and displays are accessible without the need to open the cubicle door. It is even possible to move the draw-out circuit-breaker along the guide rails with the cubicle door closed.

Edge protection and door sealing frame

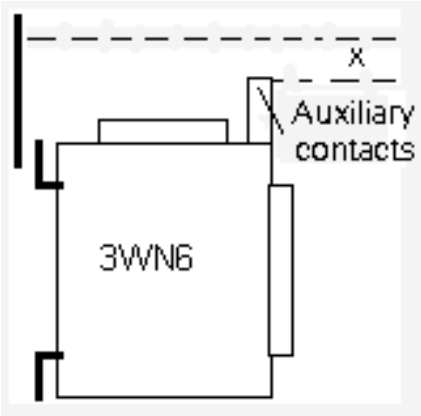
The customer has to provide a cut-out in the switchgear cubicle door for the control panel in accordance with the dimensions specified in the technical data drawings. Edge protection can be supplied for the cut-out in order to minimise the risk of injury. If a higher degree of protection is required (up to IP 54), the space between the control panel and the door cut-out can be sealed by installing a door sealing frame. This frame, that is available as an accessory, prevents both the penetration of dirt and the escape of switching gases in accordance with the specification for the degree of protection (IP 54).



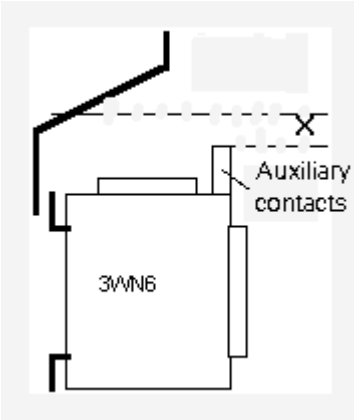
1 Clearance for removing the arc chute
2 Clearance for auxiliary connector
3 Arcing space; to be kept clear of current carrying, insulated and earthed components
4 Auxiliary connector
5 Cubicle door
6 Recessed grip
7 Nut M 8
8 Slot (4 mm deep) for phase separating barriers (not supplied)
9 Cover over arc chute
10 Ventilation



4.3.2. Circuit-breaker without covering the arc chambers



Sketch 1



Sketch 2

In certain cases covering of busbars which are under voltage is necessary.
The reference line of the circuit-breaker is the top edge of the auxiliary control connector system. Only for fixed mounted circuit-breakers is there an additional space required for changing the arc chutes (dimensions please refer to section 8).

- Rated operational voltage
  ≤ 400 V AC
  There are no covers for the mentioned busbar system necessary
  Dimension X = 0, see Sketch 1 and 2.

- Rated operational voltage
  > 400 V AC and ≤ 440 V AC
  Incoming busbar system coming from the top needs to be covered, when the following dimension is X ≤ 200 mm. Vertical incoming busbar system needs not to be covered (see sketch 1 and 2)

- Rated operational voltage
  > 440 V AC and ≤ 690 V AC
  Busbar systems laid above the circuit-breaker and vertically incoming busbar systems need to be covered in the range of the dimension X. This dimension is related to an actually existing maximum value of the short-circuit current (see table on the opposite side)

Size	Short-circuit current (r.m.s.)	Dimension X
I (up to 1600 A)	24 kA	200 mm
I (up to 1600 A)	34 kA	300 mm
I (up to 1600 A)	50 kA	500 mm
I (up to 1600 A)	65 kA	500 mm
II (up to 3200 A)	50 kA	650 mm
II (up to 3200 A)	65 kA	1000 mm
II (up to 3200 A)	80 kA	1000 mm

Other electrical equipment
Equipment mounted above or beside the circuit-breaker can be covered against the momentarily produced heat (generated by heavy short-circuit trippings).

When mounting additional separating plates or covers, the heat dissipation of the circuit-breakers needs to be considered.

4.3.3. Circuit-breaker with covering of the arc chambers

- Rated operational voltage $U_N \leq 500$ V AC
  There are neither additional covers necessary nor minimum distances to other equipment. That means that the maximum dimension of the breaker equals the minimum installation volume.

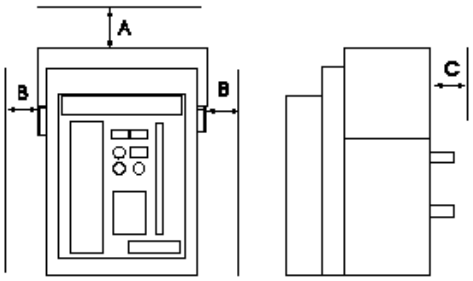
- Rated operational voltage $U_N > 500$ V AC
  Also for voltages up to 690 V there is neither upper safety clearance necessary nor busbar covers. For fixed mounted circuit-breakers with front accessible bus bar connections the standard arc chamber cover cannot be used at all.

The following table shows the minimum clearances (in mm) for other equipment.

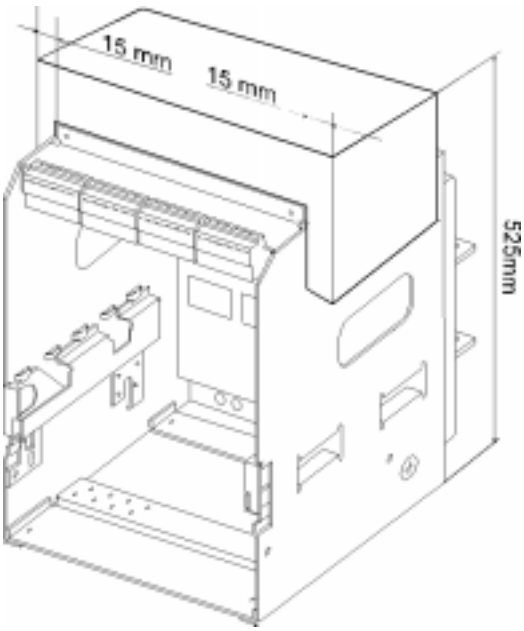
The minimum clearances in closed housings are necessary among other things for the switching gases to expand without causing damaging.

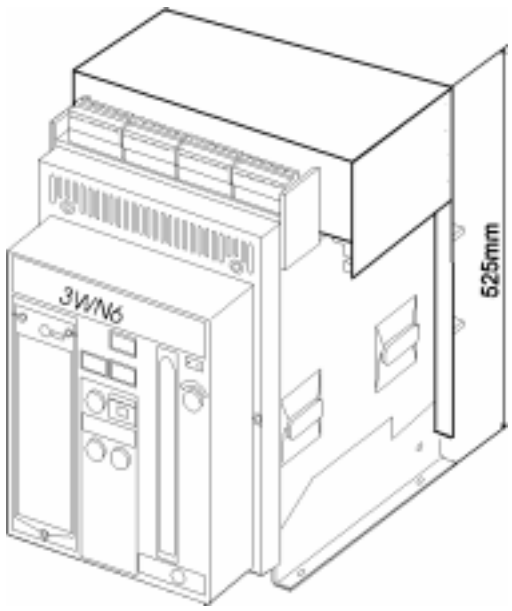
		Horizontal or vertical busbar connection				Front busbar connection			
		Fixed mounted		Draw-out		Fixed mounted		Draw-out	
		Size I	Size II	Size I	Size II	Size I	Size II	Size I	Size II
top A	1	0	0	0	0	not possible		0	0
	2	0	0	0	0			0	0
	3	60	60	60	60			60	60
side B	1	0	0	0	0			0	0
	2	0	0	0	0			0	0
	3	85	35	85	35			85	35
rear C	1	20	20	45	45			45	45
	2	95	95	45	45			45	45
	3	125	125	75	75			75	75

1 - to non conductive parts 2 - to conductive parts 3 - to busbar systems



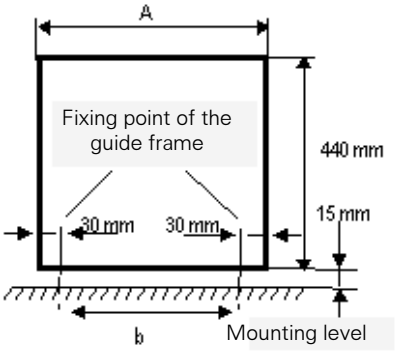
Size			Order No. (Retrofit)	As supplement to the order No.
I up to 1600A	3-pole	Fixed mounted	3WX3613 - 0GA00	Z=C35
		Draw-out	3WX3613 - 0GB00	Z=R35
	4-pole	Fixed mounted	3WX3613 - 0HA00	Z=C35
		Draw-out	3WX3613 - 0HB00	Z=R35
II up to 2000A to 3200A	3-pole	Fixed mounted	3WX3613 - 0KA00	Z=C35
		Draw-out	3WX3613 - 0KB00	Z=R35
	4-pole	Fixed mounted	3WX3613 - 0LA00	Z=C35
		Draw-out	3WX3613 - 0LB00	Z=R35



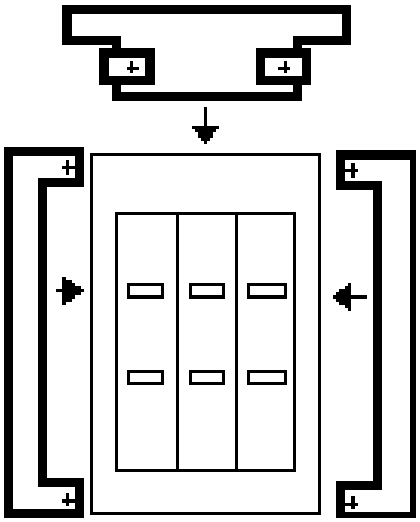


4.3.4. Separating plate on the rear side of the guide frame

To realise a separation between the circuit-breaker compartment and the connection area of the main busbar system or cabling it is only necessary to cut a rectangular opening into the rear side of the cubicle. With additionally ordered separating parts the separation can then be made (acc. to IP 20). These parts need to be fixed on the guide frame.



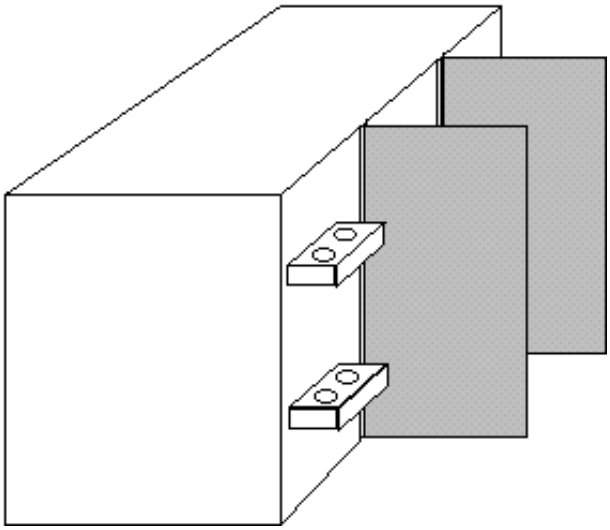
Cut-out within the compartment



Mounting of the kit parts for separating (optional parts)

4.3.5. Sheet plate for phase to phase separation

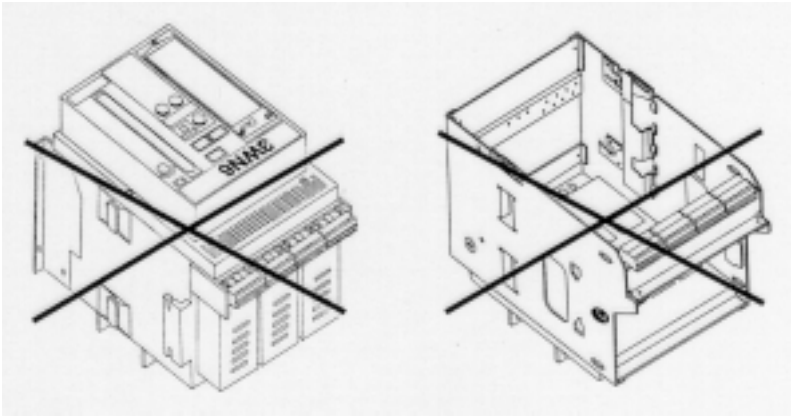
The circuit-breakers and guide frames have guiding slots (4mm wide) in their rear sides. These slots can be used to integrate phase to phase separating sheets to avoid arcing between phases. These sheets have to be fixed on the cubicle.



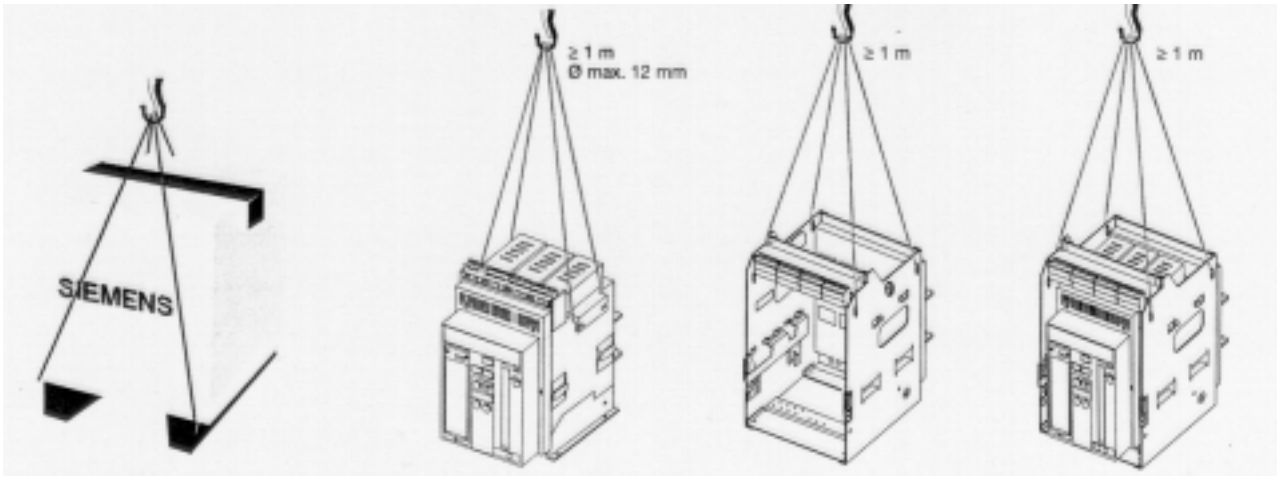
4.4. Installation

Transport

Neither the circuit-breakers nor the guide frames are permitted to be laid on the copper connections on the rear side.

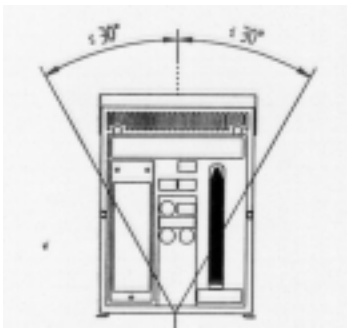


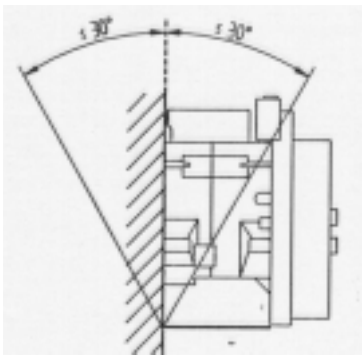
The circuit-breakers must be transported to the mounting location via a crane or forklift truck. The draw-out circuit-breaker can be transported in the connected position in the guide frames.

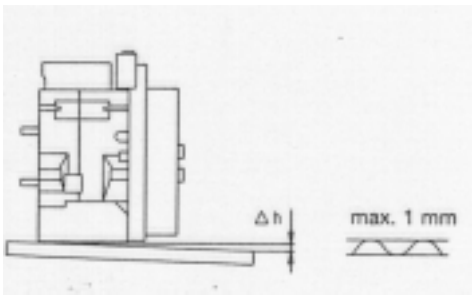


Weight in kg	Size I (up to 1600 A) 3-pole	4-pole	Size II (to 3200 A) 3-pole	4-pole
Circuit-breaker	approx. 37	approx. 51	approx. 60	approx. 70
Guide frame	approx. 22	approx. 37	approx. 27	approx. 46
Package (circuit-breaker + guide frame)	approx. 59	approx. 88	approx. 87	approx. 116

Mounting angle

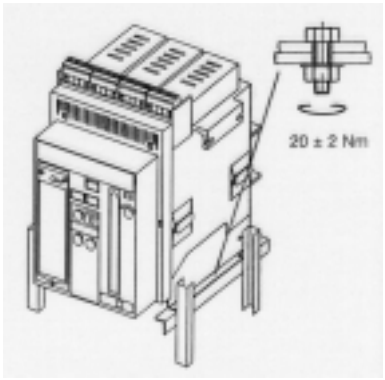






Fixed mounted circuit-breaker mounted on a horizontal surface

The circuit-breaker is positioned on the fixing brackets mounted in the cubicle and screwed in place from below with the four M8x16 bolts and securing components, both included in the delivery. The non-removable nuts in the circuit-breaker feet are used for this purpose. Any differences in the height of the mounting plate must be corrected using washers.



←
Fig. 4/7 Fixed mounted circuit-breaker mounted on a frame

↓
Fig. 4/8 Fixed mounted circuit-breaker mounted with supporting brackets

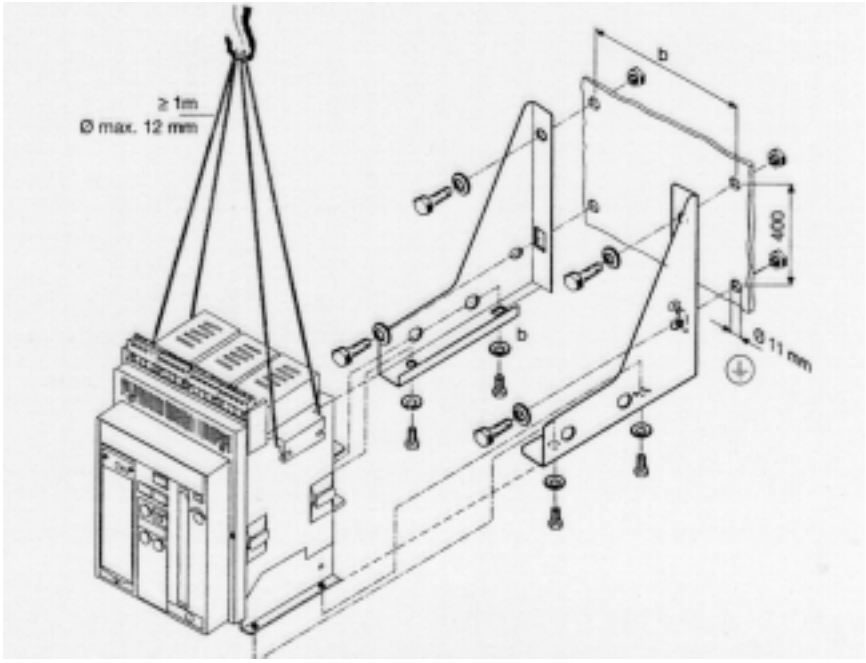
Fixed mounted circuit-breaker mounted on a vertical surface using support brackets

A vertical surface can be used for mounting the circuit-breaker with the support brackets that are available as accessories (order No. 3WX3681-0JA00).

In this case first the support brackets are attached to the vertical surface with the four hexagonal bolts, washers and M10 nuts supplied. Unevenness of more than 1 mm also has to be corrected.

The circuit-breaker is then placed on the support brackets, slid into position and fixed in place using the four M8x16 bolts and washers supplied. The non-removable nuts in the circuit-breaker feet are used for this purpose.

When using this way of mounting the busbar connections which are accessible from the front should be used.



Mounting the guide frame

The guide frame for draw-out circuit-breaker is mounted on a horizontal surface. The supplied M8x16 bolts, safety washers and nuts are to be used for fixing.

Unevenness of more than 1 mm in the mounting plate has to be corrected.

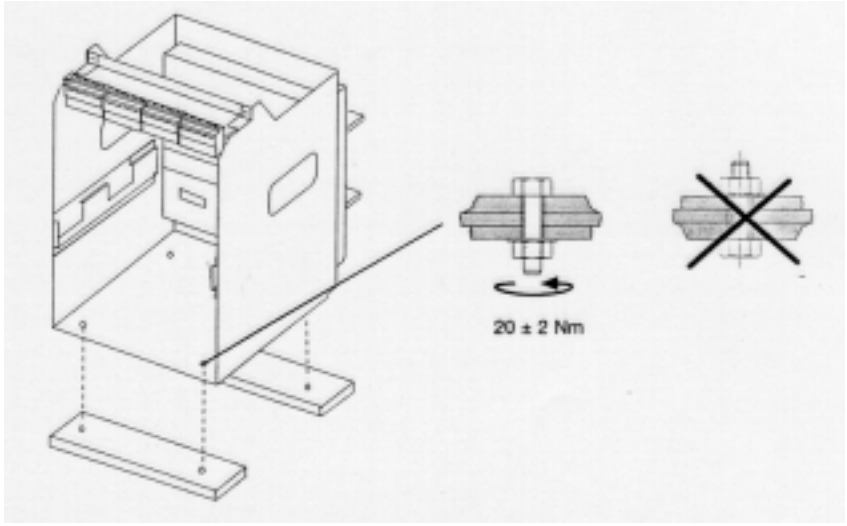


Fig. 4/9 Guide frame mounted on a horizontal plate

4.5. Main and auxiliaries connections

4.5.1. Connecting the auxiliary wiring to fixed mounted circuit-breakers

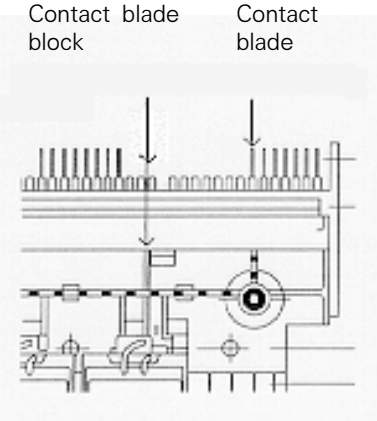
The circuit-breakers are supplied wired in accordance with the ordering data and ready to use. External control, signal and supply wires must be connected in accordance with the supplied unit wiring diagrams.

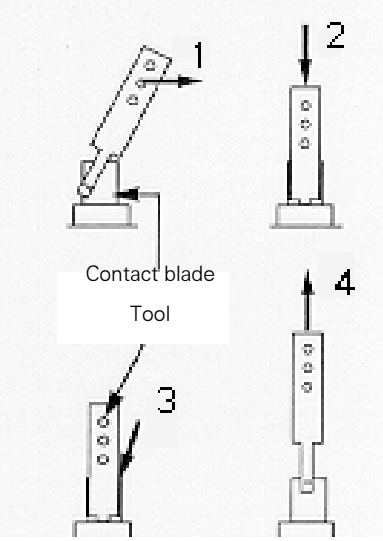
The auxiliary wiring is terminated at the contact blade block that is located on the top of the circuit-breaker behind the control panel. This plastic block is separated into 4 segments each having 14 slots for contact blades. A total of 56 auxiliary connections are thus available. The function of the slots are identical in all circuit-breakers. According to the version of circuit-breaker the equivalent function does exist / does not exist (configured by the manufacturer). Unused slots are necessary for retrofitting accessories or for customer specific assignment. Catalogue listed accessories with auxiliary connections are supplied being fitted with contact blades on the end of the individual wire. The contact plates can be inserted into the contact blade block without any special tool needed.

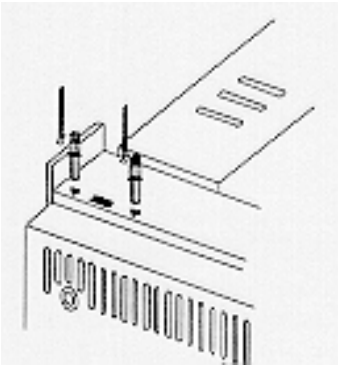
The customer connects the auxiliary connecting wires to the enclosed 14-pin hand connectors, which can be coded. The number of hand connectors enclosed depends on the version ordered (up to four). After the coding pins have been fitted, the hand connector must be latched onto the corresponding segment of the contact blade block. When the hand connector is removed, the coding pins are automatically extracted with the connector. This ensures that the hand connectors can only be connected to the correct segment of the contact blade block.

It is easy for the customer to connect the auxiliary wiring to the hand connector.

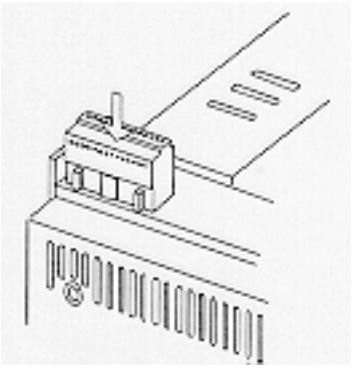
Insulated single core wires (copper) sized between 0.5 to 2.5 mm^2 can be used. Stranded wire should be fitted with end sleeves. It is also possible to connect two wires of up to 1 mm^2 in size of each terminal.



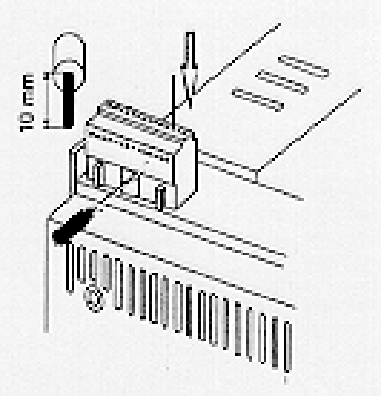




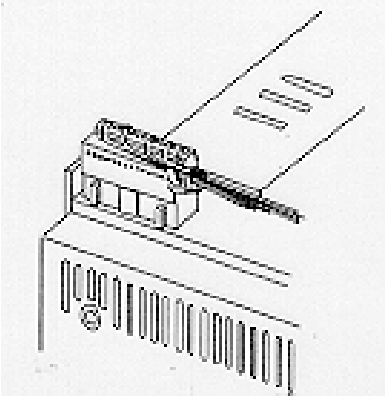
Insert coding pins



Locate hand connector



Connect wires



Bind wires

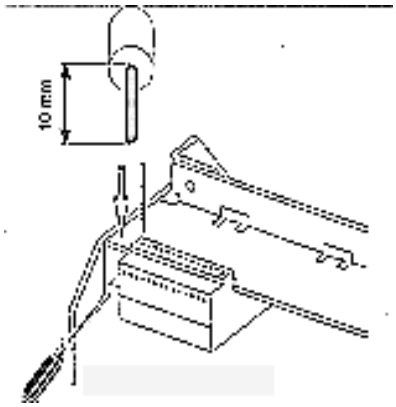
4.5.2. Connecting the auxiliary wiring to draw-out circuit-breakers

In the case of the circuit-breaker supplied together with a guide frame as a single unit the exact number of draw-out connectors is fixed on the guide frame, depending on the version ordered (up to four). The draw-out connectors are mounted by latching them onto the upper front traverse of the guide frame.

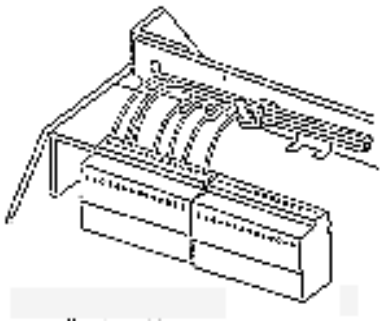
Coding is not necessary and not possible for the draw-out connectors, because they do not need to be removed. If they have to be removed (for special reasons), they must be labelled. The appropriate labelling (X100 ... X400) is indicated on the traverse of the guide frame.

The connection blades of the circuit-breaker automatically contact with the draw-out connectors as the circuit-breaker slides in the guide frame (test <-> connection position). In the disconnected position, the auxiliary connections are disconnected. The auxiliary draw-out connectors are designed finger proof and suitable for a rated operational voltage of 400 V AC/DC and rated operational current of up to 10A with the standard factory settings.

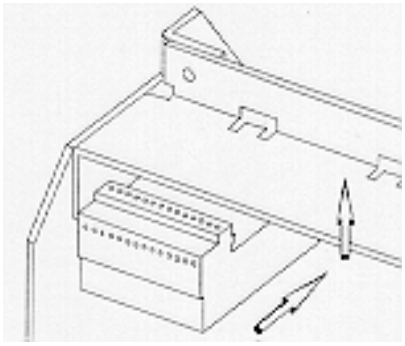
As already described for the hand connectors (fixed mounted circuit-breaker), insulated single core wires (copper) sized between 0.5 and 2.5 mm^2 can be used. Stranded wire



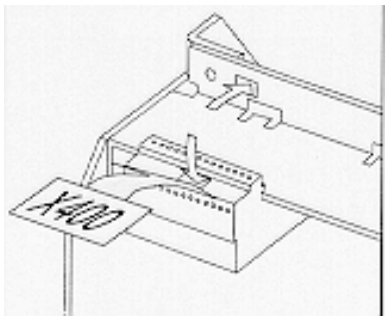
How to connect the wiring



How to bundle and bind the wiring



How to remove / add draw-out aux. connectors to / from the guide frame



How to label the draw-out aux. connectors

should be fitted with end sleeves. It is also possible to connect two wires of up to 1 mm^2 in size to each terminal.

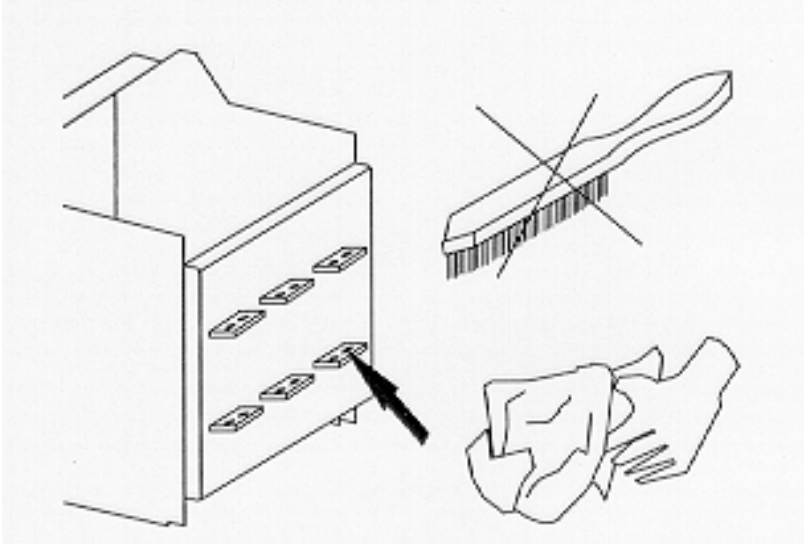
4.5.3. Control and measurement wiring to the connectors X300 and X400

The control and measurement leads for the electronic signals (auxiliary connectors X300 and X400) must be protected from high voltage peaks in neighbouring cables as well as from strong magnetic fields radiating from busbars, circuit-breakers and cables. Where longer cable lengths are necessary (>2 m), it is therefore recommended that shielded IBC cables are used (LSYCY),

Function of the circuit-breaker	Cable length (as maximum)
electronic grading control (ZSS)	300 m
Metering lead for the N-conductor transformer	5 m
Metering cable for external air-core current transformer	1 m (twisted pair)
Metering cable for the external current transformer in the star point of the network transformer	50 m or 20 Ohm resistance (twisted pair)
Voltage transformer	3 m (twisted pair)

manufactured by Siemens; or equivalent). The minimum cable cross-section of 0.75 mm^2 is recommended also to ensure mechanical rigidity.

4.6. Connecting the mains



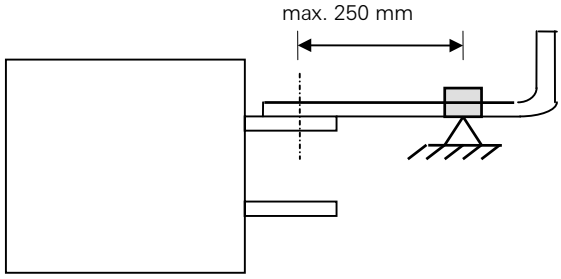
The main conductor can be copper busbar systems (see 4.6.1), aluminium busbar systems (4.6.2) or cable systems (4.6.4).
The connecting surfaces (circuit-breaker and main connectors) are to be cleaned according to standard rules.
A special plating (silver or tin) has been applied to the rear copper connections of the circuit-breaker or of the guide frame and they must, therefore, only be cleaned with a soft cloth before connecting. The bars are screwed together using spacers to DIN 6797. It must, however, be ensured that the spacers are positioned correctly.

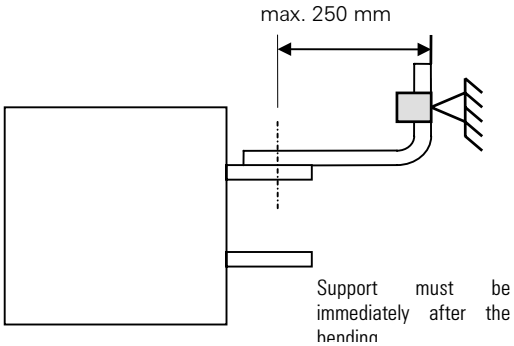
4.6.1. Connecting via busbar

The busbar systems of the plant must be accurately adjusted in such a way that the circuit-breaker does not have to support any pressure while screwing the busbar system.

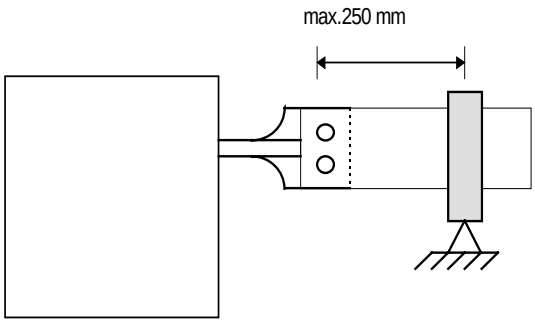
To avoid forces not allowed during possible appearing short-circuit currents the busbar system must be supported on the housing or cubicle in an appropriate manner. The permitted distance between the circuit-breaker and the support is 250 mm as maximum.

Horizontal connection

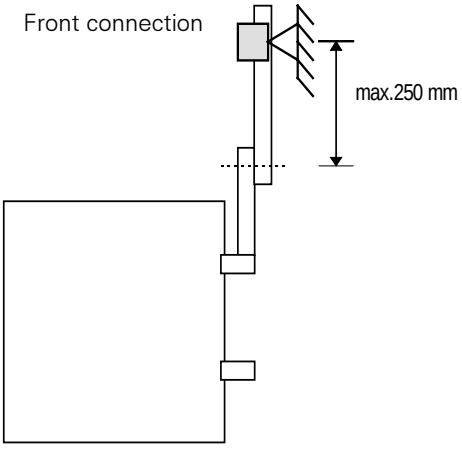




Vertical connection



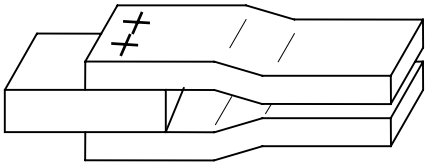
Front connection



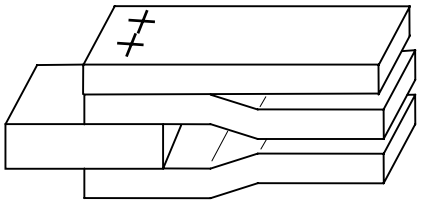
4.6.2. Examples for connecting via busbar

The main busbar systems can be connected in different ways. Important criteria for the type used are finally the necessary air and creepage distances as well as the minimum cross sections.

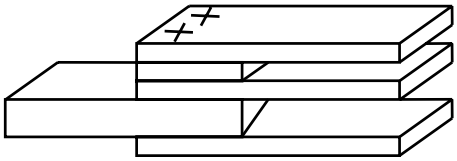
The following types shown by the horizontal rear connection can also be used for the other types of connections we offer to our circuit-breaker (front connection and vertical connection). Only the geometrical dimensions and the air and creepage distances may differ.



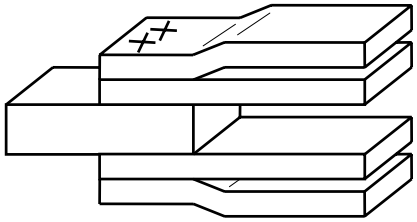
Connection of 2 busbars (bent)



Example for 3 busbars



3 busbars with a distance piece

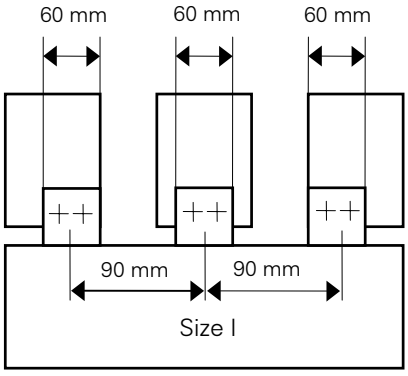


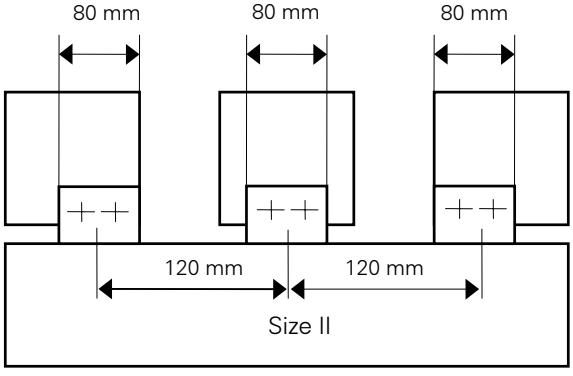
Connection type for 4 busbars

The main connections for the 3WN6 in Size I (up to 1600 A) have a width of 60 mm and a pole to pole distance (centre to centre) of 90 mm.

If wider busbar systems (> 60 mm) are used the mounting can be done according to the following examples (to maintain the air and creepage distances).

The same applies also to the circuit-breaker of Size II (2000 to 3200 A). Here the main connection has a width of 80/100 mm and a pole to pole distance (centre to centre) of 120 mm.



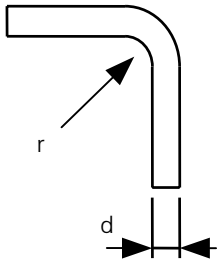


4.6.3. Tightening torque

The busbars are screwed to the main connection of the circuit-breaker with steel screws size M12 and the class of strength 8.8 plus clamping washers according to DIN 6796. The correct position and manner must be observed. The torque of 70 ± 7 Nm must be kept.

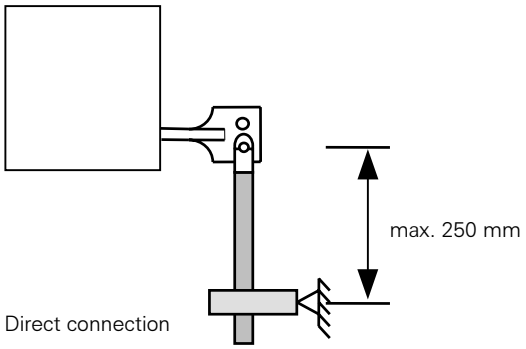
Bending radius of copper busbars

Radius [mm] class of strength F20	Radius [mm] class of strength F25	Radius [mm] class of strength F30
r_{min}	r_{min}	r_{min}
0.5 x d	1.0 x d	1.5 x d

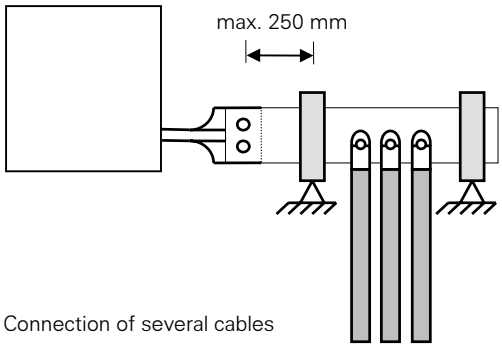


4.6.4. Connecting via cables

It is also possible to connect our 3WN6 circuit-breaker via cables.
It can be connected directly or via a busbar adapter piece.
A piece of busbar connected to the vertical connection offers the possibility to connect many cables and at the same time avoids mechanical force affecting the circuit-breaker.
It is recommended to use cable shoes according to DIN 46234 or DIN 26435 respectively. The connection surfaces need to be handled in the same manner as connecting busbar systems (see section 4.6 "Connecting the mains").
The connection surfaces of the cable shoes must be clean and free of splinters and it should be slightly greased (Contactgrease e.g. Centoplex 24 DL, Shell Vaseline B422 or Shell Alvania R3).
The possibly occurring forces during a short-circuit current makes it necessary to support the cable connections within a range 250mm maximum.
Using cables their temperature has to be observed.



Direct connection



Connection of several cables

4.6.5. Connecting copper busbar systems

Switchgear installation and circuit-breakers make certain demands on their environment in order to guarantee correct functioning. One of these environmental conditions is the temperature. If high internal temperature occurs in the switchgear cubicle (over +55°C), as can be seen from the technical data, some circuit-breakers are subject to a temperature depending reduction in rated current (derating). The 3WN6 operates in an ambient temperature range of -20°C to 70°C. In order to dissipate as much heat as possible generated from the installation by the high currents or from the circuit-breaker, the main power connections is made via busbar systems. The minimum cross sections for the 3WN6 are given in the following tables.

The values in the following tables are evaluated by temperature tests on circuit-breakers (fixed mounted and draw-out type) for vertical and horizontal busbar systems. The tables should be a help in selecting the type of connection but they cannot replace own experience and tests.

The basic parameters of the test are as follows:

- Cu-bars 10 mm thick
- Cu-bars untreated
- Cu 25 with conductivity of 56 S
- busbar temperature max. 100°C
- Elevation of erection up to 2000m

Example:

Points given:
Draw-out type, connected via vertical busbar (Cu)

Temperature inside the cubicle = 60 °C
Rated operational current = 1900 A

Solution:
According to table 4/3 the 3WN65 (I_N = 2000 A) is needed which can be connected with the following busbar systems:

- 2x60x10 ==> 1920 A
- 2x80x10 ==> 2000 A
- 2x100x10 ==> 2000 A

Minimum cross sections of Cu Busbar systems on fixed mounted circuit-breakers with horizontal connection

Circuit-breaker	I_N	No. of Cu busbars systems (switchgear)	Max. permanent rated current according to the temperature inside the cubicle				
			30°C	40°C	50°C	60°C	70°C
3WN60	630 A	1x40x10	630 A	630 A	630 A	630 A	630 A
3WN61	800 A	1x60x10	800 A	800 A	800 A	800 A	800 A
3WN62	1000 A	1x60x10	1000 A	1000 A	1000 A	1000 A	960 A
3WN63	1250 A	1x60x10	1250 A	1250 A	1250 A	1250 A	1130 A
3WN63	1250 A	2x40x10	1250 A	1250 A	1250 A	1250 A	1250 A
3WN64	1600 A	2x40x10	1600 A	1600 A	1600 A	1560 A	1410 A
3WN64	1600 A	2x60x10	1600 A	1600 A	1600 A	1600 A	1600 A
3WN65	2000 A	2x60x10	2000 A	2000 A	2000 A	2000 A	1890 A
3WN66	2500 A	2x100x10	2500 A	2500 A	2500 A	2350 A	2150 A
3WN67	3200 A	3x100x10	3200 A	3200 A	3020 A	2760 A	2500 A
3WN67	3200 A	4x100x10	3200 A	3200 A	3200 A	3160 A	2820 A

Table 4/1

Minimum cross sections of Cu Busbar systems on draw-out circuit-breakers with horizontal connection

Circuit-breaker	I_N	No. of Cu busbar systems (switchgear)	Max. permanent rated current according to the temperature inside the cubicle				
			30°C	40°C	50°C	60°C	70°C
3WN60	630 A	1x40x10	630 A	630 A	630 A	630 A	630 A
3WN61	800 A	1x60x10	800 A	800 A	800 A	800 A	800 A
3WN62	1000 A	1x50x10	1000 A	1000 A	1000 A	900 A	770 A
3WN62	1000 A	1x60x10	1000 A	1000 A	1000 A	990 A	840 A
3WN63	1250 A	1x60x10	1250 A	1250 A	1140 A	990 A	840 A
3WN63	1250 A	2x40x10	1250 A	1250 A	1250 A	1150 A	980 A
3WN64	1600 A	2x40x10	1600 A	1480 A	1330 A	1150 A	980 A
3WN64	1600 A	2x50x10	1600 A	1600 A	1560 A	1350 A	1150 A
3WN64	1600 A	2x60x10	1600 A	1600 A	1600 A	1540 A	1300 A
3WN65	2000 A	2x60x10	2000 A	1980 A	1770 A	1540 A	1300 A
3WN65	2000 A	2x80x10	2000 A	2000 A	2000 A	1890 A	1600 A
3WN65	2000 A	2x100x10	2000 A	2000 A	2000 A	2000 A	1850 A
3WN66	2500 A	2x80x10	2500 A	2430 A	2180 A	1890 A	1600 A
3WN66	2500 A	2x100x10	2500 A	2500 A	2500 A	2220 A	1880 A
3WN67	3200 A	3x80x10	3090 A	2960 A	2750 A	2510 A	2120 A
3WN67	3200 A	2x100x10	3070 A	2850 A	2560 A	2220 A	1880 A
3WN67	3200 A	3x100x10	3190 A	3010 A	2830 A	2590 A	2320 A
3WN67	3200 A	4x100x10	3200 A	3120 A	2930 A	2740 A	2550 A

Table 4/2

Minimum cross sections of Cu Busbar systems on draw-out circuit-breakers with vertical connection

Circuit-breaker	I_N	No. of Cu busbar systems (switchgear)	Max. permanent rated current according to the temperature inside the cubicle				
			30°C	40°C	50°C	60°C	70°C
3WN60	630 A	1x40x10	630 A	630 A	630 A	630 A	630 A
3WN61	800 A	1x60x10	800 A	800 A	800 A	800 A	800 A
3WN62	1000 A	1x50x10	1000 A	1000 A	1000 A	950 A	810 A
3WN62	1000 A	1x60x10	1000 A	1000 A	1000 A	1000 A	930 A
3WN63	1250 A	1x60x10	1250 A	1250 A	1250 A	1100 A	930 A
3WN63	1250 A	2x40x10	1250 A	1250 A	1250 A	1250 A	1220 A
3WN64	1600 A	2x40x10	1600 A	1600 A	1600 A	1440 A	1220 A
3WN64	1600 A	2x50x10	1600 A	1600 A	1600 A	1580 A	1430 A
3WN64	1600 A	2x60x10	1600 A	1600 A	1600 A	1600 A	1530 A
3WN65	2000 A	2x60x10	2000 A	2000 A	2000 A	1920 A	1630 A
3WN65	2000 A	2x80x10	2000 A	2000 A	2000 A	2000 A	1960 A
3WN65	2000 A	2x100x10	2000 A	2000 A	2000 A	2000 A	2000 A
3WN66	2500 A	2x80x10	2500 A	2500 A	2500 A	2360 A	2000 A
3WN66	2500 A	2x100x10	2500 A	2500 A	2500 A	2500 A	2330 A
3WN67	3200 A	3x80x10	3200 A	3150 A	2950 A	2750 A	2530 A
3WN67	3200 A	2x100x10	3190 A	3010 A	2830 A	2650 A	2420 A
3WN67	3200 A	3x100x10	3200 A	3200 A	3070 A	2860 A	2650 A
3WN67	3200 A	4x100x10	3200 A	3200 A	3200 A	3120 A	2800 A

Table 4/3

4.6.6. Connecting aluminium busbar systems

Horizontal and vertical connection

It is not permitted to connect aluminium bars directly onto the silver plated horizontal connections of the 3WN6 (guide frame and fixed mounted circuit-breaker) due to the insulating rating. Aluminium busbars can, however, still be used if an intermediate CupAl plate is inserted to prevent direct contact between the silver plating and the aluminium bar.

Front connection

The front connections of the 3WN6 fixed mounted circuit-breaker and guide frame (from 1250A upwards) are tin-plated, not silver-plated, at the connection point for the cubicle busbar, so in this case it is possible to connect aluminium bars directly, however, we recommend here as well an intermediate CupAl plate To increase the heat dissipation a black coating can be used. The minimum cross section should be selected in accordance with the following tables.

The values in the following tables are evaluated by temperature tests on circuit-breakers (fixed mounted and draw-out type) for vertical and horizontal busbar systems. The tables should be a help to select the type of connection but they cannot replace own experience and tests.

The basic parameters of the test are as follows:

- Al-bars 10 mm thick
- Al-bars untreated
- Al 25 with conductivity of 56 S
- Busbar temperature max. 100°C
- Elevation of erection up to 2000m

Minimum cross sections of Al Busbar systems on fixed mounted circuit-breakers with horizontal connection

Circuit-breaker	I_N	No. of Al busbar systems (switchgear)	Max. permanent rated current according to the temperature inside the cubicle				
			30°C	40°C	50°C	60°C	70°C
3WN60	630 A	1x40x10	630 A	630 A	630 A	630 A	630 A
3WN61	800 A	1x60x10	800 A	800 A	800 A	800 A	770 A
3WN62	1000 A	1x60x10	1000 A	1000 A	950 A	860 A	770 A
3WN63	1250 A	1x60x10	1250 A	1190 A	1100 A	1000 A	910 A
3WN63	1250 A	2x40x10	1250 A	1250 A	1250 A	1250 A	1230 A
3WN64	1600 A	2x40x10	1600 A	1490 A	1370 A	1250 A	1230 A
3WN64	1600 A	2x60x10	1600 A	1600 A	1600 A	1480 A	1340 A
3WN65	2000 A	2x60x10	2000 A	2000 A	1900 A	1730 A	1550 A
3WN66	2500 A	2x100x10	2500 A	2500 A	2370 A	1900 A	1780 A
3WN67	3200 A	3x100x10	2940 A	2730 A	2520 A	2310 A	2090 A

Table 4/4

Minimum cross sections of Al Busbar systems on draw-out circuit-breakers with horizontal connection

Circuit-breaker	I_N	No. of Al busbar systems (switchgear)	Max. permanent rated current according to the temperature inside the cubicle				
			30°C	40°C	50°C	60°C	70°C
3WN60	630 A	1x40x10	630 A	630 A	630 A	630 A	540 A
3WN61	800 A	1x60x10	800 A	800 A	800 A	800 A	680 A
3WN62	1000 A	1x50x10	1000 A	910 A	820 A	710 A	600 A
3WN62	1000 A	1x60x10	1000 A	1000 A	920 A	800 A	680 A
3WN63	1250 A	1x60x10	1130 A	1030 A	920 A	800 A	680 A
3WN63	1250 A	2x40x10	1240 A	1190 A	1070 A	930 A	780 A
3WN64	1600 A	2x40x10	1360 A	1190 A	1070 A	930 A	780 A
3WN64	1600 A	2x50x10	1510 A	1390 A	1250 A	1080 A	920 A
3WN64	1600 A	2x60x10	1600 A	1520 A	1420 A	1260 A	1070 A
3WN65	2000 A	2x60x10	1800 A	1630 A	1460 A	1260 A	1070 A
3WN65	2000 A	2x80x10	2000 A	1960 A	1770 A	1540 A	1310 A
3WN65	2000 A	2x100x10	2000 A	2000 A	1930 A	1800 A	1550 A
3WN66	2500 A	2x80x10	2220 A	1980 A	1770 A	1540 A	1310 A
3WN66	2500 A	2x100x10	2500 A	2340 A	2180 A	1860 A	1580 A
3WN67	3200 A	2x100x10	2570 A	2390 A	2140 A	1860 A	1580 A
3WN67	3200 A	3x80x10	2600 A	2520 A	2340 A	2140 A	1810 A
3WN67	3200 A	3x100x10	2660 A	2510 A	2360 A	2170 A	1940 A

Table 4/5

Minimum cross sections of Al Busbar systems on draw-out circuit-breakers with vertical connection

Circuit-breaker	I_N	No. of Al busbar systems (switchgear)	Max. permanent rated current according to the temperature inside the cubicle				
			30°C	40°C	50°C	60°C	70°C
3WN60	630 A	1x40x10	630 A	630 A	630 A	630 A	630 A
3WN61	800 A	1x60x10	800 A	800 A	800 A	800 A	750 A
3WN62	1000 A	1x50x10	1000 A	960 A	890 A	740 A	630 A
3WN62	1000 A	1x60x10	1000 A	1000 A	990 A	890 A	750 A
3WN63	1250 A	1x60x10	1250 A	1140 A	1020 A	890 A	750 A
3WN63	1250 A	2x40x10	1250 A	1250 A	1220 A	1150 A	980 A
3WN64	1600 A	2x40x10	1490 A	1400 A	1320 A	1160 A	980 A
3WN64	1600 A	2x50x10	1540 A	1450 A	1360 A	1270 A	1150 A
3WN64	1600 A	2x60x10	1600 A	1540 A	1450 A	1350 A	1260 A
3WN65	2000 A	2x60x10	2000 A	1950 A	1820 A	1580 A	1340 A
3WN65	2000 A	2x80x10	2000 A	1970 A	1850 A	1730 A	1600 A
3WN65	2000 A	2x100x10	2000 A	2000 A	1940 A	1810 A	1680 A
3WN66	2500 A	2x80x10	2470 A	2370 A	2220 A	2010 A	1710 A
3WN66	2500 A	2x100x10	2500 A	2430 A	2270 A	2110 A	1960 A
3WN67	3200 A	2x100x10	2680 A	2520 A	2370 A	2220 A	2030 A
3WN67	3200 A	3x80x10	2790 A	2680 A	2520 A	2350 A	2160 A
3WN67	3200 A	3x100x10	2920 A	2740 A	2570 A	2390 A	2210 A

Table 4/6

4.7. Circuit examples

4.7.1. Interface module

A coupling device (interface module) converts the DC-signal of the optocoupler from the overcurrent release into a floating contact signal. The contacts can be used to activate signalling lamps or auxiliary contactors in the control circuit.
The coupling devices should be the 3TX7 002 relay couplers in the output coupler version for 24 V DC operation. The power consumption of the couplers must not exceed 0.5 W. The maximum permissible loading on the optocoupler at 24 V DC is 20mA.

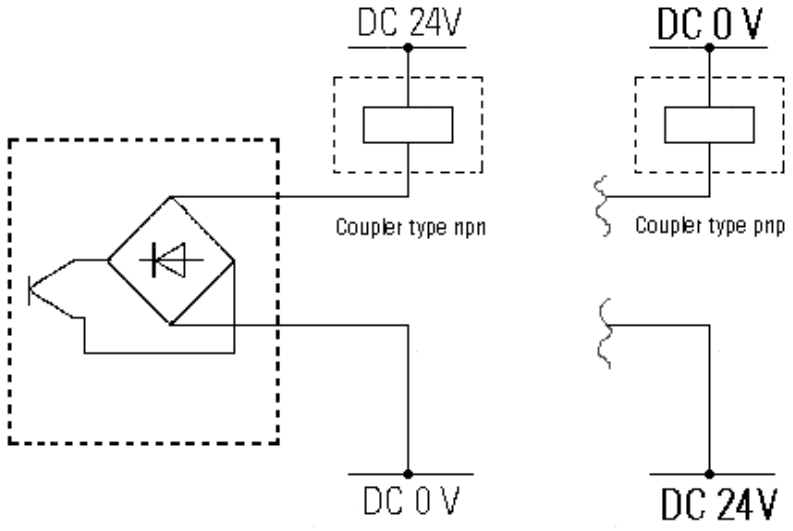


Fig. 4/11 Activating a coupler

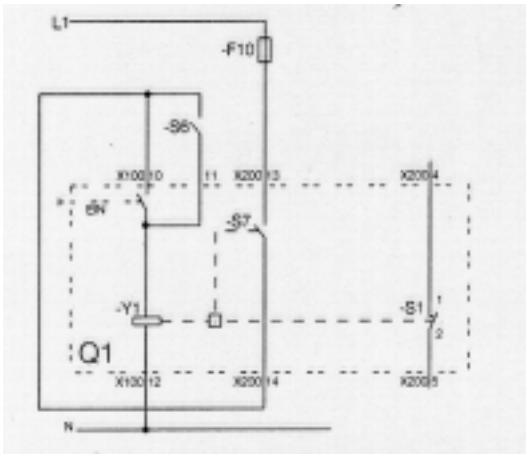
4.7.2. Conditions for the "ready to close" signal

Before a circuit-breaker can be closed, all the necessary conditions must be met.
Ready-to-close is indicated on the circuit-breaker by "OK" and signalled by the signalling contact S7. In the 3WN6 circuit-breaker, this signal is also available for output as an external signal. In order to ensure that the closing solenoid actually operates the energy store in order to close the circuit-breaker, the signalling contact (S7) must be incorporated into the activation circuit of the closing solenoid, During an attempt to close, it otherwise is possible that only the plunger of the solenoid is moved. If the condition for ready-to-close is subsequently fulfilled, the coil voltage of the closing solenoid has to be interrupted briefly to allow the circuit-breaker to close.

Circuit diagrams for activation are shown on the following pages.

Fig. 4/12 Electrical switch on at the circuit-breaker or remotely operated

Electrical closing, remote controlled or via "electrical ON button



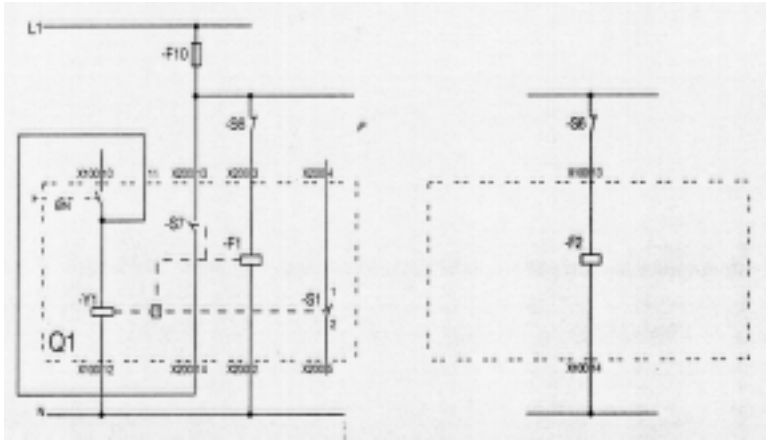
	Legend:
F10	Fuse
S1	Auxiliary contact
S6	Remotely operated electrical ON
S7	Ready-to-close signalling contact
Q1	3WN6 circuit-breaker
Y1	Closing solenoid

In order to close, the following conditions must be fulfilled by the circuit-breaker (Q1)

1. OFF button not locked in the OFF position
2. Circuit-breaker in OFF position
3. Stored energy mechanism charged
4. Closing solenoid not activated
5. Mutual interlocking inactive
6. Crank hole of draw-out circuit-breaker closed
7. Interlocks inactive

Note:
The circuit-breaker closes automatically when the last condition is met (e.g. OFF button is not operated) and Y1 is not activated.

Fig. 4/13 Remote control of the circuit-breaker with shunt release



Electrical closing and interlocking with shunt release "f", F1 or F2

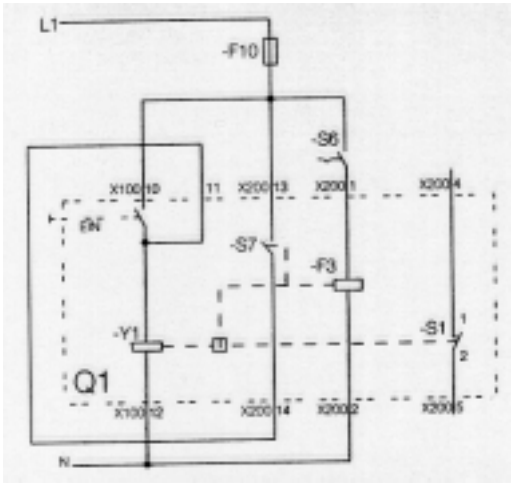
	Legend:
F10	Fuse
F1, F2	Shunt release f Shunt release f
S1	Auxiliary contact
S6	Remotely operated electrical ON
S7	Ready-to-close signalling contact
Q1	3WN6 circuit-breaker
Y1	Closing solenoid

In order to close, the following conditions must be fulfilled by the circuit-breaker (Q1)

1. OFF button not locked in the OFF position
2. Circuit-breaker in OFF position
3. Stored energy mechanism charged
4. Closing solenoid not activated
5. Mutual interlocking inactive
6. Crank hole of draw-out circuit-breaker closed
7. Interlocks inactive
8. Shunt release not activated (i.e. S6 open)

Note:
The circuit-breaker closes automatically when the last condition is met (e.g. OFF button is not operated) and Y1 is not activated.

Fig. 4/13 Remote control of the circuit-breaker with undervoltage release



Electrical closing and interlocking with undervoltage release "r", F3 and ready-to-close signalling contact S7

	Legend:
F10	Fuse
F1,	Shunt release r
S1	Auxiliary contact
S6	Remotely operated electrical ON
S7	Ready-to-close signalling contact
Q1	3WN6 circuit-breaker
Y1	Closing solenoid

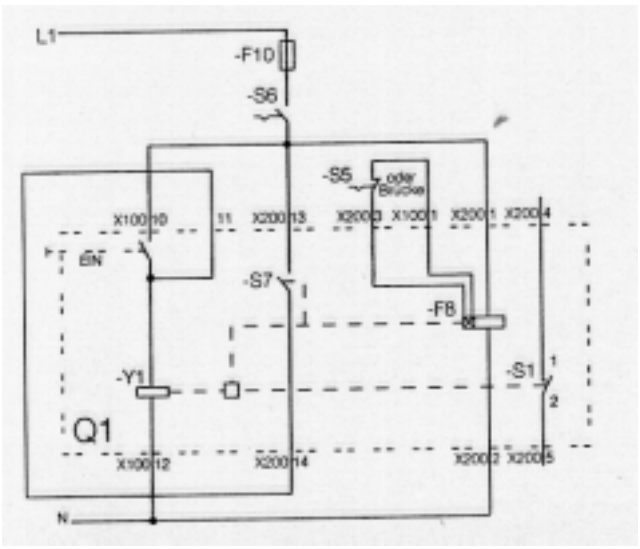
In order to close, the following conditions must be fulfilled by the circuit-breaker (Q1)

1. OFF button not locked in the OFF position
2. Circuit-breaker in OFF position
3. Stored energy mechanism charged
4. Closing solenoid not activated
5. Mutual interlocking inactive
6. Crank hole of draw-out circuit-breaker closed
7. Interlocks inactive
8. Undervoltage release not activated (i.e. S6 open)

Note:
The circuit-breaker closes automatically when the last condition is met (e.g. OFF button is not operated) and Y1 is not activated.

Fig. 4/13 Remote control of the circuit-breaker with shunt release

Electrical closing and interlocking with undervoltage release "rc", F8 and ready-to-close signalling contact S7



	Legend:
F10	Fuse
F8	Undervoltage release with delay "rc"
S1	Auxiliary contact
S5	External electrical ON (without delay) for EMERGENCY OFF
S6	Remotely operated electrical ON
S7	Ready-to-close signalling contact
Q1	3WN6 circuit-breaker
Y1	Closing solenoid

In order to close, the following conditions must be fulfilled by the circuit-breaker (Q1)

1. OFF button not locked in the OFF position
2. Circuit-breaker in OFF position
3. Stored energy mechanism charged
4. Closing solenoid not activated
5. Mutual interlocking inactive
6. Crank hole of draw-out circuit-breaker closed
7. Interlocks inactive
8. Undervoltage release not activated (i.e. S6 open)

Note:
The circuit-breaker closes automatically when the last condition is met (e.g. OFF button is not operated) and Y1 is not activated.

4.7.3. Earth fault detection between transformer and the L.V. incoming breaker

Earth faults in the area between transformer T2 and the incoming circuit-breaker Q2 can be detected using the 3WN6 circuit-breaker. For this purpose, the 3WN6 has to be equipped with overcurrent release version E, J or P with additional functions 2. These functions offer an optocoupler signal ("g"-alarm) that remains active as long as the earth fault exists. If the overcurrent release is supplied by an external (uninterrupted) 24 V DC power supply the earth fault ("g"-alarm) protection is still active after the circuit-breaker has tripped. An earth fault measured by the external current transformer T6 would then still be evaluated in the overcurrent release and signalled via the optocoupler output. This output signal can be converted to a floating signalling contact by using an interface relay (K1). With this for example the medium voltage circuit-breaker Q1 can be switched off, to clear the fault.

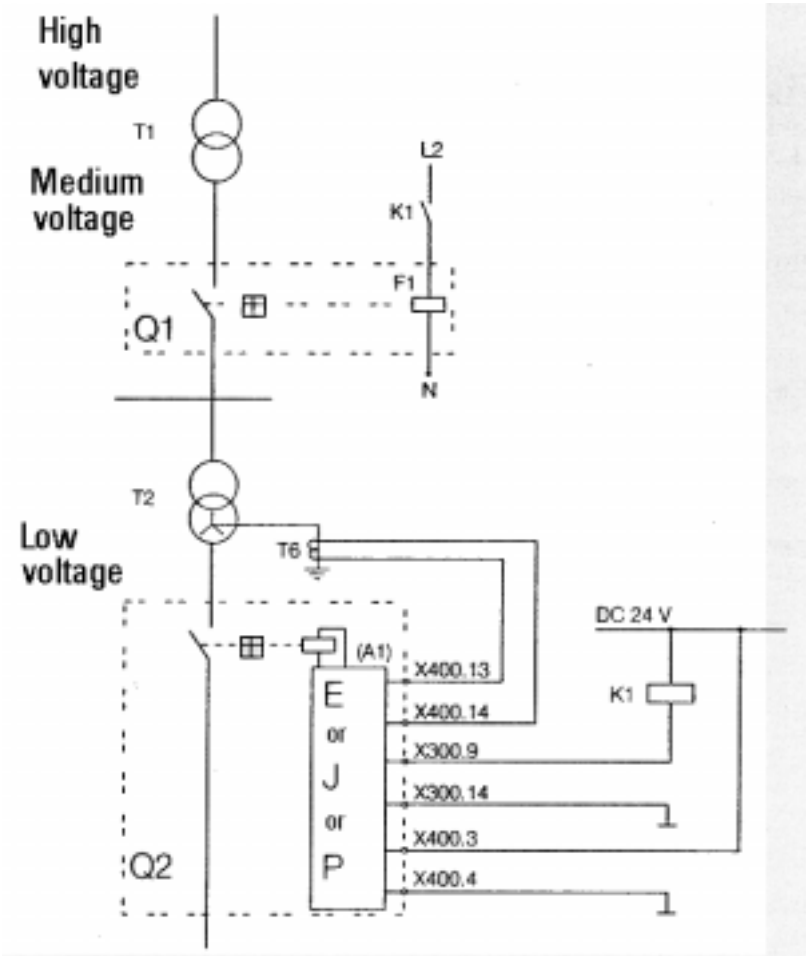


Fig. 4/16 Circuit-breaker with earth fault detection

A1	Overcurrent release version E, J of P ("aznNg")
Q1	Medium voltage circuit-breaker
Q2	Low voltage circuit-breaker 3WN6
F1	Shunt release
F5	Closing solenoid energised by overcurrent release A1
K1	Coupling device 3TX7 002 for conversion of the "g"-alarm signal
T1	High / Medium voltage transformer
T2	Medium / Low voltage transformer
T6	Current transformer for the earth fault detection

4.7.4. Control circuit for tripping and alarm signals

Grouped tripping signal
The 3WN6 circuit-breaker is equipped with a tripped signalling contact as standard. This signals tripping due to overload in the phases ("a"), overload in the N-conductor ("N"), short-circuit ("z/n") or earth-fault ("g") in the form of a grouped signal

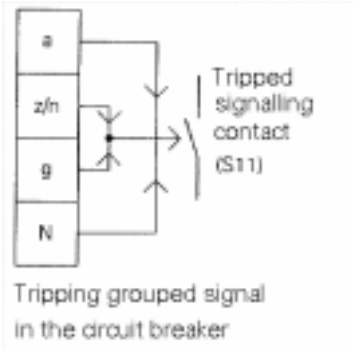


Fig. 4/17 Grouped tripping signal

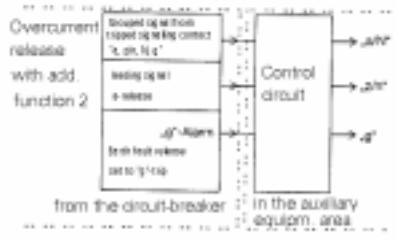
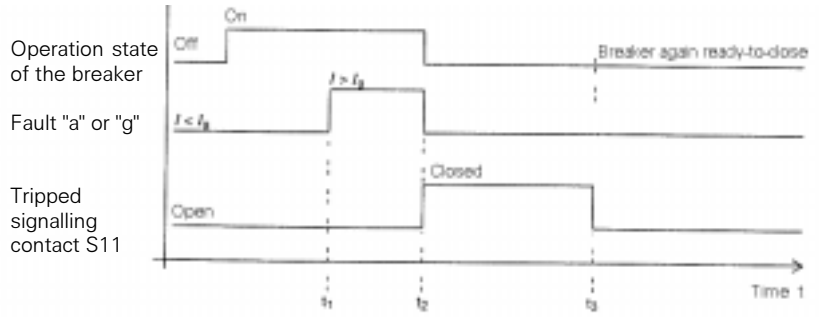


Fig. 4/18 Differentiated signalling of the cause of tripping

Differentiated tripping signals
An evaluation circuit can be used to implement differentiated signalling of the cause of tripping. The signals



t_1 Response value of the overload release (earth fault release) exceeded
t_2 Tripping of the breaker by "a" or "g" after expiring of delay time
t_3 Resetting of the tripped signal and reclosing lock out by pressing the red RESET button

Fig. 4/19 Signal timing in the event of a fault

are converted from optocoupler signals to electrical floating signals via coupling devices. The couplers are connected to the evaluation circuit to process continuous signals (e.g. "g-alarm", tripped signalling contact) and temporary signals (e.g. leading signal of "a- tripping"). Temporary signals must be stored in a latching circuit element.

4.7.5. Signal conversion for control circuits

If solid-state switching devices such as coupling devices are used for further processing of signals, it is important to observe the following information:

The coupling devices or control elements must be connected to a protected supply voltage because in the event of a short-circuit, the supply voltage falls to an undetermined value.

The control elements must be located at an adequate distance from busbars and conductive paths inside the circuit-breakers or the cubicle. This prevents malfunctioning that could otherwise occur due to high voltage peaks of inductive loads of neighbouring cables or due to strong magnetic fields radiating from busbars, circuit-breakers and cables in the event of an short-circuit.

Signalling via optocouplers:
- Permissible external supply voltage U_S at the optocouplers (auxiliary terminal block X300; releases with additional functions 1 and 2): U_S = 20 to 26.3 V
- Characteristic data for the optocoupler:
  - Low signal U_L <= 0.5V
  - High signal U_H >= U_B - 2V
  - Max. load current: 20 mA

4.7.6. Control circuit for overtemperature and µP-Alarm

(Overcurrent release versions D, E/F, H, J/K, N and P with additional functions 1 or 2)

The overcurrent releases with additional functions 1 or 2 output alarm signals such as "temperature >85°C" and "µP fault". The µP-fault signal can be linked with the phase imbalance signal to form one output signal. The signals are output by the closed circuit-breaker for external interlocking and control purposes.

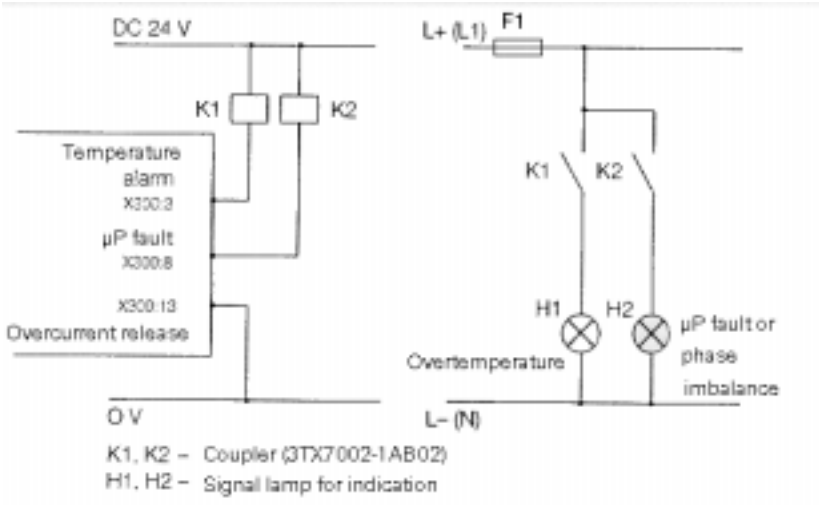


Fig. 4/20 Conversion of temperature alarm and µP fault signals

4.7.7. Control circuit for load monitoring and load shedding signals

(Overcurrent release versions D, E/F, H, J/K, N and P with additional functions 2)

Figure 4/21 shows a control circuit for load monitoring with load shedding. This requires that the function leading signal of "a" tripping" is switched over to load shedding on the overcurrent release.

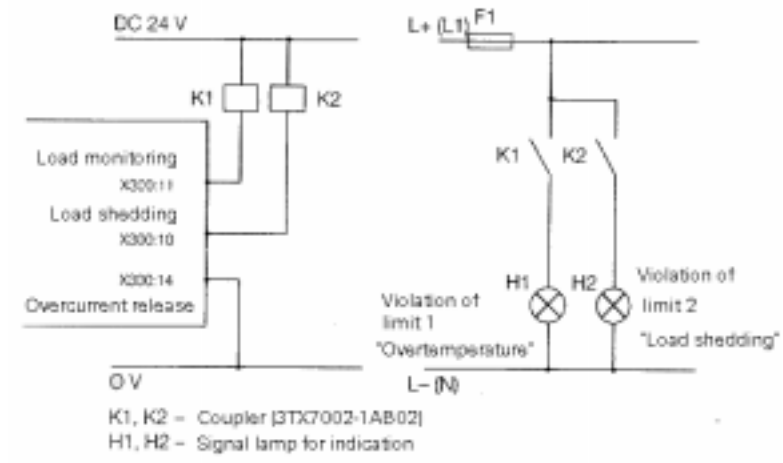


Fig. 4/21 Conversion of load monitoring and load shedding signals

4.7.8. Control circuit for overload or short-circuit signal

(Overcurrent release versions D, E/F, H, J/K, N and P with additional function 2)
The overcurrent releases must be equipped with additional function 2. The leading signal of overload tripping is output 200 ms before the circuit-breaker trips. This signal is converted using a coupling device (DC 24V) for activating the release time delay relay.

When K2 activates K4, the delayed NO contact of K4 closes immediately. When overload tripping occurs and the tripped signalling contact S11 signals the tripping, relay K5 simultaneously opens and latches.
Following the delay of >100 ms, the delayed NO contact of K4 opens, but because K5 is latched and S11 signals tripping, H1 signals overload tripping ("a" or "N").

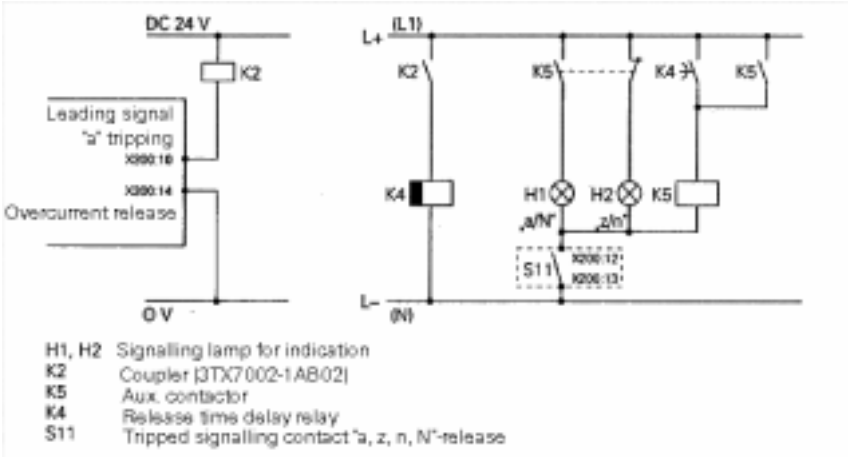


Fig. 4/22 Conversion of overload and short-circuit tripping signals

If K4 is not activated and S11 signals tripping (i.e. closes), consequently the tripping was a short-circuit tripping ""z" or "n"). In this case, relay K5 was not operated and its NC-contact remains closed, so H2 signals tripping due to a short-circuit.

The cause of tripping, either overload or short-circuit, is signalled by the respective signalling lamp until contact S11 on the circuit-breaker is reset by pressing the red reset button.

4.7.9. Control circuit for earth fault, overload or short-circuit signal

(Overcurrent release versions D, E/F, H, J/K, N and P with additional function 2)

The circuit shown in Fig. 4/23 can be used to differentiate between tripping due to overload, short-circuit or the occurrence of an earth fault or a remote signal.

The earth fault release must be set to the function "alarm". The earth fault signal is stored in the control circuit via the auxiliary contact K3 until the reset button S1 is pressed. Any reoccurring transient earth faults are detected and signalled continuously. If the earth-fault is cleared or if the earth fault current drops below the response value, the signal remains activated due to the latching of K3.

In this circuit, signalling lamp H2 indicates tripping due to a short-circuit.

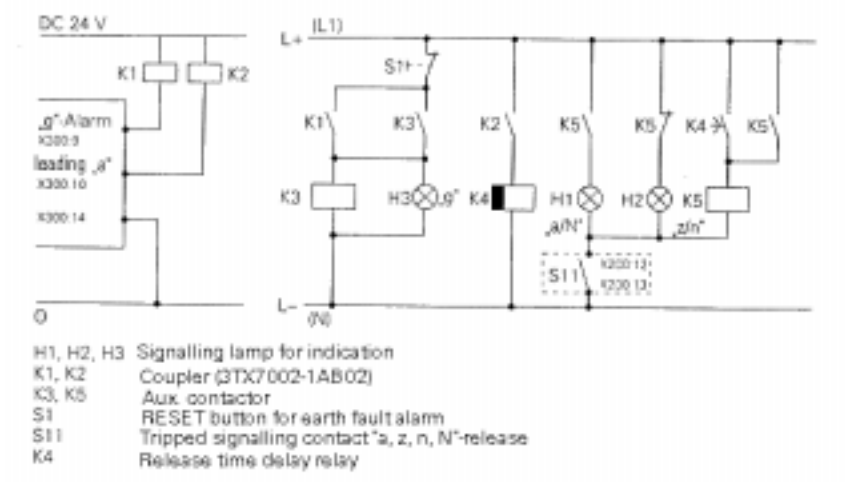
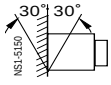


Fig. 4/23 Conversion of earth fault tripping signals

5. Technical Data

Technical data				Circuit-breaker 3WN6, 3-pole and 4-pole, up to 3200 A							
Size				I					II		
Type				3WN60	3WN61	3WN62	3WN63	3WN64	3WN65	3WN66	3WN67
Rated current I_n at 55 °C, at 50/60 Hz Main conductor			A	630	800	1000	1250	1600	2000	2500	3200
N-conductor (4-pole only)			A	630	800	1000	1250	1600	2000	2500	3200
Rated operational voltage U_e at 50/60 Hz			AC V	up to 690							
Rated impulse withstand Voltage U_{imp}	Main conducting paths [7]		kV	8							
	auxiliary circuits		kV	4							
Utilisation category				B							
Rated short-circuit making capacity I_{qm} (peak value)	up to AC 415 V		kA	143					176		
	up to AC 500 V		kA	143					176		
	up to AC 690 V		kA	110					110		
Rated service short-circuit breaking capacity I_{cs} (r.m.s. value)	up to AC 415 V		kA	65					80		
	up to AC 500 V		kA	65					80		
	up to AC 690 V		kA	50					50		
Rated ultimate short-circuit breaking capacity I_{cu} (r.m.s. value)	up to AC 415 V		kA	65					80		
	up to AC 500 V		kA	65					80		
	up to AC 690 V		kA	50					50		
Permissible ambient temperature	Operation		°C	-20...+70							
	Storage		°C	-40...+80							
Rated short time withstand current I_{cw} at 50/60 Hz	0,5	s	kA	50			50		65		
	1	s	kA	35/50 1)			50		65		
	2	s	kA	25/30 1)			30		60		
	3 s		kA	20/25 1)			25		50		
Permissible loading fixed mounted and draw-out type with internal cubicle temperature [2] [3] [4]	up to 55 °C		A	630	800	1000	1250	1600	2000	2500	3200
	at 60 °C		A	630	800	1000	1250	1550	2000	2270	3050
	at 70 °C		A	630	800	1000	1250	1450	2000	2030	2850
Rotor rated operational voltage	U_{ar}		V	2000							
Power loss at I_n with 3-phase balanced load (without busbar and metal components) [2] [4]	Fixed mounted type		W	40	60	90	90	140	170	260	420
	Draw-out type incl. guide frame		W	80	130	205	205	310	310	510	760
Endurance with maintenance [5]	mechanical/ electrical	Operating cycles		20 000 20 000					20 000 20 000		
without maintenance [5]	mechanical/ electrical [6]	Operating cycles		10 000 6.000					10 000 6 000		
Switching frequency		1/min		1							
Minimum interval between circuit-breaker tripping by overcurrent release and the next closing command (only with automatic mechanical reset of the reclosing lockout		ms		80							
Mounting position				 and / or 							
Degree of protection				Circuit-breaker IP 20, control panel with door frame IP 54 (optional)							
Cross-sections of the main conductors	busbar Cu bare	Qty mm²		1 x 50*10	1 x 60*10	2 x 40*10	2 x 50*10	2 x 60*10	2 x 100*10	3 x 100*10	3 x 100*10
	busbar Cu painted black	Qty mm²		1 x 40*10	1 x 50*10	1 x 60*10	2 x 40*10	2 x 50*10	2 x 80*10	2 x 100*10	3 x 100*10
Auxiliary wiring (Cu)	Max. no. of aux. conn. leads x cross-section	solid and finally stranded with end sleeves		1 x 0,5 ... 2,5 mm²; 1 x AWG 14 2 x 1,0 mm²							
Weight	3-pole circuit-breakers	Fixed mounted type	approx. kg	34	34	34	36	36	57	59	61
		Draw-out type	approx. kg	36	36	36	38	38	59	61	63
		Guide frame	approx. kg	22	22	22	23	23	35	37	37
	4-pole circuit-breakers	Fixed mounted type	approx. kg	47	47	47	49	49	70	72	74
		Draw-out type	approx. kg	49	49	49	51	51	72	74	76
		Guide frame	approx. kg	27	27	27	28	28	46	48	48

[1] Values are valid for circuit-breakers with order code "K03",(see section 7)

[2] Horizontal connection with fixed mounted version, vertical connection with draw-out version.

[3] The temperature refer to the air around the upper third of the circuit-breaker

[4] The values are valid for sinusoidal current at 50/60Hz. Heating and loss will rise due to harmonics and higher frequencies

[5] Maintenance: replacement of the main contact set

[6] Per set of main contacts. Breaking the rated current I_n with p.f.=0.8

[7] Rated insulation voltage U_i = 1000 V AC

Technical data				Circuit-breaker 3WN6, 3- and 4-pole, up to 3200 A
Operating mechanism				
Manual operating mechanism with stored-energy drive with mechanical closing				
	Max. operating force required to move the handle N Number of handle strokes required for charging			210 5
Manual operating mechanism with stored-energy drive with mechanical and electrical closing				
Charging stored energy mechanism			see	manual operating mechanism with stored energy drive with mechanical closing
Closing solenoid (Y1)	Coil voltage tolerance extended tolerance for battery operation [1])		at DC 24 V, DC 48 V, DC 60 / 110 / 220 V	0.7 up to 1.1 x U_s, at DC 24 V 0.7 up to 1.26 x U_s
	Power consumption		AC/DC VA/W	15
	Min. command duration at U_s for the closing solenoid		ms	min. 60
	Total closing time at U_s after start of the command signal for the closing solenoid, suitable for synchronizing tasks		ms	80
	Short-circuit protection Smallest permissible DIAZED fuse (Class gL)/MCB with C characteristics			1 A TDz (slow low)/1 A
Manual/motorised operating mechanism with stored-energy drive with mechanical and electrical closing				
Manual operating mechanism			see	manual operating mechanism with stored energy drive with mechanical closing
Motor	Coil voltage tolerance extended tolerance for battery operation [1])		at DC 24 V, DC 48 V, DC 60 / 110 / 220 V	0.7 up to 1.1 x U_s 0.7 up to 1.26 x U_s
	Power consumption of the motors		AC/DC VA/W	40
	Time required for charging the stored energy mechanism at 1 x U_s		s	20
Closing solenoid			see	manual operating mechanism with stored energy drive with mechanical and electrical closing
For motor and closing solenoid	Short-circuit protection Motor and closing for equal rated control voltage. Smallest permissible DIAZED fuse (Class gL)/MCB with C characteristics		at U_s = 24 V at U_s = 110 - 127 V at U_s = 220 - 250 V	2 A TDz (slow low)/2 A 1 A TDz (slow low)/1 A 1 A TDz (slow low)/ 1 A
Auxiliary release				
Shunt release "f"-(F1, F2)	permanent command(100% ON), suitable for jog-safe blocking	Operating values	pickup	[3]) 0.7 x U_s (switch will be tripped)
		Coil voltage tolerance; extended tolerance for battery operation [1])	at DC 24 V, DC 48 V DC 60 / 110 / 220 V	0.7 up to 1.1 x U_s 0.7 up to 1.26 x U_s
		Rated control voltage U_s	AC 50/60 Hz V DC V	110 - 127. 220 - 240 24, 48, 110 - 125, 220 - 250
		Power consumption	AC/DC VA/W	15
		Min. command duration at U_s	ms	60
		Break-time of the circuit-breaker at U_s = 100 %	AC/DC ms	[3]) 80
		Short-circuit protection Smallest permissible DIAZED fuse (Class gL)/ MCB with C characteristics		1 A TDz (slow low) 1 A
	With energy store (f-release + storage-device) 3WX31 56-1J.01	Rated control voltage U_s	AC 50/60 Hz V DC V	110 -127. 220 - 240 110 - 125. 220 - 250
		Coil voltage tolerance		0.85 to 1.1 x U_s
		Power consumption	AC/DC VA/W	1
		Storage time [2]) at U_s/recharging time [3]) at U_s		max. 5min. / min. 5 s
		Break-time of the circuit-breaker, short-circuit protection		See "For permanent command" (above)

The closing solenoid, motor, shunt release and undervoltage release are surge proof up to 4 kV

[1]) The coil voltage tolerance is only applicable for the rated voltages indicated and corresponds to the battery charging voltage

[2]) Storage time = max. time after drop of the auxiliary power supply for which safe tripping by the shunt release is still assured. Thereby it is assumed that the stored energy mechanism was fully charged

[3]) Recharging time = minimum time for recharging the stored energy mechanism after tripping by the shunt release

Technical data					Circuit-breaker 3WN6, 3- and 4-pole, up to 3200 A			
Auxiliary release								
Undervoltage release "r" (F3) and "rc" (F8)		operating value		pickup dropout	0.85 x U_s (circuit-breaker ready to close) (0.35 to 0.7) x U_s (circuit-breaker trips)			
		Coil voltage tolerance; extended tolerance for battery operation [1]		DC 24 V, DC 48 V DC 60 / 110 / 220 V	0.85 to 1.1 x U_s 0.7 to 1.26 x U_s			
		Rated control voltage U_s		AC 50/60 Hz V DC V	110 - 127, 220 - 240, 380 - 415 24, 48, 60, 110 - 125, 220 - 250			
		Power consumption		AC VA DC W	15 15			
		Break-time of the circuit-breaker at U_s = 0 Version "r" (F3) without delay ms with delay 100 ms, internally switchable ms Version "rc" (F8) with delay, t_d = 0.2 to 3.2 s s Reset with add. NC contact for direct opening ms			 < 100 < 200 0.2 to 3.2 < 100			
		Short-circuit protection Smallest permissible DIAZED fuse (Class gL)/ MCB with C characteristics			1 A TDz (slow low) 1 A			
Contact position driven auxiliary contacts (S1, S2, S3, S4)								
Rated insulation voltage U_i				AC/DC V	400			
Rated operational voltage U_s				AC/DC V	400			
Switching capacity	AC 50/60 Hz	Rated operational voltage Rated operational current	U_{ir} I_s/AC-12 I_s/AC-15	V A A	up to 240 10 4		400/415 10 3	
	DC	Rated operational voltage Rated operational current	U_{ir} I_s/DC-12 I_s/DC-13	V A A	24 10 8	48 8 4	110 3.5 1.2	220 1 0.4
Short-circuit protection [2]		Largest permissible DIAZED fuse (Class gL) Largest permissible MCB with C-Characteristics			10 A TDz (slow low) 10 A			
Ready to close signalling contact (S7) and tripped signalling contact (S11), acc. to DIN VDE 0630								
Switching capacity	AC 50/60 Hz	Rated operational voltage Rated operational current	U_s I_s	V A	110 0.14		220 0.1	
	DC	Rated operational voltage Rated operational current	U_s I_s	V A	24 0.2		220 0.1	
Short-circuit protection [2]		Largest permissible DIAZED fuse (Class gL)			2 A Dz (flink)			
Tripped signalling contact		S11 is signalling duration after tripping			continuous, till reset			
Signals of the overcurrent release								
Signals of the overcurrent release via Optocoupler		Contactless outputs of the overcurrent release. max. Rated operational voltage max. Rated operational current	U_s I_s	DC V DC mA	 24 20			
Position signalling contact on the guide frame								
Contact version	Signalling:	"circuit-breaker in connected position" "circuit-breaker in test position" "circuit-breaker in disconnected position"			3 NO + 3 NC 2 NO + 2 NC 1 NO + 1 NC		1 NO + 1 NC or 1 NO + 1 NC	
Rated insulation voltage U_i					AC 400V, DC 450V			
Rated operational voltage U_s					AC 240V, DC 220V			
Switching capacity	AC 50/60 Hz	Rated operational voltage Rated operational current	U_s I_s/AC-1 I_s/AC-15	V A A	up to 240 8 1			
	DC	Rated operational voltage Rated operational current	U_s I_s/DC-1 I_s/DC-13 (L/R = 50ms)	V A A	24 8 6	48 8 5	110 8 1.2	220 1 0.15
Short-circuit protection [2]		Largest permissible DIAZED fuse (Class gL) Largest permissible MCB with C-Characteristics			8 A TDz (slow low) 8 A			

[1] The coil voltage tolerance is only applicable for the rated voltages indicated and corresponds to the battery charging voltage

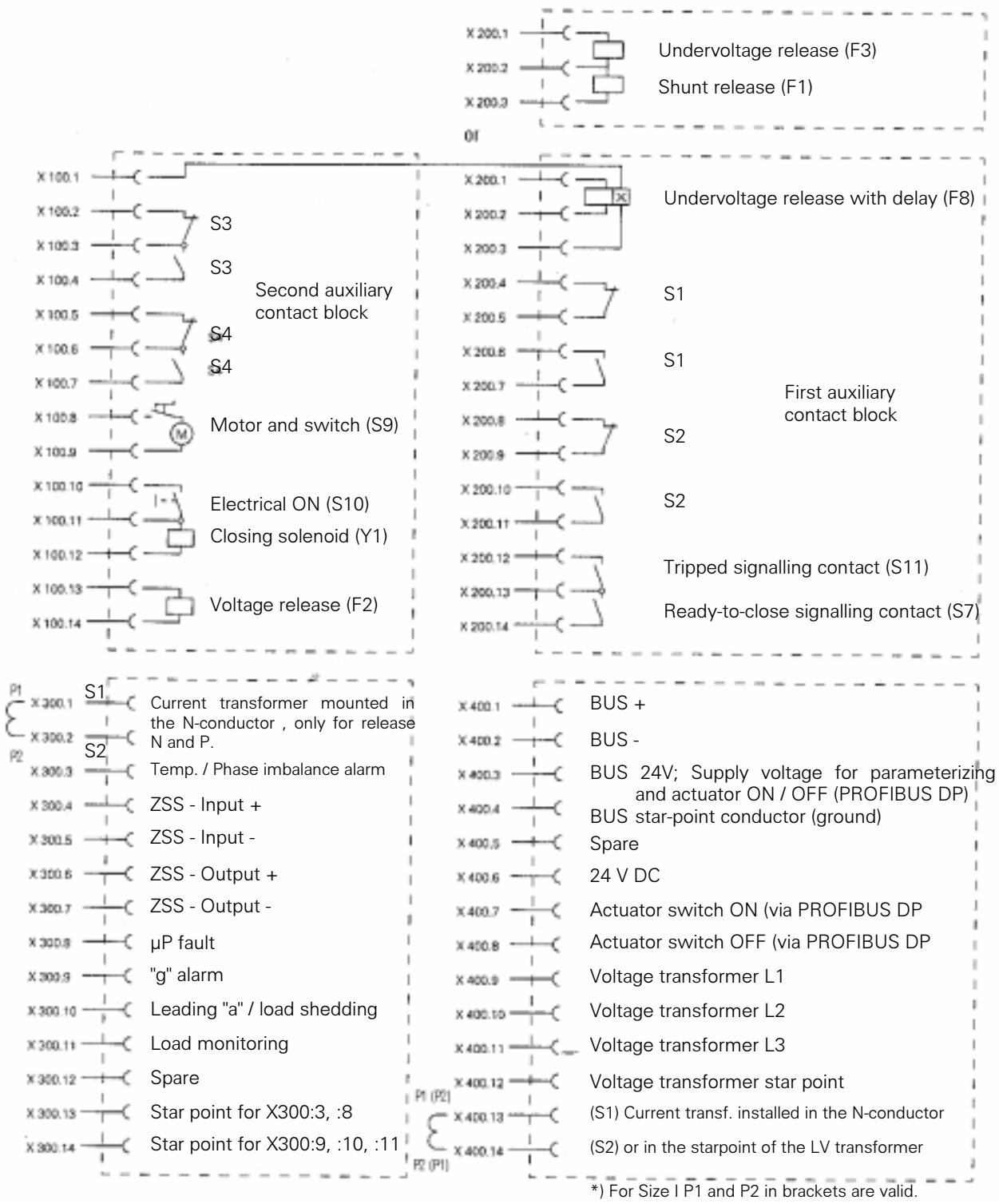
[2] Absolutely weld-free contacts only at $I_k < 1$ kA acc. to DIN VDE 0660 Part 200

6. Circuit Diagram

The Circuit diagrams referring to exact order numbers can be printed out at any time from the product database AUSTER (order number E20002 - D1000 - A107 -A3) or from the 3WN6 CD-ROM Show/Info (order no. E20001 - P285 - Y258 - X - 7400).
The following overview shows which point internal equipment is connected to which point of the contact blocks, i.e. this is a complete auxiliary wiring diagram of the circuit-breaker.

For controlling of the circuit-breaker see also section 4.7 "Circuit diagrams"

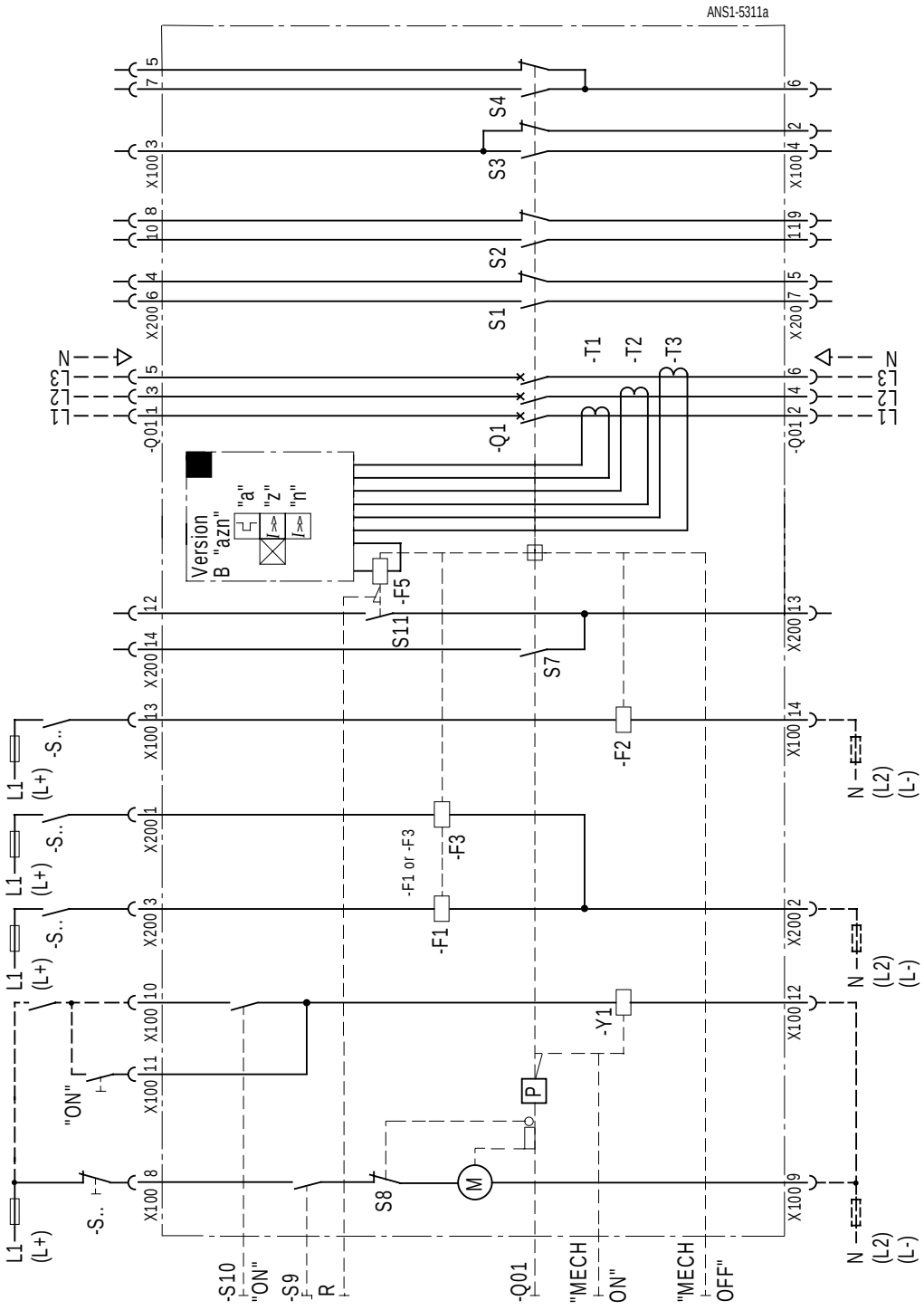
Auxiliary contact connections



*) For Size I P1 and P2 in brackets are valid.
General: This inputs are necessary for N-conducter or ground fault protection.

Example 1 of a full circuit diagram

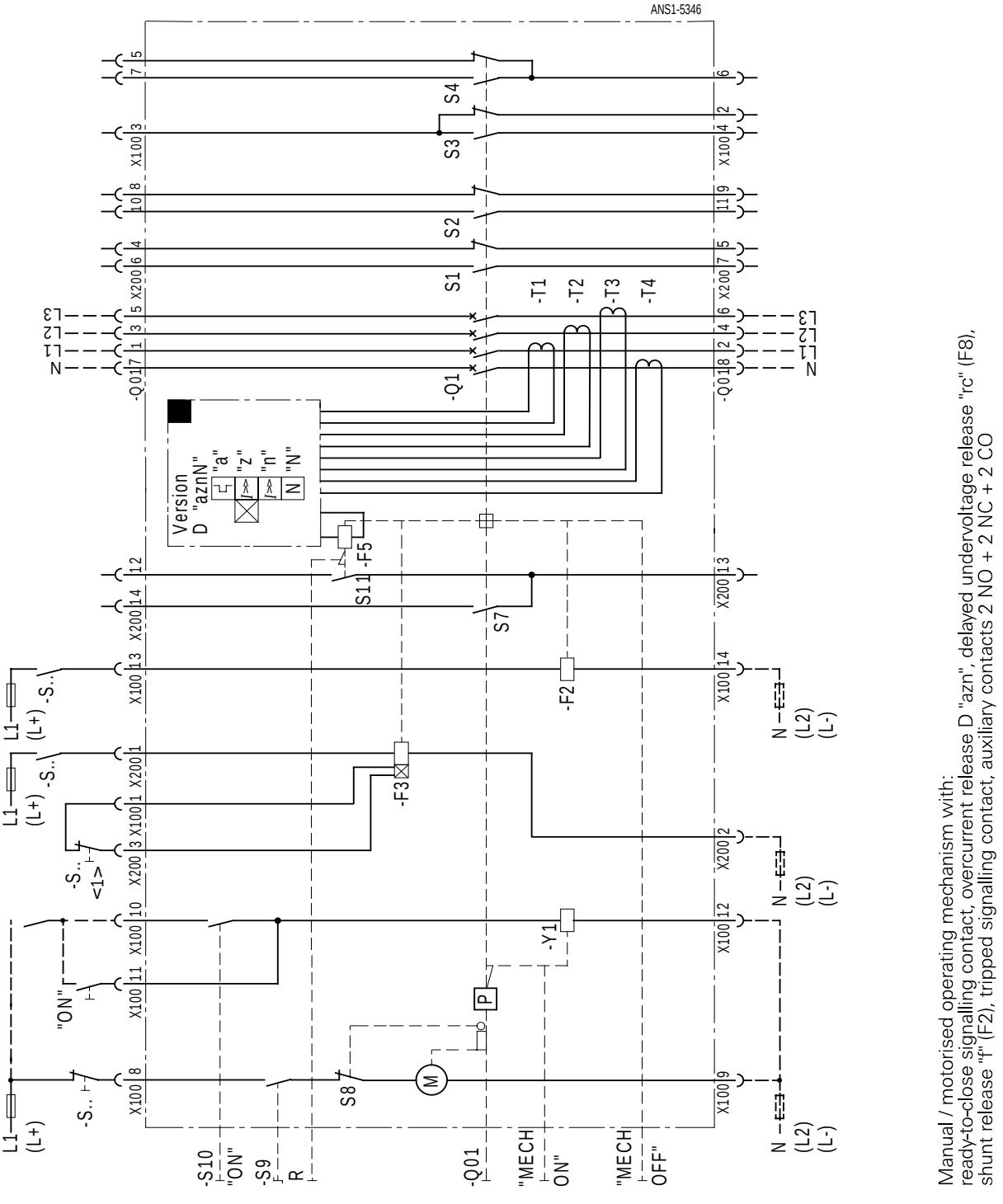
A1	Solid state overcurrent release	S1/S2	1. aux. contact block
F1	1. shunt release "f"	S3/S4	2. aux. contact block
F2	2. shunt release"f"	S7	Ready-to-close signalling contact
F3	Undervoltage release "r"	S8	Stored energy contact
F5	Trip solenoid	S9	External switch (0ptional) for spring charge mechanism
M1	Motor for charging stored-energy mechanism	S10	Push-button for electrical ON
P	Stored-energy mechanism	S11	Tripped signalling contact
Q01	Operating handle for stored-energy mechanism	T1...3	Current transformer
Q1	Main contact	X100 / X200	Terminal for control circuit
R	Display and reset push-button for overcurrent release	Y1	Closing solenoid



Manual / motorised operating mechanism with:
ready-to-close signalling contact, overcurrent release B "azn", undervoltage release "r" (F3) or shunt release "f" (F1),
shunt release "f" (F2), tripped signalling contact, auxiliary contacts 2 NO + 2 NC + 2 CO

Example 2 of a full circuit diagram

A1	Solid state overcurrent release	S1/S2	1. aux. contact block
F2	2. shunt release"f"	S3/S4	2. aux. contact block
F5	Trip solenoid	S7	Ready-to-close signalling contact
F8	Undervoltage release "rc" with delay (0.2 to 3.2 s)	S8	Stored energy contact
M1	Motor for charging stored-energy mechanism	S9	External switch (0ptional) for spring charge mechanism
P	Stored-energy mechanism	S10	Push-button for electrical ON
Q01	Operating handle for stored-energy mechanism	S11	Tripped signalling contact
Q1	Main contact	T1...4	Current transformer
R	Display and reset push-button for overcurrent release	X100 / X200	Terminal for control circuit
<1>	External electrical OFF (instantaneous) for EMERGENCY STOP device	Y1	Closing solenoid

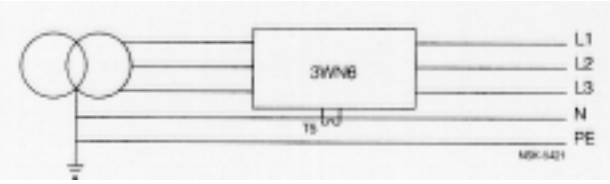


Connection of current transformers

Measurement of the N-conductor current and the earth fault-current

Method 1
Vectorial summation with current transformer at the N-conductor

3-pole circuit-breaker



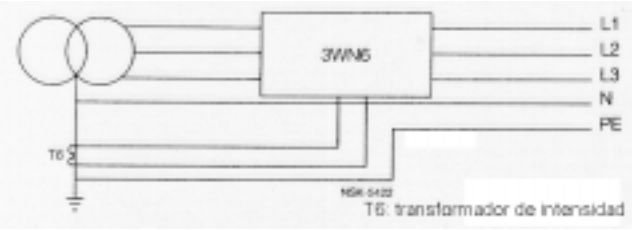
4-pole circuit-breaker
(Overcurrent release G, D, F, H, K, N, P)
In case of a 4-pole circuit-breaker, the 4th current transformer for the N-conductor is installed internally.

Exception:
For overcurrent release of type E and J, it must be mounted externally at the N-conductor

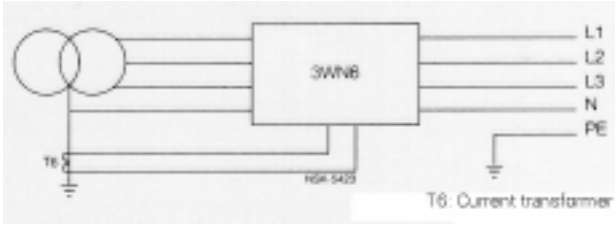
Overcurrent release version	Current transformer T5 Connection to aux terminals
C, D, E, H, J	400.13 400.14
N, P	300.1 300.2

Method 2
Direct detection of the earth fault current via a current transformer at the earthed star point of the main L.V. transformer-

3-pole circuit-breaker



4-pole circuit-breaker
(only with overcurrent release P)

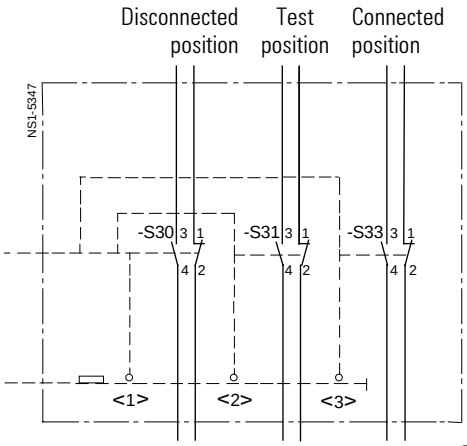


Overcurrent release version	Current transformer T5 Connection to aux. terminals
C, E, J	400.13 400.14
P	300.1 300.2

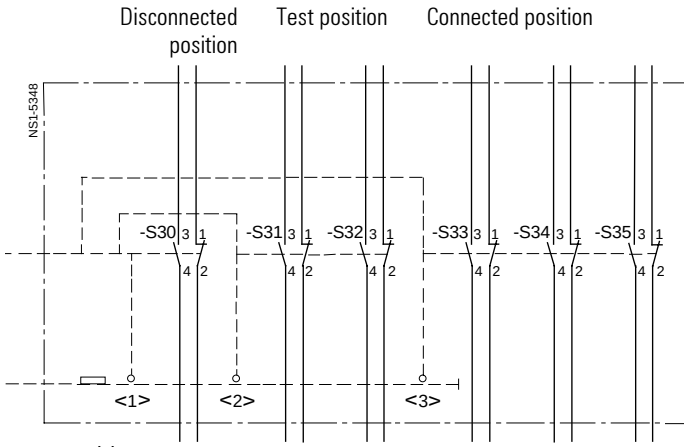
Overcurrent release version	Current transformer T6 Connection to aux. terminals
P	300.1 300.2

Signalling devices for circuit-breaker position in the guide frame

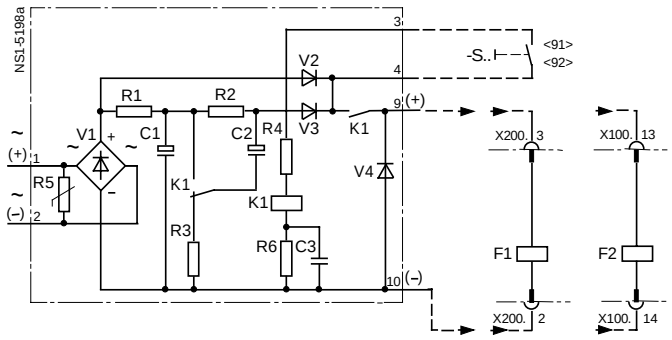
Short code "R15" 3WX36 84-1JA00



short code "R16" 3WX36 84-1JC00



Circuit diagram for supplementary devices



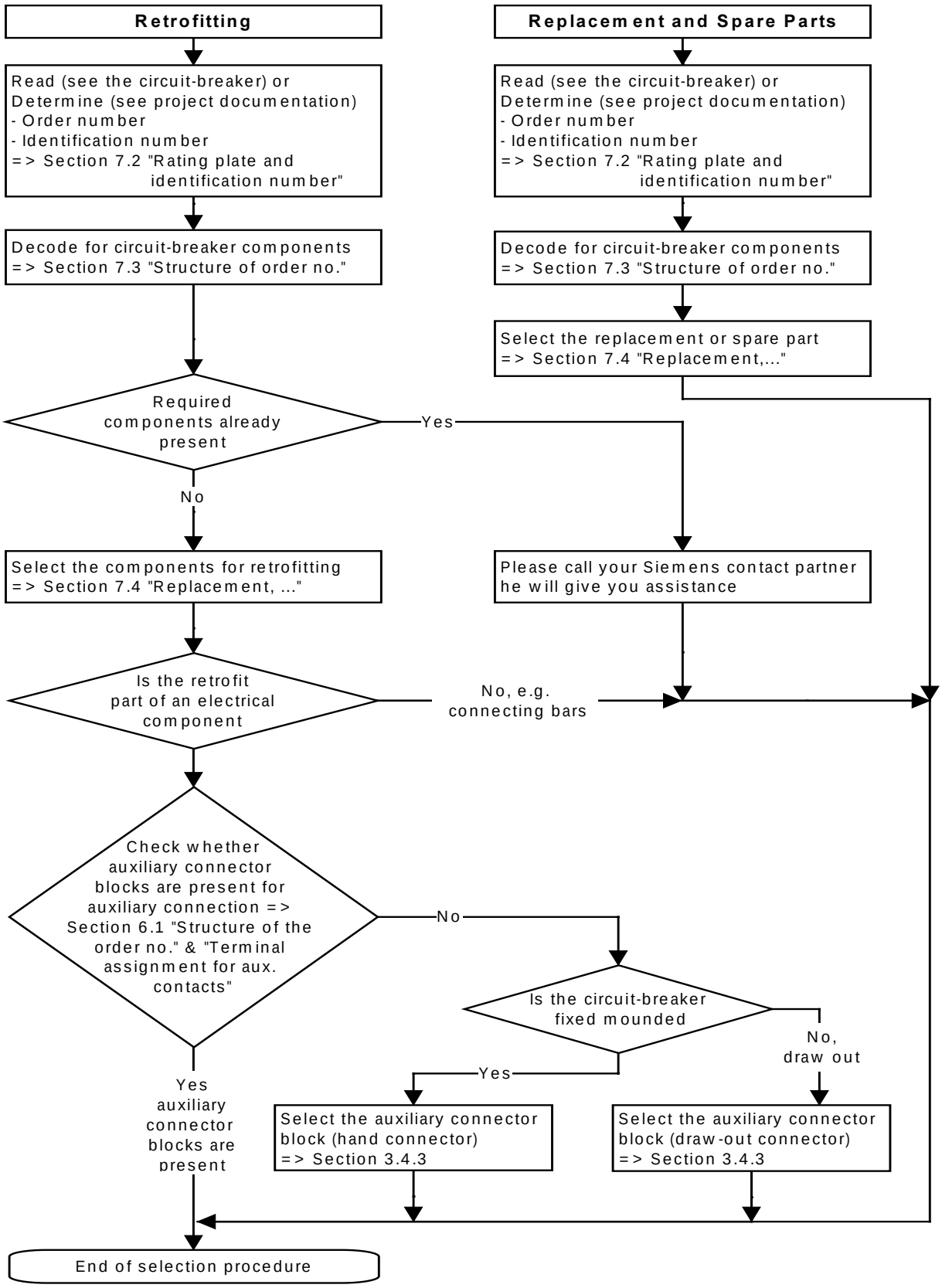
<21> 1. shunt release -F1
<22> auxiliary contact for <21>
<27> 2. shunt release -F2
<28> auxiliary contact for <27>
<91> resp. <92> external "electrical OFF" by -F1 resp. -F2; push-buttons only

3WX31 56-1JG01 and 3WX31 56-1JJ01 storage unit for shunt release with stored energy feature

7. Retrofitting and Conversions

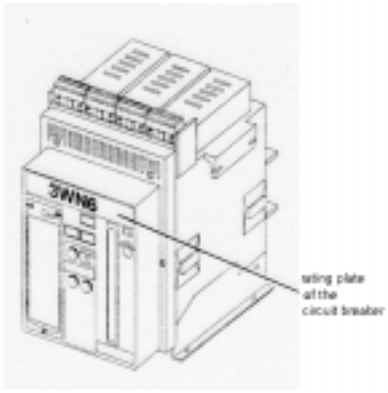
7.1. Procedure

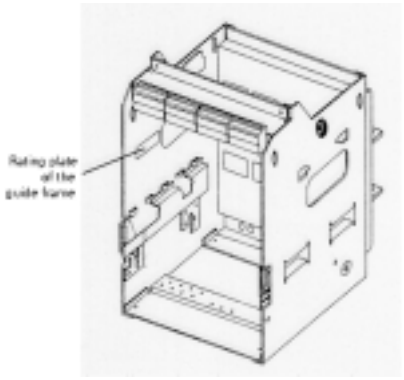
The following flow chart shows the reordering procedure for retrofitting, conversion, replacement and spare parts. Each component of the circuit-breaker and guide frame is uniquely coded with numbers.

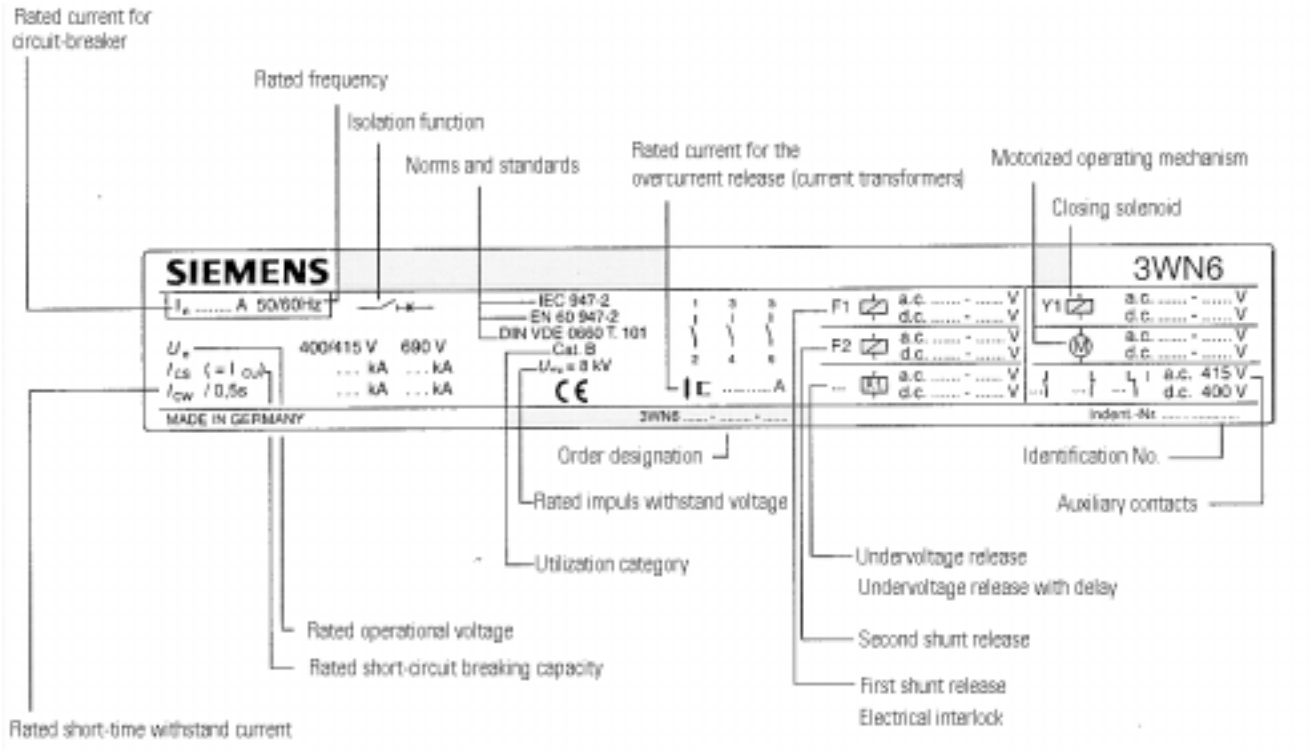


7.2. Rating plate and Ident-number

All component and ordering data for the circuit-breakers as well as the identification number are listed on the rating plate in the top section of the control panel. The 3WN6 can be equipped with additional functions by retrofitting accessories or by replacement or conversion. Changes must be noted on the rating plate (a new rating can be ordered if desired according to the Operating instructions).
The rating plate and ordering data must be kept up to date on both the circuit-breaker and the guide frame.







Identification number

The circuit-breakers are marked with a 9-digit identification number. When accessories must be ordered, this identification number needs to be indicated for the appropriate components for the circuit-breaker to be delivered. Each identification number exists only one time.

7.3. Structure of the ordering number

The composition of the order number from the characteristics and possible versions of the 3WN6 circuit-breaker is shown in the following tables. If the order number is known, the basic rating and version data can be determined. In a similar manner; it is possible to build up the order number with reference to the components.
A recording of all possible versions and ordering options is, however, only provided using the catalogue.

Example for an order number

3WN6	331-0GB58-1KK1 Z = C01 + ...	Z

Determination of the type and version of the circuit-breaker with known order number

3WN6 circuit-breaker / non-automatic circuit-breaker (without current transformers)				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Order codes
Make up of the order number (pos. 1. to 12.)				3	W	N	6				–					–				-Z
	in	Size	(current transformer)																	
Rated current of the 3WN6	630 A	I	(315A, 400 A, 500 A, 630 A)	0																
	800 A	I	(800 A)	1																
	1000 A	I	(1000 A)	2																
	1250 A	I	(1250 A)	3																
	1600 A	I	(1600 A)	4																
	2000 A	II	(630 A, 1250 A, 1600 A, 2000 A)	5																
	2500 A	II	(2500 A)	6																
	3200 A	II	(3200 A)	7																
Fixed mounted version	Main connections accessible from the front, double hole top and bottom (holes in busbars acc. DIN 43 673)			2																
	Accessible from the front, single hole, top and bottom			3																
	At the rear, horizontal			6																
draw-out version	Draw-out circuit-breaker			7																
	Draw-out circuit-breaker with guide frame (only for ordering; at delivery the "7" is shown on the rating plate and the order number "3WX36 83-..."is shown on the guide frame.			8																
No. of poles and rated voltage	3-pole version up to AC 690 V			1																
	4-pole version up to AC 690 V			3																
Additional function of the overcurrent release	Only basic functions (type V, B, C, G)			0																
	Basic function with LCD-display (type D, E, F, N, H, P, J, K)			1																
	Basic function with additional function 1			3																
	Basic function with additional function 2			7																
CT's and adjustment range of the overcurrent release	Current transformer		Range of the overcurrent release																	
	315 A		126 - 315 A	A																
	400 A		160 - 400 A	B																
	500 A		200 - 500 A	C																
	630 A		252 - 630 A	D																
	800 A		320 - 800 A	E																
	1000 A		400 - 1000 A	F																
	1250 A		500 - 1250 A	G																
	1600 A		640 - 1600 A	H																
	2000 A		800 - 2000 A	J																
	2500 A		1000 - 2500 A	K																
	3200 A		1280 - 3200 A	M																
Overcurrent release with tripped display (LED) with test functions	Without overcurrent release (non-automatic circuit-breaker)			A																
	Version B, "azn"			B																
	Version C, "aznNg"		(only 3-pole circuit-breakers)	C																
	Version D, "aznN",		with current display	D																
	Version E, "aznNg",		with current display	E																
	Version F, "aznNg",		with current display (only 4-pole CB)	F																
	Version G, "aznNg",		(only 4-pole circuit-breakers)	G																
	Version H, "aznN",		adjustment/current display with manual operating device	H																
				J																
	Version J, "aznNg",		adjustment/current display with manual operating device	K																
	Version K, "aznNg",		(only 4-pole circuit-breakers) adjustment/..see Version J																	
	Version N, "aznN",		with menu-assisted display	N																
	Version P, "aznNg"		with menu-assisted display	P																
	Version V, "zn"			V																
Operating mechanism	Manual operating mechanism with stored energy feature with mechanical closing			0	5															
	Manual operating mechanism with stored energy feature with mechanical and electrical closing																			
	Electrical closing for		DC 24 V	1	1															
			DC 48 V	1	4															
			DC 60 V	1	5															
			AC 110-127 V/DC 110-125 V	1	6															
			AC 220-240 V/ DC 220-250V	1	8															
	Manual motorized operating mechanism with stored energy feature with mechanical and electrical closing																			
	Motor		electrical closing																	
	DC 24 V		DC 24 V	5	1															
	DC 48 V		DC 48 V	5	4															
	DC 60 V		DC 60 V	5	5															
	AC 110-127 V/DC 110-125 V		DC 24 V	7	1															
	AC 110-127 V/DC 110-125 V		DC 48 V	7	4															
	AC 110-127 V/DC 110-125 V		DC 60 V	7	5															
	AC 110-127 V/DC 110-125 V		AC 110-127 V/DC 110-125 V	5	6															
	AC 110-127 V/DC 110-125 V		AC 220-240 V/ DC 220-250V	7	8															
	AC 220-240 V/ DC 220-250V		DC 24 V	8	1															
	AC 220-240 V/ DC 220-250V		DC 48 V	8	4															
	AC 220-240 V/ DC 220-250V		DC 60 V	8	5															
	AC 220-240 V/ DC 220-250V		AC 110-127 V/DC 110-125 V	8	6															
	AC 220-240 V/ DC 220-250V		AC 220-240 V/ DC 220-250V	5	8															

Aux. releases, Aux. contacts, Order code see following page -Z

Circuit-breaker 3WN6			1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	Order codes
Make up of the order number (pos. 13. to 16. and order code - Z)			3 W N 6 – -	-Z
1. Aux release	None		0 A	
	Shunt release "f", F1 (operating current release)	DC 24 V	1 B	
		DC 48 V	1 F	
		DC 60 V	1 G	
		AC 110 - 127 V/DC 110 - 125 V	1 H	
		AC 220 - 240 V/DC 220 - 250 V	1 K	
	Undervoltage release "rc", F3	DC 24 V	3 B	
		DC 48 V	3 F	
		DC 60 V	3 G	
		AC 110 - 127 V/DC 110 - 125 V	3 H	
		AC 220 - 240 V/DC 220 - 250 V	3 K	
		AC 380 -415 V	3 M	
		AC 110 - 127 V	4 H	
		AC 220 - 240 V	4 K	
		AC 380 - 415 V	4 M	
2. Aux release	None		A	
	Shunt release "f", F2 (operating current release)	DC 24 V	B	
		DC 48 V	F	
		DC 60 V	G	
		AC 110 - 127 V/DC 110 - 125 V	H	
		AC 220 - 240 V/DC 220 - 250 V	K	
Auxiliary contacts	1. auxiliary contact blocks 2NO + 2NC		1	
	1. + 2. Auxiliary contact block NO	3 NO + 3 NC + 1 CO (till 10/95)	2	
	1. + 2. Auxiliary contact block NO	2 NO + 2 NC + 2 CO	3	

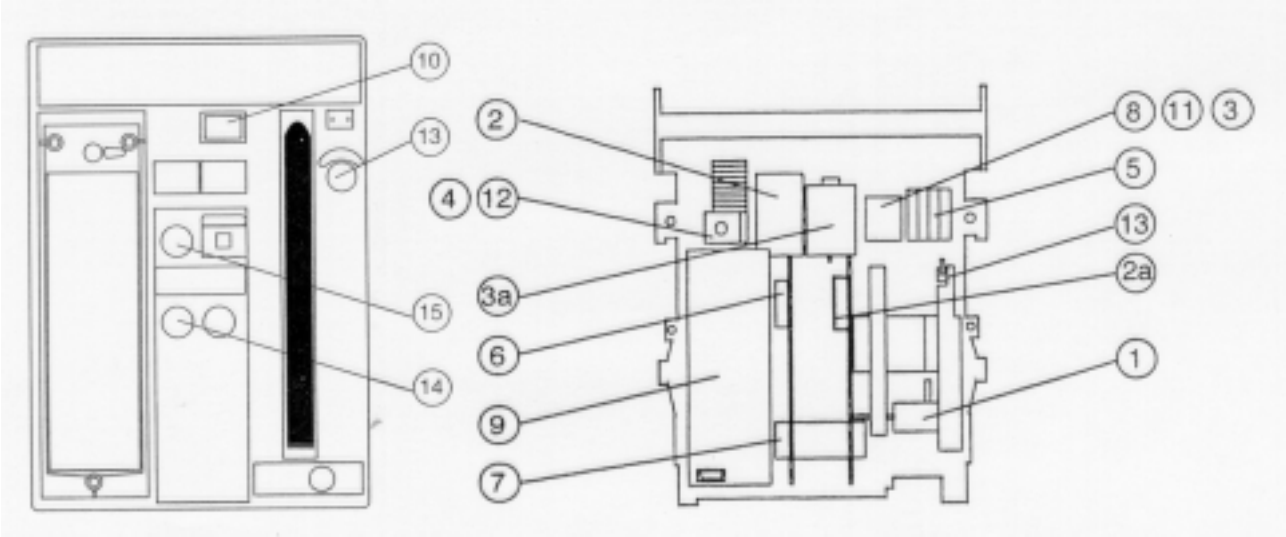
Circuit-breaker 3WN6			1 2 3 4 5 6 7 8 9 10 11 12	Order code
Make up of the order number			3 W X 3 6 8 3 - A 0 - Z	
1. Aux release	I_N	Size		
Rated current for the circuit-breaker non automatic circuit-breaker	630 A	I	0	
	800 A	I	1	
	1000 A	I	2	
	1250 A	I	3	
	1600 A	I	4	
	2000 A	II	5	
	2500 A	II	6	
	3200 A	II	7z	
Auxiliary connector blocks	1 Auxiliary connector block		B	
	2 Auxiliary connector block		C	
	3 Auxiliary connector block		D	
	4 Auxiliary connector block		E	
No. of poles	3-pole Version		1	
	4-pole		3	

Further versions of the guide frame

Main connections	At the rear, horizontal (standard), no order code	
	Accessible from the front, double-hole, top and bottom (holes in connecting bars acc. to DIN 43 673)	R 0 2
	Accessible from the front, single-hole, top and bottom	R 0 3
	At the rear, vertical, top and bottom	R 0 7
Position signalling switch	With signalling switch (operated by draw-out circuit-breaker Pos: connected (1NO + 1NC), test (1NO + 1NC); disconnected. (1NO + 1NC)	R 1 5
	Pos: connected (3NO + 3NC), test (2NO + 2NC); disconnected. (1NO + 1NC)	R 1 6
Shutter	Two parts, protection against touching the main connections	R 2 0
Locking device (associated with the door)	Breaker in connected pos.: Prevents opening of the cubicle door;	R 3 0
	prevents closing when the cubicle door is open.	R 4 0
	Prevents moving of the CB, when the cubicle door is open	R 5 0
Mutual mechanical interlocking	Interlocking module with <u>one</u> Bowden wire (2m) Module can be adjusted to different interlocks	R 5 5
Locking device with lock in the door	A lock is mounted outside the circuit-breaker, Unauthorised closing of the circuit-breaker is prevented via Bowden wire. Lock types are: CES, BKS, IKON, O.M.R, CASTELL, FORTRESS	R 6 .

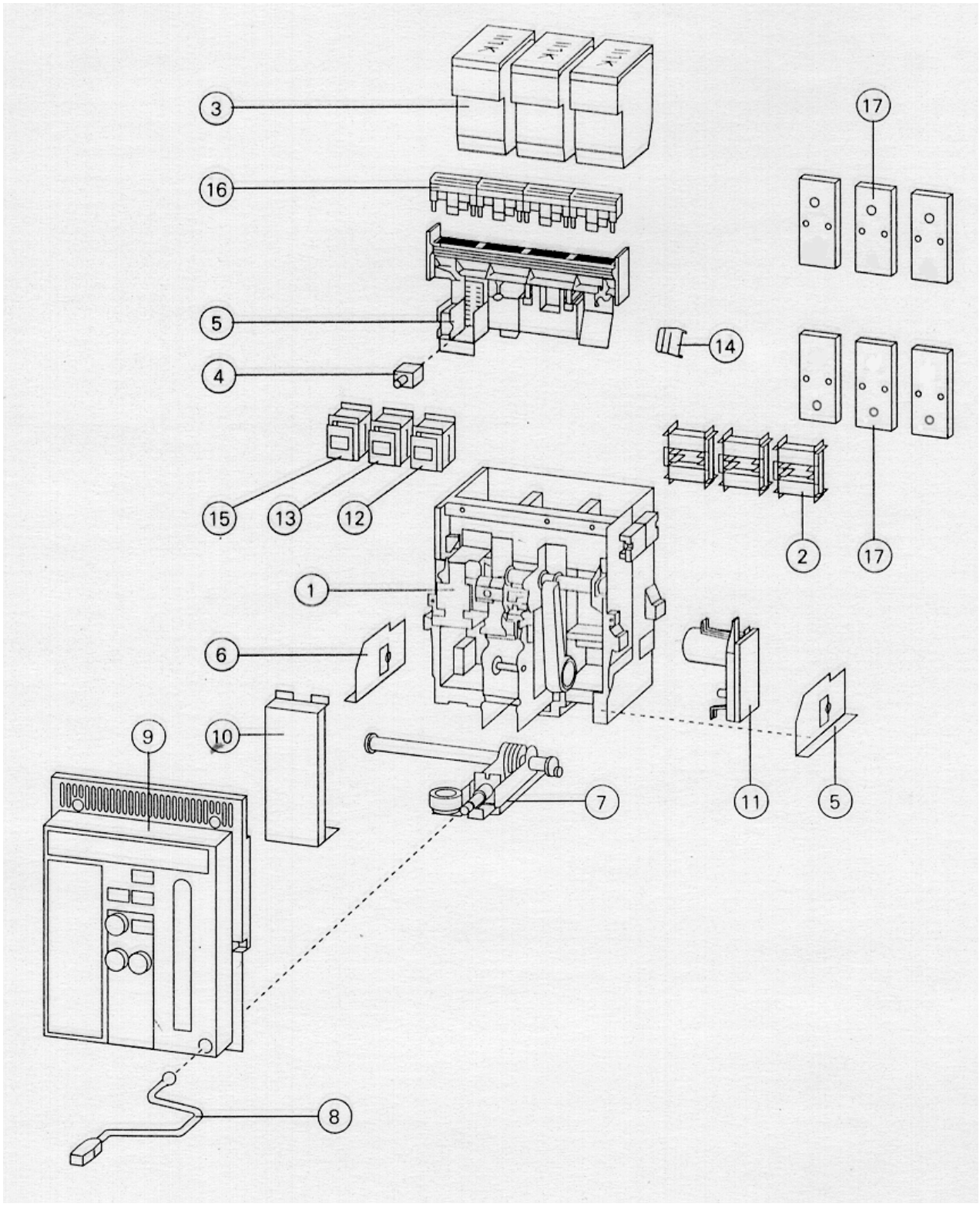
Further version of the 3WN6 fixed mounted and draw-out version			Order code
Make up of the order number (order code - Z)			3 W N 6 . . . - . . . . . - . . . Z
5-digit operating cycle counter			C 0 1
Communication module for overcurrent release			F 0 1
Automatic mechanical reset after overcurrent tripping			K 0 1
Higher rated short time withstand current (I_{cw}) = 50 kA) at 1 s) for circuit-breaker up to 1000 A			K 0 3
Locking device against unauthorised closing	CES safety lock instead of "mech. OFF"		S 0 1
	BKS safety lock instead of "mech. OFF"		S 0 2
	IKON safety lock instead of "mech. OFF"		S 0 3
	EMERGENCY STOP push button (self latching))		S 1 2
	Covering "mech. OFF" and "electr. ON" for padlocks		S 2 0
	CES safety lock instead of "mech. ON"		S 0 5
	BKS safety lock instead of "mech. ON"		S 0 6
	IKON safety lock instead of "mech. ON"		S 0 7
	Mounting kit for locks		
	FORTRESS-LOCK	H31RH/AC 65°/Standard	S 1 4
	CASTELL-LOCK	FS2	S 1 5
	KIRK-KEY-LOCK		S 1 6
Motor switch at control panel (only for CB with motorised spring charging feature)			S 1 3
Sealing cap over "mechanical OFF" push-button			S 2 1
Sealing cap over "mechanical ON" push-button			S 2 2
For fixed mounted circuit-breaker Locking device against closing the circuit-breaker when the cubicle door is open			S 2 4
Locking device against opening cubicle door when the circuit-breaker is closed			S 2 5
Mutual mechanical interlocking	Interlocking module with <u>one</u> Bowden wire (2m) Module can be adjusted to different interlocks		S 5 5
Locking device with lock in the door (fixed mounted circuit-breaker)	A lock is mounted outside the circuit-breaker, Unauthorised closing of the circuit-breaker is prevented via Bowden wire. Lock types are: CES, BKS, IKON, O.M.R, CASTELL, FORTRESS		S 6 .
Locking device with lock in the door	The safety lock prev. opening of the crank hole of the draw-out CB. Lock types are: CES, BKS, IKON, O.M.R., Profalux, Ronis		S 7 .

7.4. Replacement, Retrofit and Spare Parts

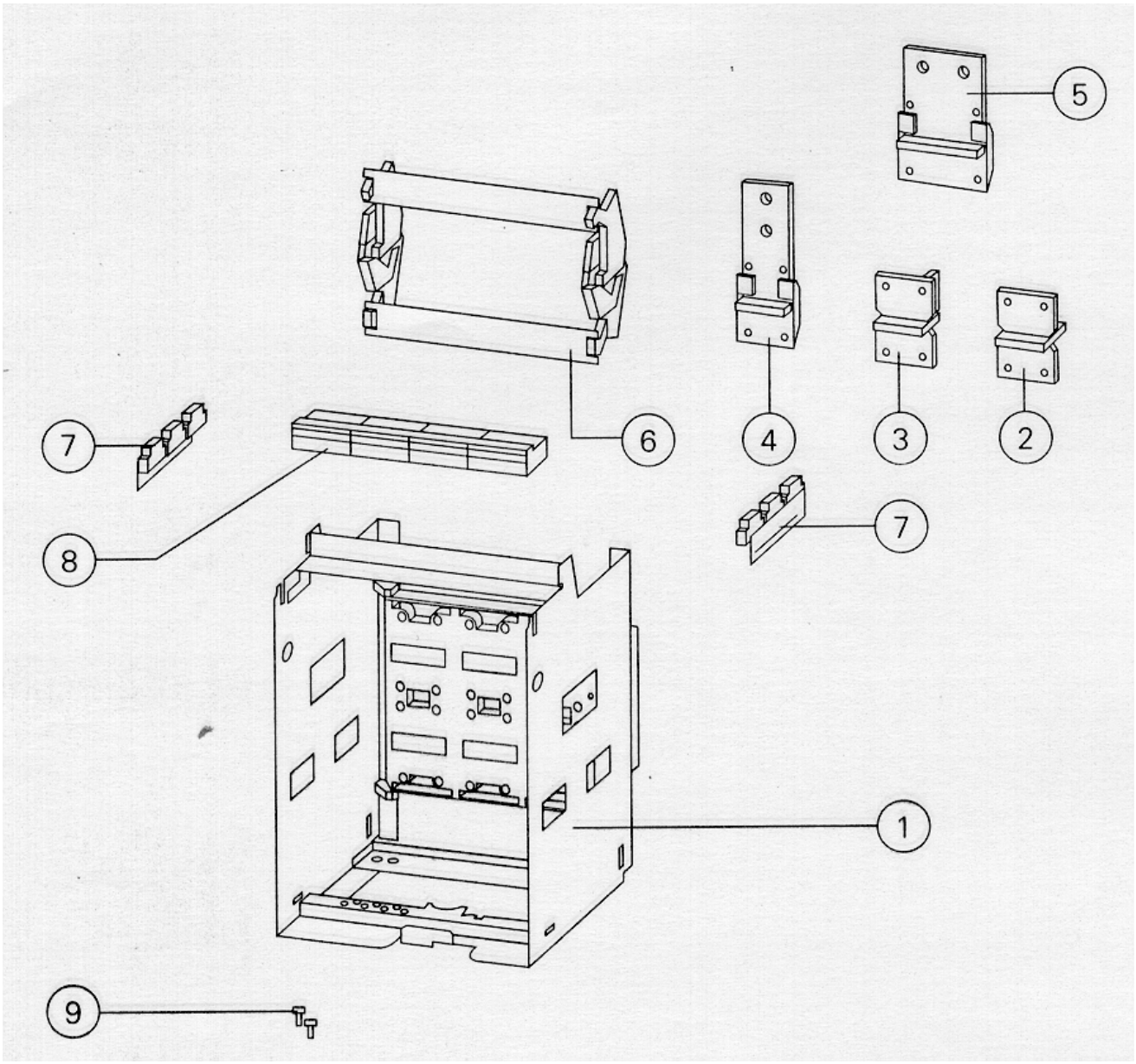


To switch on			For monitoring		
Motor	1		Aux. switch for position indication	5	
Closing solenoid	2		Ready-to-close signalling switch	6	
Switch for electrical on	2a		Stored energy signalling switch (only for overcurrent releases with communication / measurement capability	7	
			Undervoltage release (for overcurrent releases with communication / measurement capability with additional auxiliary switch)	8	U <
			Overcurrent release	9	
			Operating cycles counter	10	

To switch OFF			To lock		
Shunt release	3		Electrical closing interlock (shunt release)	11	
Undervoltage release	3a		Closing interlock with tripped signalling contact	12	
Tripping solenoid	4		Motor switch	13	
			Key switch "OFF"	14	
			Sealing cap for "mechanical OFF"	14	
			Key switch "ON"	15	



1	Basic circuit-breaker	10	Solid state overcurrent release
2	Current transformer	11	Motorised operating mechanism
3	Arcing chamber	12	1. Aux. release (shunt-(-F1)/ undervoltage (-F3, -F8))
4	Tripping solenoid (-F5)	13	2. Aux. release (shunt release (-F2))
5	Mounting plate with auxiliary connector blocks	14	Contact position signalling switch
6	Circuit-breaker feet	15	Closing coil
7	Cranking device	16	Hand connector (fixed mounted circuit-breaker)
8	Crank handle	17	Main connections accessible from the front (fixed mounted version)
9	Control panel in acc. with the version		



1 Guide frame
2 Horizontal connections (standard)
3 Vertical connections
4 Connections accessible from the front double hole Size I
5 Connections accessible from the front single hole Size II
6 Shutter
7 Position signalling switch
8 Auxiliary connector
9 Rated current coding

Overview
The following list gives an overview of the components that can be replaced, installed in place of a component or retrofitted by the customer at site.

For fixed mounted and draw-out circuit-breakers
All parts are, if necessary, prewired for the circuit-breaker internal wiring.
- Auxiliary contacts (e.g. 1NO, 1NC, 1CO, 2 x 2NO)
- Door sealing frame
- Locking devices CES, BKS, IKON, CASTELL, FORTRESS, KIRK KEY; Profalux, Ronis
- Sealing cap
- Operating cycles counter
- Current transformer for earth fault and N-Conductor protection
- Overcurrent release
- Connecting bars for connections accessible from the front and vertically
- Electrical closing for remote ON command (closing solenoid Y1) prewired
- Motorised operating mechanism for automatic charging of the spring energy store
- Shunt release "f" (F1 and F2, also as electrical closing interlock). Module prewired, for remote OFF command and remotely activated closing interlock
- Undervoltge release "r" (F3), Module pre-wired, for remote OFF command or monitoring the power supply
- Undervoltage release with delay "rc" (F8) Module pre-wired, for monitoring the power supply (but with the allowance of voltage drop for a short time) or for an EMERGENCY STOP Circuit (separate wiring!)

For fixed mounted circuit-breakers
- Support bracket
- Hand connector for auxiliary connections
- Locking device

For draw-out version - guide frame
- Position signalling switch
- Shutter
- Draw-out connector for auxiliary connections
- Coding device
- Locking device

Spare parts
Further spare parts are:
- Main contact set
- Arcing chute with additional arcing enclosure fitted

For fixed mounted and draw-out circuit-breaker			
Item		Quantity required per circuit-breaker	Order No. Per 1 Item
Auxiliary contacts (pre-wired) (without auxiliary connectors that may also be required but ordered separately)	Auxiliary contacts, 2 CO (2nd Block) (Contacts S3 and S4; Total: 2NO + 2NC + 2CO)	1 Item	3WX36 16-1CE00
	Auxiliary contacts, 2 x 2NO (Contact S3 and S4; Total: 6NO + 2NC)	1 Item	3WX36 16-1CA00

General Remark:

For all part Numbers of the 3WN6 circuit-breaker please refer to our main catalogue. There you will find all data which are necessary for the selection and ordering of the pieces of equipment.

Solid state overcurrent release
The overcurrent release can be replaced by equivalent versions or by versions with higher functionality. The power and measured values are supplied by the internal current transformers. With nominal rated current applied to the primary side, these current transformers always supply the same current on the secondary side. For this reason, the various versions of overcurrent releases with standard functions can (without the need for additional wiring) be replaced by another version with higher functionality. For this purpose, the control panel has to be removed and the overcurrent release and the connecting cable to the current transformers have to be detached.
An upgrade of overcurrent release of type V, B, C/G, D, E/F, H, J/K to type N or P is not possible,nor is a down grade of N or P to all other types.

To include the N-conductor or ground fault protection, there must be added a separate internal wiring.

After a release has been replaced, a function test using the test unit is recommended

Description (see section 2.8.2 "Function overview") Overcurrent release with LED tripped signal with test function	Protection function	Over-current release Version *)	Circuit-breaker Order No.: pos. 8. and 10. for the 3-pole Breaker	4-pole Breaker	Order No. Per 1 Item *4)
Basic function (Overload, Short-circuit)	azn	B	0 B	0 B	3WX36 41-0JB00
with N-conductor and earth fault protection	aznNg	C	0 C	*2)	3WX36 41-0JC00
with N-conductor protection and current display	aznN	D	1 D	1 D	3WX36 41-1JD00
with N-conductor and earth fault protection and current display	aznNg	E	1 E	*2)	3WX36 41-1JE00
with N-conductor and earth fault protection and current display	aznNg	F	*3)	1 F	3WX36 41-0JF00
with N-conductor and earth fault protection	aznNg	G	*3)	0 G	3WX36 41-0JC00
with N-conductor protection adjustable by using the manual operating device	aznN	H	0 H	0 H	3WX36 41-0JH00
with N-conductor and earth fault protection adjustable by using the manual operating device	aznNg	J	0 J	*2)	3WX36 41-0JJ00
with N-conductor and earth fault protection adjustable by using the manual operating device	aznNg	K	*3)	0 K	3WX36 41-0JJ00
Basic function - Short-circuit protection, only	zn	V	0 V	0 V	3WX36 41-0JV00

*) For upgrading a circuit-breaker from version "B" and "V" to a release with other functions, an additional adapter plug (3WX3646-4JA00) is required for circuit-breakers that were manufactured before 11/95 (Ident-No. 315 111 600),

*2) Only for 3-pole circuit-breakers (version "C" ("E", "J") has the same functions as version "G" ("F", "K"))

*3) Only for 4-pole circuit-breaker (version "F" ("G", "K") has the same functions as version "E" ("C", "J"))

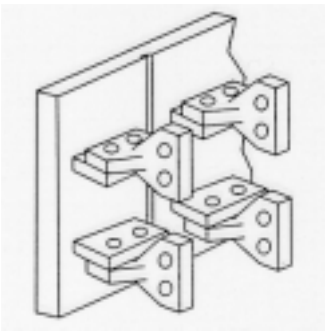
*4) With your order please give us the detailed order number and the nominal current of the current transformer of the 3WN6 which will be up- or downgraded

Internal current transformer for the main and N-conductor paths

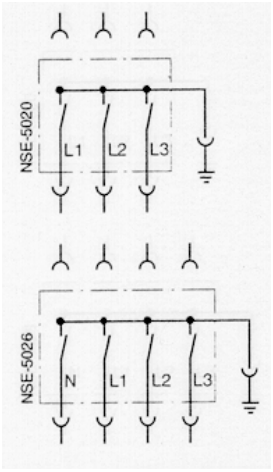
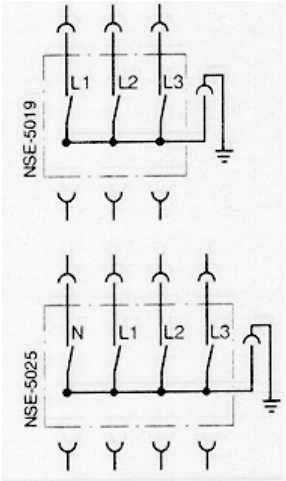
(for replacement and spare parts)

For the overcurrent release versions
B, C, D, E, F, G, H, J, K, V

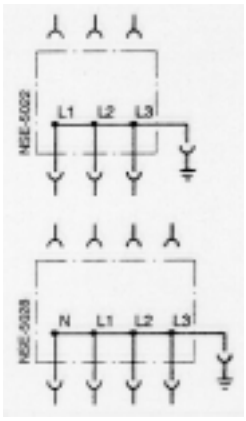
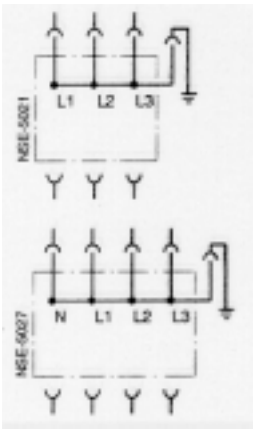
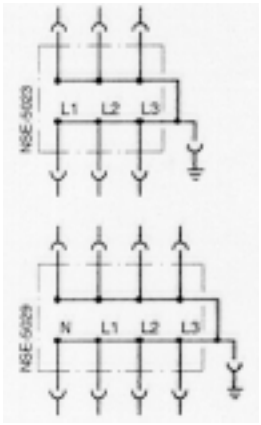
Current transformer	Circuit-breaker size		Quantity required	Order No.
Primary rated current	3-pole	4-pole	per circuit-breaker	Per 1 set
315 A	I	I	1 Set = 1 Item	3WX36 42-2CA00
	I	-	1 Set = 3 Items	3WX36 42-2CA10
	-	I	1 Set = 4 Items	3WX36 42-2CA20
400 A	I	I	1 Set = 1 Item	3WX36 42-2CB00
	I	-	1 Set = 3 Items	3WX36 42-2CB10
	-	I	1 Set = 4 Items	3WX36 42-2CB20
500 A	I	I	1 Set = 1 Item	3WX36 42-2CC00
	I	-	1 Set = 3 Items	3WX36 42-2CC10
	-	I	1 Set = 4 Items	3WX36 42-2CC20
630 A	I	I	1 Set = 1 Item	3WX36 42-2CD00
	I	-	1 Set = 3 Items	3WX36 42-2CD10
	-	I	1 Set = 4 Items	3WX36 42-2CD20
800 A	I	I	1 Set = 1 Item	3WX36 42-2CE00
	I	-	1 Set = 3 Items	3WX36 42-2CE10
	-	I	1 Set = 4 Items	3WX36 42-2CE20
1000 A	I	I	1 Set = 1 Item	3WX36 42-2CF00
	I	-	1 Set = 3 Items	3WX36 42-2CF10
	-	I	1 Set = 4 Items	3WX36 42-2CF20
1250 A	I	I	1 Set = 1 Item	3WX36 42-2CG00
	I	-	1 Set = 3 Items	3WX36 42-2CG10
	-	I	1 Set = 4 Items	3WX36 42-2CG20
1600 A	I	I	1 Set = 1 Item	3WX36 42-2CH00
	I	-	1 Set = 3 Items	3WX36 42-2CH10
	-	I	1 Set = 4 Items	3WX36 42-2CH20
630 A	II	II	1 Set = 1 Item	3WX36 42-2FD00
	II	-	1 Set = 3 Items	3WX36 42-2FD10
	-	II	1 Set = 4 Items	3WX36 42-2FD20
1250 A	II	II	1 Set = 1 Item	3WX36 42-2FG00
	II	-	1 Set = 3 Items	3WX36 42-2FG10
	-	II	1 Set = 4 Items	3WX36 42-2FG20
1600 A	II	II	1 Set = 1 Item	3WX36 42-2FH00
	II	-	1 Set = 3 Items	3WX36 42-2FH10
	-	II	1 Set = 4 Items	3WX36 42-2FH20
2000 A	II	II	1 Set = 1 Item	3WX36 42-2FJ00
	II	-	1 Set = 3 Items	3WX36 42-2FJ10
	-	II	1 Set = 4 Items	3WX36 42-2FJ20
2500 A	II	II	1 Set = 1 Item	3WX36 42-2FK00
	II	-	1 Set = 3 Items	3WX36 42-2FK10
	-	II	1 Set = 4 Items	3WX36 42-2FK20
3200 A	II	II	1 Set = 1 Item	3WX36 42-2FM00
	II	-	1 Set = 3 Items	3WX36 42-2FM10
	-	II	1 Set = 4 Items	3WX36 42-2FM20

For fixed mounted circuit-breaker					
Connecting bars for vertical main connections at the rear side	Rated current I_N	Size	Number of poles	Quantity required per circuit-breaker	Order No. Per 1 set
	up to 1000 A	I	3-pole	1 Set = 3 Items	3WX36 21-7AA00
		I	4-pole	1 Set = 4 Items	3WX36 21-7AB00
	1250 A, 1600 A	I	3-pole	1 Set = 3 Items	3WX36 21-7BA00
			4-pole	1 Set = 4 Items	3WX36 21-7BB00
	2000 A	II	3-pole	1 Set = 3 Items	3WX36 21-7DA00
			4-pole	1 Set = 4 Items	3WX36 21-7DB00
	2500 A, 3200 A	II	3-pole	1 Set = 3 Items	3WX36 21-7FA00
			4-pole	1 Set = 4 Items	3WX36 21-7FB00

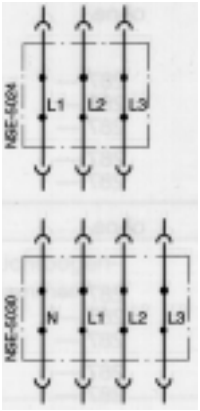
Short-circuit and earthing drawers (see also our main catalogue)

Selection and ordering data					
	Version			Size	Order No. (Order No. supplement see main catalogue)
	Lower main path is bridged and earthed Incoming from top	3-pole	up to 1000 A	I	3WN6 271-0VA..-....
			up to 1250/1600 A	I	3WN6 471-0VA..-....
			up to 2000 A	II	3WN6 571-0VA..-....
			up to 2500 A	II	3WN6 671-0VA..-....
			up to 3200 A	II	3WN6 771-0VA..-....
		4-pole	up to 1000 A	I	3WN6 273-0VA..-....
			up to 1250/1600 A	I	3WN6 473-0VA..-....
			up to 2000 A	II	3WN6 573-0VA..-....
			up to 2500 A	II	3WN6 673-0VA..-....
			up to 3200 A	II	3WN6 773-0VA..-....
	Upper main paths is bridged and earthed Incoming from bottom	3-pole	up to 1000 A	I	3WN6 271-0UA..-....
			up to 1250/1600 A	I	3WN6 471-0UA..-....
			up to 2000 A	II	3WN6 571-0UA..-....
			up to 2500 A	II	3WN6 671-0UA..-....
			up to 3200 A	II	3WN6 771-0UA..-....
		4-pole	up to 1000 A	I	3WN6 273-0UA..-....
			up to 1250/1600 A	I	3WN6 473-0UA..-....
			up to 2000 A	II	3WN6 573-0UA..-....
			up to 2500 A	II	3WN6 673-0UA..-....
			up to 3200 A	II	3WN6 773-0UA..-....

Short-circuit and earthing drawers

Selection and ordering data					
	Version			Size	Order-No.
	Lower main paths is briged and earthed Incoming from top	3-pole	up to 1000 A	I	3WX36 87-1AA00..-....
			up to 1250/1600 A	I	3WX36 87-1BA00..-....
			up to 2000 A	II	3WX36 87-1DA00..-....
			up to 2500 A	II	3WX36 87-1EA00..-....
			up to 3200 A	II	3WX36 87-1FA00..-....
		4-pole	up to 1000 A	I	3WX36 87-1AB00..-....
			up to 1250/1600 A	I	3WX36 87-1BB00..-....
			up to 2000 A	II	3WX36 87-1DB00..-....
			up to 2500 A	II	3WX36 87-1EB00..-....
			up to 3200 A	II	3WX36 87-1FB00..-....
	Upper main paths is bridged and earthed Incoming from bottom	3-pole	up to 1000 A	I	3WX36 87-0AA00..-....
			up to 1250/1600 A	I	3WX36 87-0BA00..-....
			up to 2000 A	II	3WX36 87-0DA00..-....
			up to 2500 A	II	3WX36 87-0EA00..-....
			up to 3200 A	II	3WX36 87-0FA00..-....
		4-pole	up to 1000 A	I	3WX36 87-0AB00..-....
			up to 1250/1600 A	I	3WX36 87-0BB00..-....
			up to 2000 A	II	3WX36 87-0DB00..-....
			up to 2500 A	II	3WX36 87-0EB00..-....
			up to 3200 A	II	3WX36 87-0FB00..-....
	Upper and Lower main paths is bridged and earthed	3-pole	up to 1000 A	I	3WX36 87-2AA00..-....
			up to 1250/1600 A	I	3WX36 87-2BA00..-....
			up to 2000 A	II	3WX36 87-2DA00..-....
			up to 2500 A	II	3WX36 87-2EA00..-....
			up to 3200 A	II	3WX36 87-2FA00..-....
		4-pole	up to 1000 A	I	3WX36 87-2AB00..-....
			up to 1250/1600 A	I	3WX36 87-2BB00..-....
			up to 2000 A	II	3WX36 87-2DB00..-....
			up to 2500 A	II	3WX36 87-2EB00..-....
			up to 3200 A	II	3WX36 87-2FB00..-....

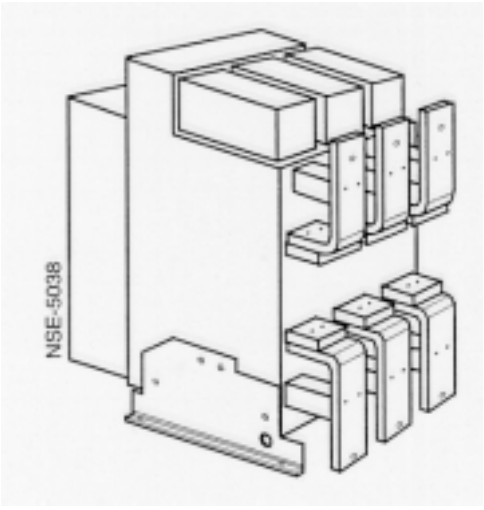
Bridging drawers

Selection and ordering data				
	Version		Size	Order-No.
	Incoming and outgoing sides are connected through	3-pole up to 1000 A	I	3WX36 85-0AA00..-....
		up to 1250/1600 A	I	3WX36 85-0BA00..-....
		up to 2000 A	II	3WX36 85-0DA00..-....
		up to 2500 A	II	3WX36 85-0EA00..-....
		up to 3200 A	II	3WX36 85-0FA00..-....
		4-pole up to 1000 A	I	3WX36 85-0AB00..-....
		up to 1250/1600 A	I	3WX36 85-0BB00..-....
		up to 2000 A	II	3WX36 85-0DB00..-....
		up to 2500 A	II	3WX36 85-0EB00..-....
		up to 3200 A	II	3WX36 85-0FB00..-....

7.5. Adapter for replacing 3WN5 by 3WN6

The 3-pole fixed mounted 3WN6 circuit-breaker in size I (up to 1600 A) can be ordered with fitted adaptation components to allow mounting in place of the 3WN5.

The mounting and fixing dimensions for the 3WN6 fitted with the adapter conform to those of the 3WN5. The cut-out in the door must be adapted to suit the cut-out required for the control panel of the 3WN6.



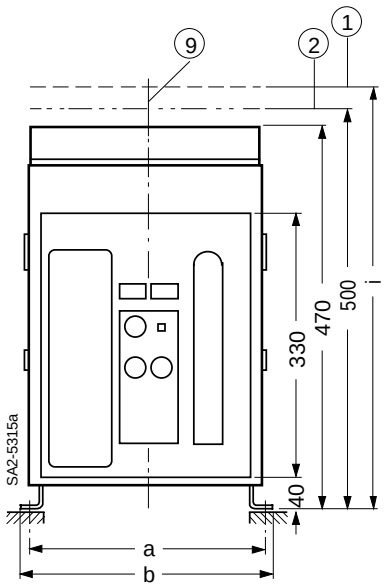
Conversion table

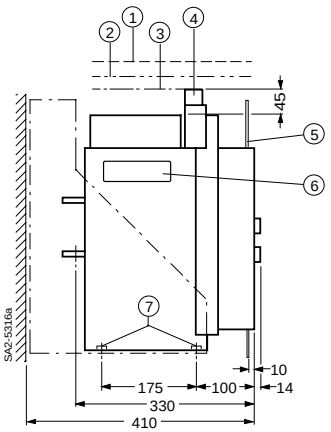
Rated current I_n	Circuit-breaker 3WN5 (superseded)	Circuit-breaker 3WN6 with adapter components to replace 3WN5
630 A	3WN5 031-.....-....	3WN6 031-.....-....-Z Z = B02
800 A	3WN5 131-.....-....	3WN6 131-.....-....-Z Z = B02
1000 A	3WN5 231-.....-....	3WN6 231-.....-....-Z Z = B02
1250 A (3WN5; BG I/1)	3WN5 231-.....-....	3WN6 331-.....-....-Z Z = B02
1250 A (3WN5; BG I/2)	3WN5 331-.....-....	3WN6 331-.....-....-Z Z = B02
1600 A	3WN5 431-.....-....	3WN6 431-.....-....-Z Z = B02

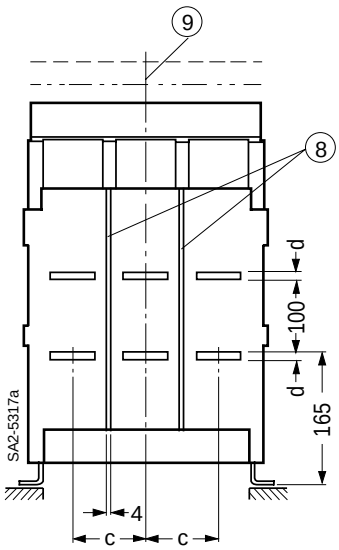
8. Dimension Drawings

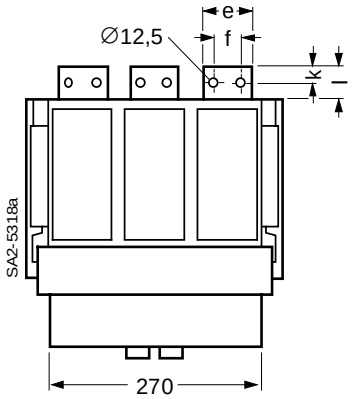
3WN6 fixed-mounted circuit-breakers, 3-pole

Horizontal connection

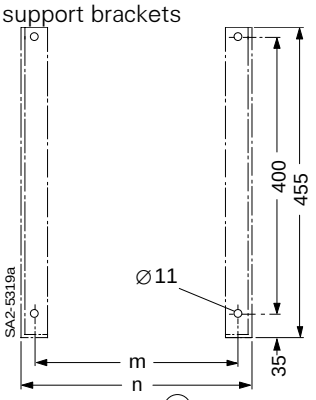






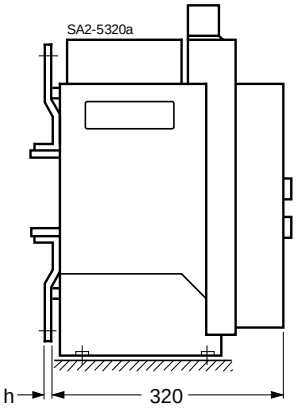


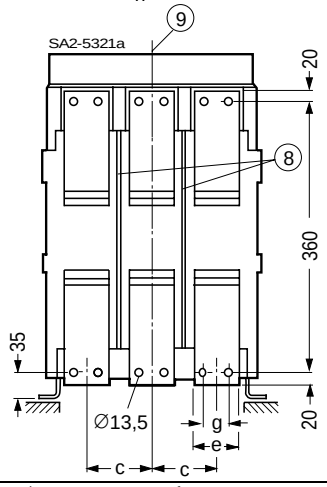
Mounting holes for the support brackets

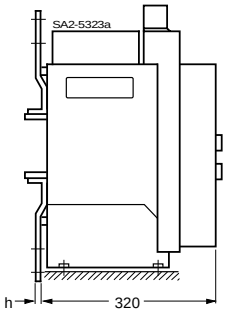


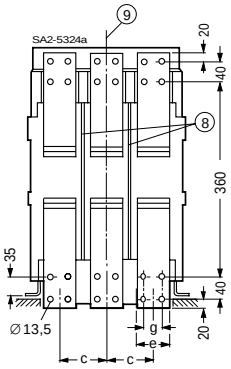
1.) Clearance for removing of the arc chute
2.) Clearance for auxiliary connector
3.) Arcing space
4.) Auxiliary connector
5.) Cubicle door
6.) Recessed grip
7.) M8 Nut
8.) Slots (4 mm deep) for phase separating barriers; (not included in the scope of supply)
9.) Axis of the circuit-breaker

Front connection









Double hole Holes in bar ends acc. to DIN 43 673

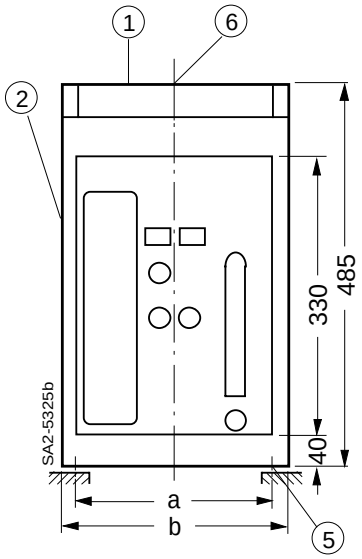
Rated current A	a	b	c	d	e	f	g	h	j	k	l	m	n
630 to 1000	300	320	90	8	60	30	-	8	530	18	40	300	338
1250 to 1600	300	320	90	15	60	30	-	20	530	18	40	300	338
2000	400	420	120	15	80	40	40	20	560	22	44	400	438
2500 to 3200	400	420	120	30	80	40	40	20	560	22	44	400	438

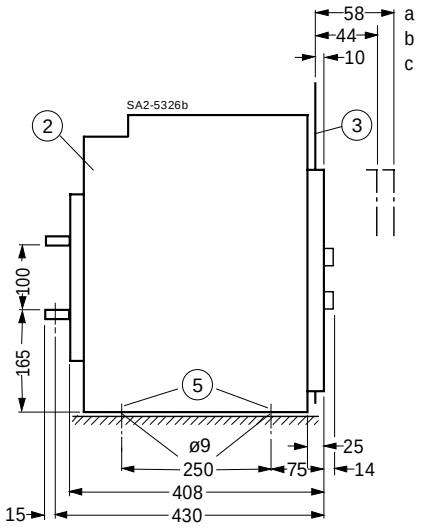
Main conductor connections		
Terminal screws with clamping washers (inner diameter = 12 mm acc. DIN 6769-Fst		M 12
Recommended tightening torque	Nm	70
Required screw strength		8.8 acc. DIN 267

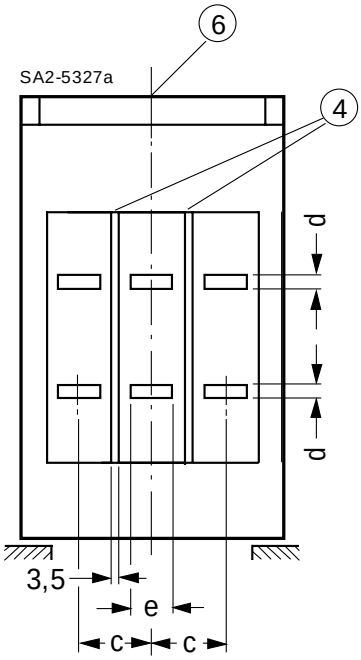
For safety clearances, see section 4.3

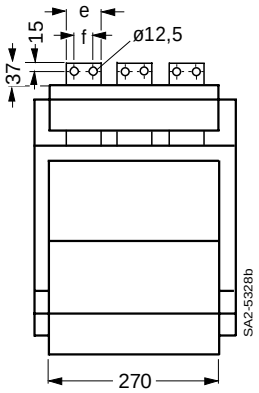
3WN6 draw out circuit-breakers, 3-pole

Horizontal connection





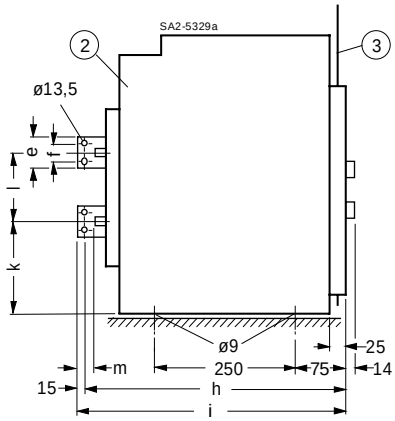


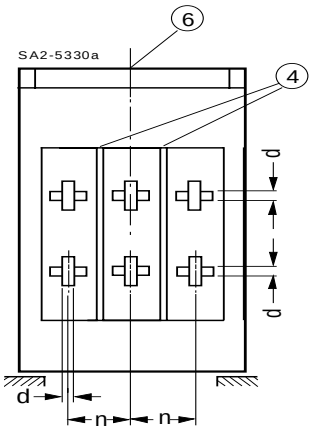


a Disconnected position
b Test position
c Connected position
1.) Auxiliary wiring connection system
2.) Guide frame
3.) Cubicle door
4.) Slots (6 mm deep), for phase separating barriers (not included in the scope of suply)
5.) Holes for fixing screws (for the draw out-frame)
6.) Axis of the circuit-breaker

For safety clearances, see section 4.3

Vertical connection

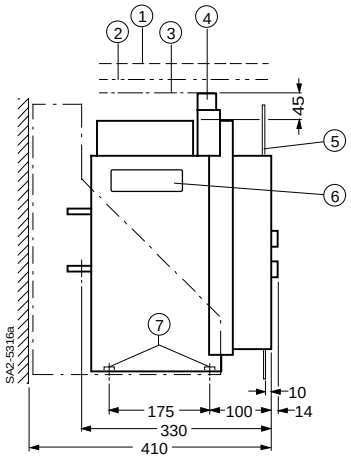


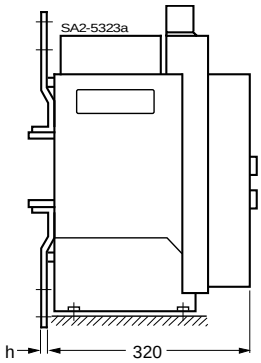


Rated current A	a	b	c	d	e	f	h	j	k	l	m	n
630 up to 1000	280	320	90	8	60	30	455	470	157,5	115	37	90
1250 up to 1600	280	320	90	15	60	30	455	470	157,5	115	37	90
2000	380	420	120	15	80	40	465	480	157,5	115	40	140
2500 up to 3200	380	420	120	30	100	40	465	480	150	130	40	140

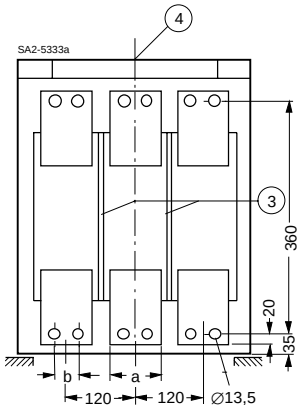
3WN6 draw out circuit-breakers, 3-pole

Front connection





Single hole, 630 to 1600 A

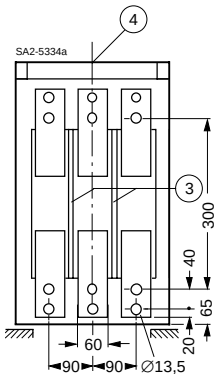


Single hole, 2000 to 3200 A

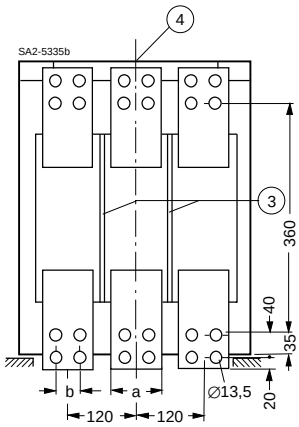
Rated current A	a	b	c	d	e
630 to 1000	60	-	8	390	408
1250 to 1600	60	-	15	390	408
2000	80	40	20	420	445
2500 to 3200	100	50	20	420	445

1.) Guide frame
2.) Cubicle door
3.) Slots (6 mm deep, 3,5 mm wide), for phase separating barriers,)not included in the scope of supply)
4.) Axis of the circuit-breaker

Safety clearances, see section 4.3



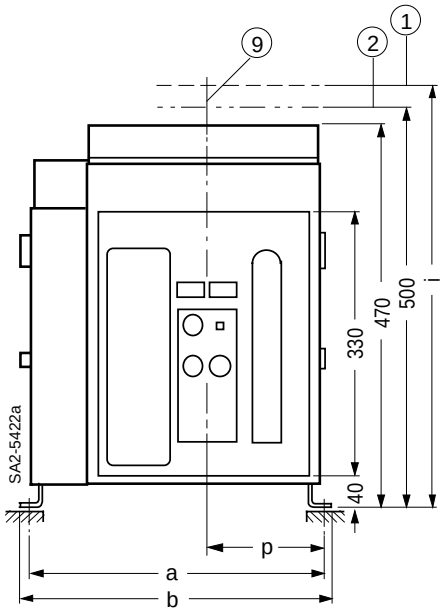
Double hole, 630 to 1600 A
Holes in bar ends acc. DIN 43 673

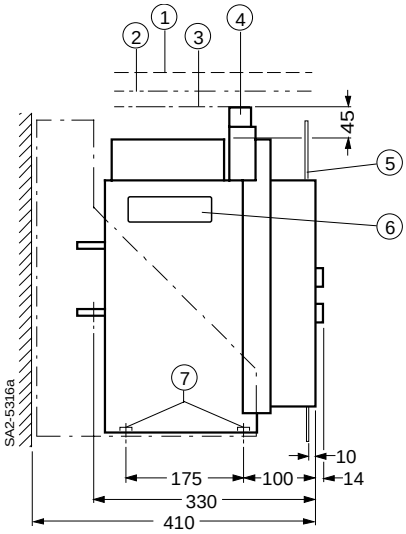


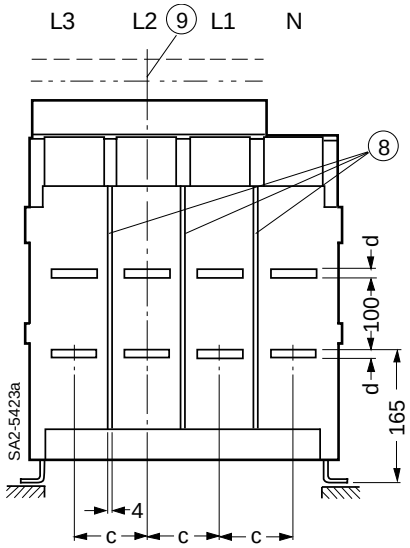
Double hole, 2000 to 3200 A
Holes in bar ends acc. DIN 43 673

3WN6 fixed mounted circuit-breakers, 4-pole

Horizontal connection



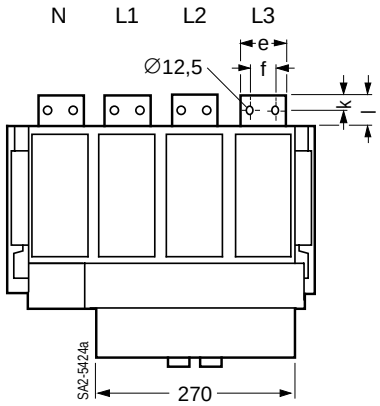


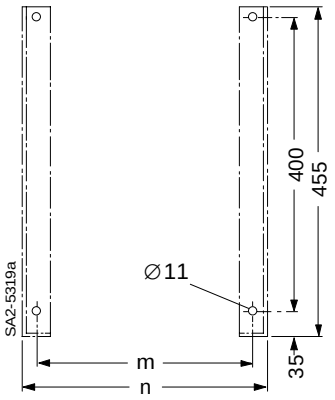


Mounting holes for the support brackets

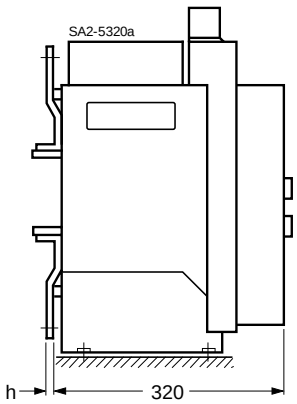
1.) Clearance for removing the arc chute
2.) Clearance for auxiliary connector
3.) Arcing space
4.) Auxiliary connector
5.) Cubicle door
6.) Recessed grip
7.) Nut M 8
8.) Slots (4 mm deep), for phase separating barriers, (not included in the scope of supply)
9.) Axis of the operating panel

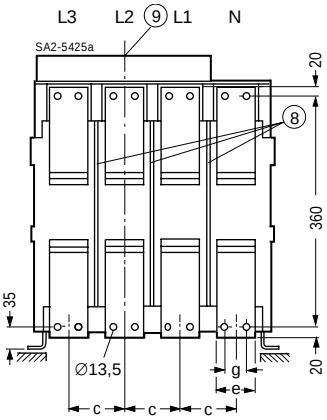
Safety clearances, see section 4.3

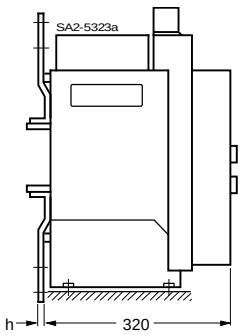




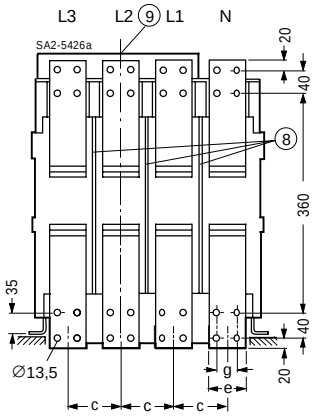
Front connection







Holes double hole in bar



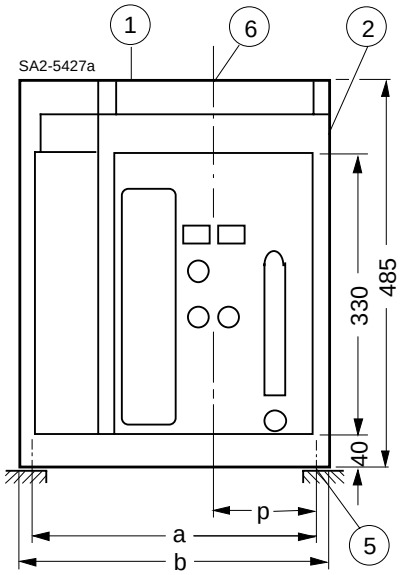
ends acc. to DIN 43 673

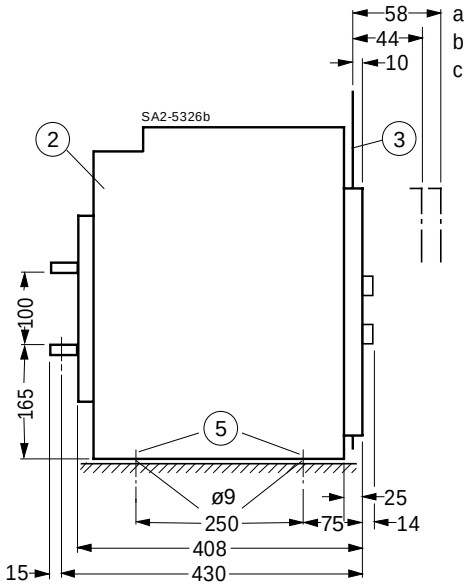
Single hole

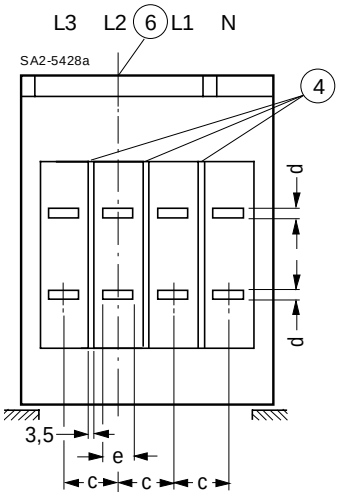
Rated current A	a	b	c	d	e	f	g	h	j	k	l	m	n	p
630 to 1000	390	410	90	8	60	30	-	8	530	18	40	390	428	150
1250 to 1600	390	410	90	15	60	30	-	15	530	18	40	390	428	150
2000	520	540	120	15	80	40	40	20	560	22	44	520	558	200
2500 to 3200	520	540	120	30	80	40	40	20	560	22	44	520	558	200

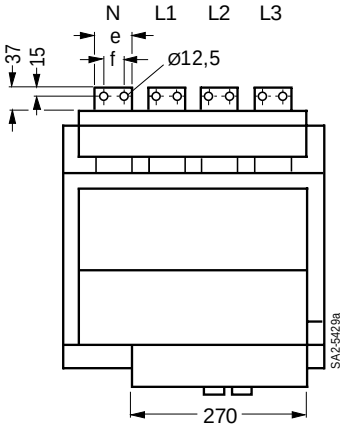
3WN6 draw out circuit-breakers, 4-pole

Horizontal connection





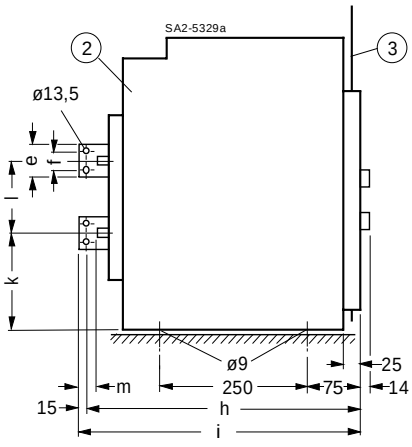


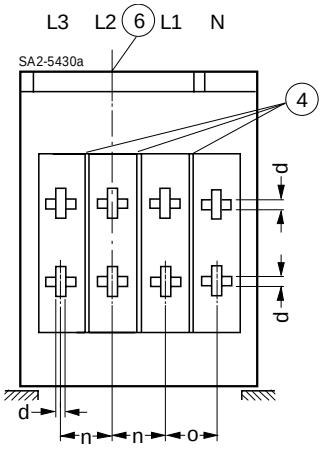


a Disconnected position
b Test position
c Connected position
1.) Auxiliary wiring connection system
2.) Guide frame
3.) Cubicle door
4.) Slots (6 mm deep), for phase separating barriers, (not included in the scope of supply
5.) Holes for fixing screws
6.) Axis of the operating panel

Safety clearances, see section 4.3

Vertical connection

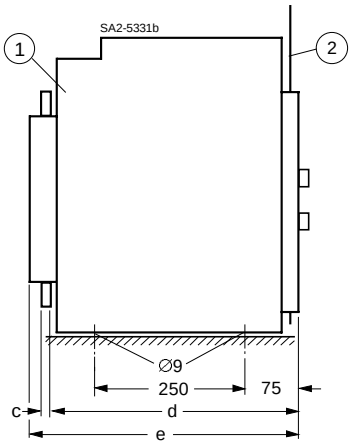


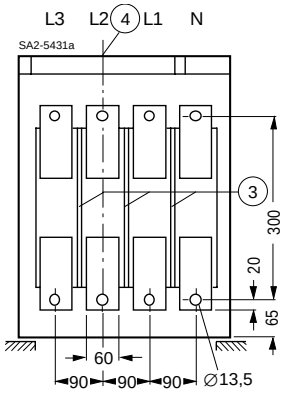


Rated current A															
630	to	1000	370	410	90	8	60	30	455	470	157,5	115	37	90	90	140
1250	to	1600	370	410	90	15	60	30	455	470	157,5	115	37	90	90	140
2000			500	540	120	15	80	40	465	480	157,5	115	40	140	120	190
2500 to 3200			500	540	120	30	100	40	465	480	150	130	40	140	120	190

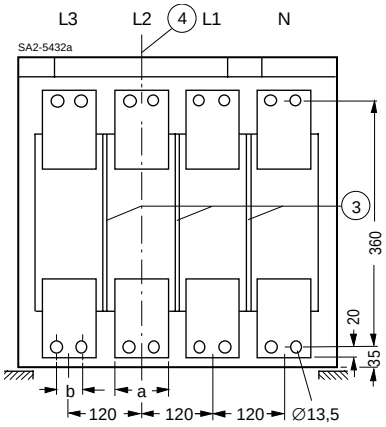
3WN6 draw out circuit-breakers, 4-pole

Front connection

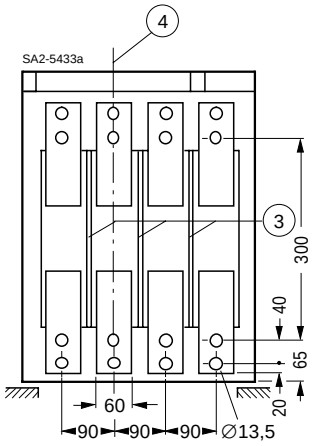




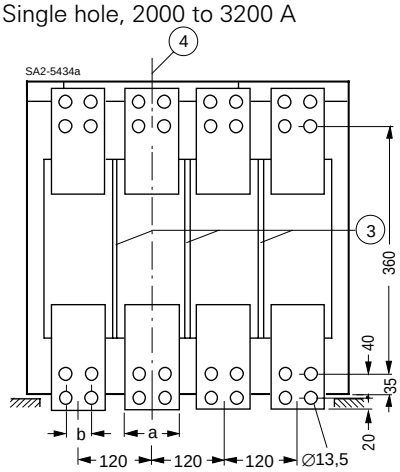
Single hole, 630 to 1600 A



Single hole, 2000 to 3200 A



Double hole, 630 to 1600 A
Holes in bar ends acc. DIN 43 673



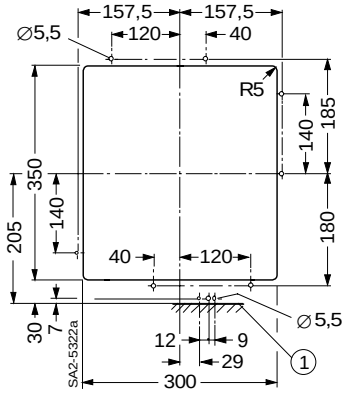
Double hole, 2000 to 3200 A
Holes in bar ends acc. DIN 43 673

Rated current A			b	c	d	e
630	to	1000	60	-	8	390	408
1250	to	1600	60	-	15	390	408
2000			80	40	20	420	445
2500 to 3200			100	50	20	420	445

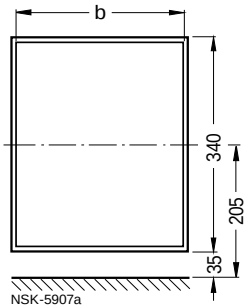
1.) Guide frame
2.) Cubicle door
3.) Slots (6 mm deep, 3,5 mm wide), for phase separating barriers, (not scope of supply(
4.) Axis of the circuit-breaker
Safety clearances, see section 4.3

Circuit-breaker 3WN6, 3- and 4-pole

Door cut out for control panel with use of a sealing frame



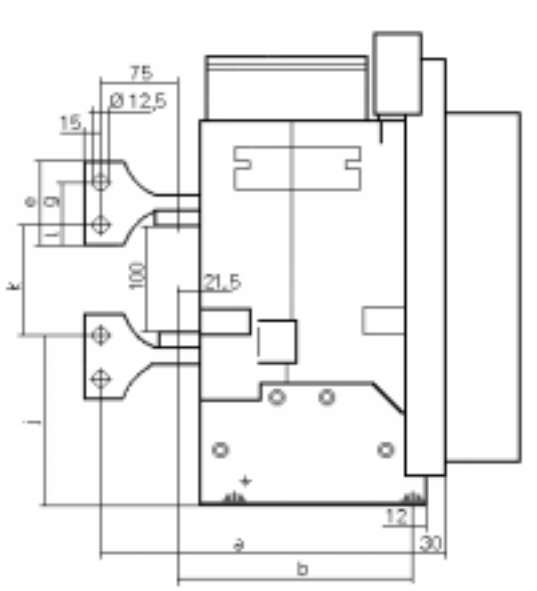
Door cut out with edge protection. Shown after mounting the edge protection

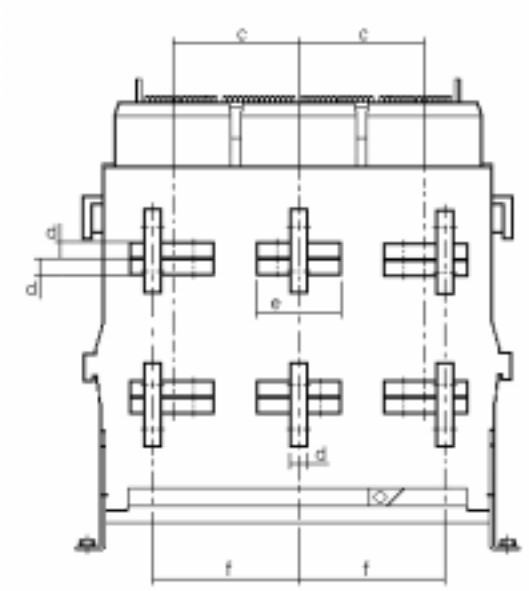


Cut out for mounting the circuit breaker in a cubicle, concentric

Width	fixed type b	draw-out b
400	275	292
500	275	290
600	275	288

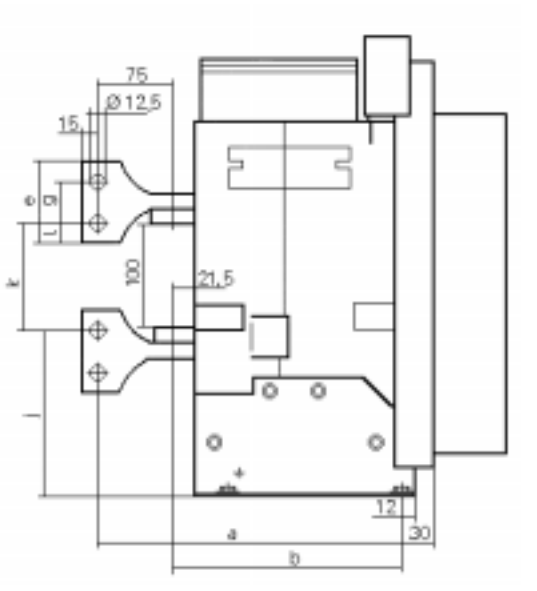
3WN6 fixed mounted circu
it-breaker, 3-pole, vertical connections (accessories)

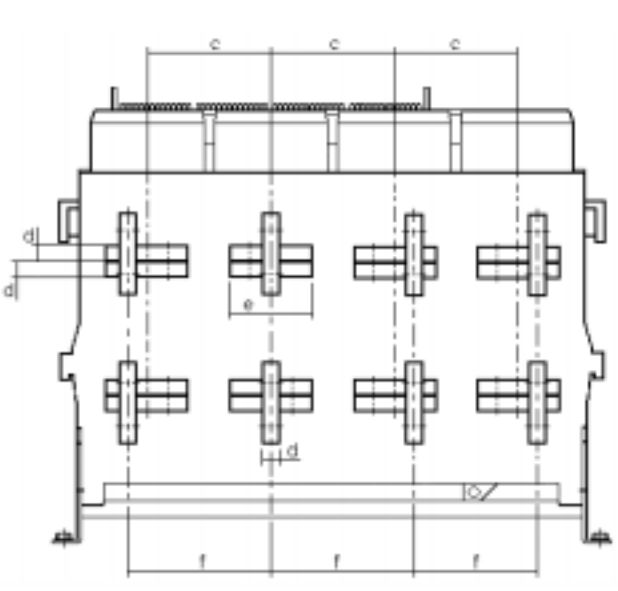




Rated current A	a	b	c	d	e	f	g	j	k	l
630 to 1000	295	230	90	8	60	90	30	164,5	101	15
1250 to 1600	292	230	90	15	60	90	30	157,5	115	15
2000	305	230	120	15	80	140	40	162,5	105	20
2500 to 3200	305	230	120	30	100	140	40	145	140	25

3WN6 fixed mounted circuit-breaker, 4-pole, vertical connections (accessories)



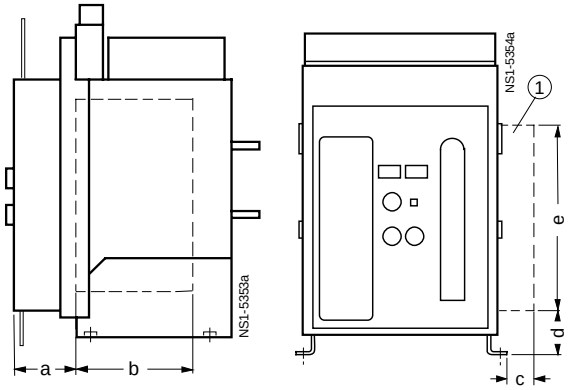


Rated current A	a	b	c	d	e	f	g	j	k	l
630 to 1000	295	230	90	8	60	90	-	164,5	101	15
1250 to 1600	292	230	90	15	60	90	-	157,5	115	15
2000	305	230	120	15	80	140	40	162,5	105	20
2500 to 3200	305	230	120	30	100	140	40	145	140	25

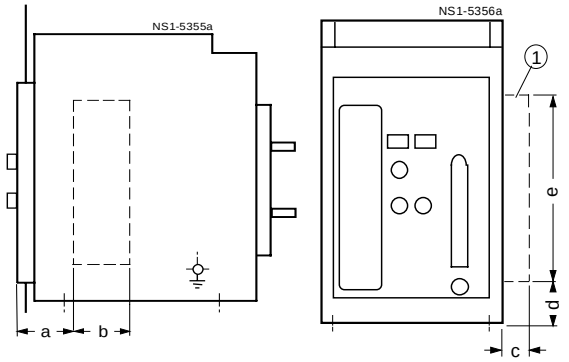
Accessories for the 3WN6 circuit-breakers, 3-pole and 4-pole

Mutual mechanical interlocking (1) / Locking device against closing (2) comprising lock in the cubicle door and interlocking module with Bowden cable

for fixed mounted circuit breaker



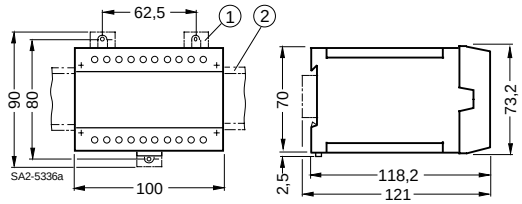
for draw out circuit-breaker



1.) Space for interlocking module (without Bowden wire)

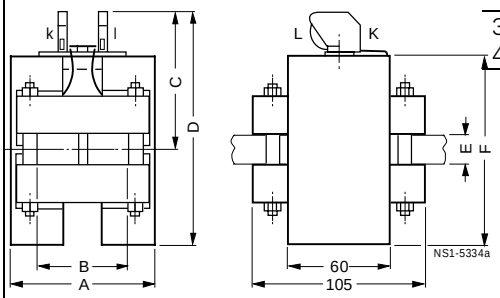
Space for	a	b	c	d	e
(1)	90	90	50	65	270
(2)	58	215	10	250	115

3WX31 56-1J.01 storage device for shunt release



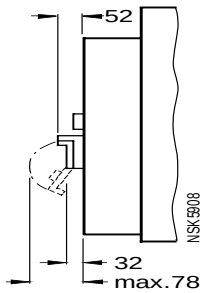
1.) Mounting feet
2.) Standard mounting rail acc. to DIN EN 50 022-35

Current transformer for overload protection in the N-conductor and for the earth-fault protection for sizes I and II



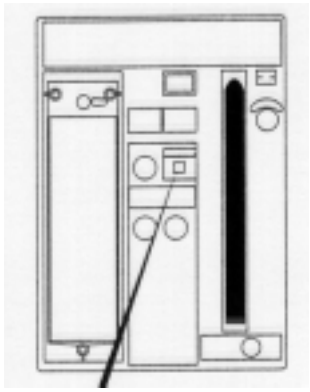
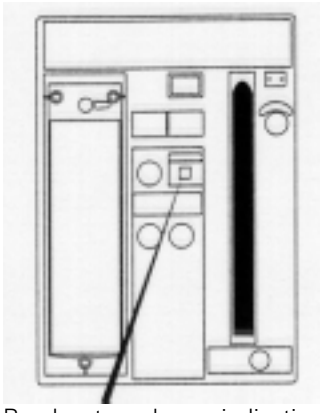
3WX36 43-1..00

Current transformer	Current transformer primary rated current I_N	Size	A	B	C	D	E	F
3WX36 43-1. . 00	A		approx.					
CA	315	I	92	60	86,5	140	5 to 15	107
CB	400							
CC	500							
CD	630							
CE	800							
CF	1000							
CG	1250							
CH	1600							
FJ	2000	II	128	80	99	167	5 to 35	136
FK	2500							
FM	3200							



Locking device for "electrical ON" and "mechanical OFF" push buttons

9. Troubleshooting

Fixed mounted circuit-breaker	Draw-out circuit-breaker	Fault	Cause	Correction
X	X	Circuit-breaker cannot be closed mechanically and/or electrically	1. Energy store not charged	Charge the energy store
X	X	(circuit-breaker is not ready to close, ready to close indication shows ☐	2. Undervoltage release not energised	Apply voltage to the undervoltage release
X	X		3. Mechanical reclosing lockout active	Correct cause of overcurrent tripping and press RESET
X	X		4. Electrical closing lockout active	Remove control voltage for closing interlock *)
X	X		5. Mechanical OFF push button is locked	Release push button *)
X	X		6. Interlock against closing when cubicle door is open activated (accessory)	Close cubicle door
X	X		7. Mutual mechanical interlock active (accessory)	Switch off second circuit-breaker or crank it into the disconnected position *)
X	X	Ready to close indication displays ☐	8. Solid-state overcurrent release missing or incorrectly installed	Install the overcurrent release correctly
	X		9. Circuit-breaker is located in intermediate position in the guide frame	Crank the circuit-breaker into the disconnected, test connected position
	X		10. Closing slide for crank hole is not closed	Close slide
X	X	Circuit-breaker cannot be closed electrically (circuit-breaker is ready to close, ready to close indication shows OK)	1. Operational voltage for the closing solenoid is incorrect or not applied	Check and apply the correct voltage
			2. Circuit-breaker is in the disconnected position in the guide frame	Crank the circuit-breaker into the test or connected position
		Ready to close indication displays OK		

*) Important - This is a safety device! Only release after checking that the operation is permitted under the present conditions.

Fixed mounted circuit-breaker	Draw-out circuit-breaker	Fault	Cause	Correction
	X	Guide rails cannot be pulled out for inserting the circuit-breaker	1. Shutter is locked with one or more padlocks	Remove padlocks
	X	Circuit-breaker cannot be moved from the maintenance position to the disconnected position	1. The crank mechanism for the circuit-breaker is not in the disconnected position (check position indication)	Crank cranking mechanism into the disconnected position
	X		2. An attempt is being made to slide the circuit-breaker into a guide frame with differently rated current	Only insert a circuit-breaker with the same rated current as the guide frame
	X		3. Coding of the circuit-breaker does not correspond to that of the guide frame	Check which circuit-breaker does correspond
	X	On cranking from the disconnected position to the test position, considerable resistance is felt immediately after leaving the disconnected position	1. The circuit-breaker has not been pushed in as far as to the stop. The latches on the side have not yet latched	Crank back to disconnected position, slide the circuit-breaker as far as to the stop in the disconnected position. The latches on the side must be latched in place
	X	On cranking from the disconnected position to the test position, the circuit-breaker does not move during the first 8 revolutions	1. No fault	Continue cranking
	X	The crank handle can not be mounted on the spindle for cranking	1. Crank hole is not open	Hold OFF pushbutton down while moving the slide to the right
	X		2. Cubicle door is not closed correctly	Close cubicle door
	X		3. Crank hole is locked with padlock(s)	Remove padlock(s) *)
X		Cubicle door will not open	1. Cubicle door locked due to the closed circuit-breaker	Switch OFF circuit-breaker
	X		2. Circuit-breaker is in the connected position in case door locking has been used.	Crank circuit-breaker into the test or disconnected position
	X	Crank hole cannot be opened	1. OFF push button is not being pressed	Hold OFF pushbutton down while moving the slide to the right

*) Important - This is a safety device! Only release after checking that the operation is permitted under the present conditions.

10. Form for adjustment of the overcurrent release

Breaker-no:

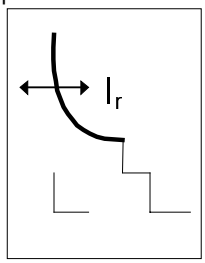
Adjustment of the overcurrent release

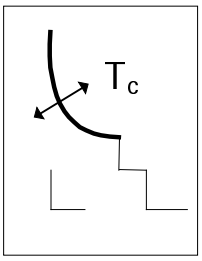
Breaker: 3WN6 ..-☐ ☐ ..-.... ;trip unit version:(10th digit of order-no.): ☐ (B...V)

c.t. rating current: ☐ A = I_N 3WN6 - -

9th digit of order-no.: A=315 A, B= 400 A, C= 500 A, D= 630 A, E= 800 A, F= 1000 A, G= 1250 A, H= 1600 A, J= 2000 A, K= 2500 A, M= 3200 A

Overload protection





Inverse-time overload release "a" for phases

setting current I_r = ☐ A , I_r = ☐ x I_n (factor: 40 to 100%)

Time-lag class of the overload T_c = tripping time at 6 x I_r

	fixed setting 10 s
☐	

var.	adjustable in s									
	2	3.5	6	8	10	14	17	20	24	30
☐										

Thermal memory after tripping operations,
ON-OFF-switchable, trip unit version: N and P setting: ☐ ON ☐ OFF

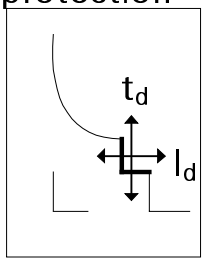
Phase failure sensitivity,
- at all trip unit types with setting t_d = 20 ms
- switching on, trip unit version: N, P. adjustment: ☐ ON ☐ OFF

Inverse-time overload release "a" for the N-conductor

adjustment I_N = ☐ % x I_r (factor: 50% / 100% or 20...100%)

☐ c.t. installed in the N conductor 3WX36

Short-circuit protection



Short-time-delayed short-circuit release "z"

Setting of response current I_d

1.25	1.5	2	3	4	5	6	8	10	12

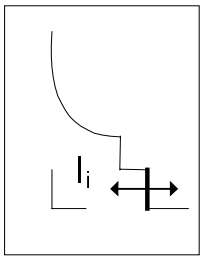
x I_r = ☐ A (value abs.)

Setting of delay time t_d

0	20	80	150	220	300	400	

ms

With I^2t-dependent delay (I^2t_d = constant),
adjustable at version: D, E, F .. N, P setting: ☐ ON ☐ OFF



Instantaneous short-circuit release "n"

Setting of response current I_i

1.5	2	3	4	5	6	8	10	12

x I_n = ☐ A (value abs.)

or ☐ ○○ = switched off (I_{cu} = I_{cs} = I_{cw})

Breaker-no.

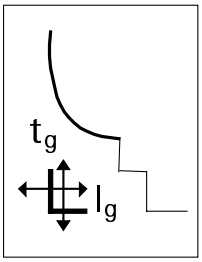
Adjustment of the earth-fault release

Breaker: 3WN6 ...-. ☐☐ ..-....; trip unit version. (10th digit of order no): ☐ (C, E to P)

c.t. rating current : ☐ A = I_N 3WN6 - -

9th digit order-no.: A=315 A, B= 400 A, C= 500 A, D= 630 A, E= 800 A, F= 1000 A, G= 1250 A, H= 1600 A, J= 2000 A, K= 2500 A, M= 3200 A

Earth-fault protection



Earth-fault release "g"

Setting of response current I_g

20 %	30 %	40 %	50 %	60 %

x I_n = ☐ A

Setting: ☐ c.t. installed in the N conductor

☐ c.t. installed at the earthed star point

Setting of delay time t_g

100	200	300	400	500	☐

ms

After the delay time is over alarm (LED) or tripping (Trip) occur; setting: ☐ Alarm ☐ Trip

I^2t-dependent delay (I^2t_d = constant), setting: ☐ ON ☐ OFF

Additional functions of the overcurrent release

(8th digit of the order-no.: 2, 3, 6, 7)
Optocoupler outputs for further signalling.

☐ µP-fault

☐ temperature > 85°C and ☐ phase imbalance

☐ leading signal of "a" tripping or load shedding

☐ load monitoring response value
I_{AW1} = ☐ A (50 to 150% x Ir)
t_{AW1} = ☐ s (1 to 15 s)

☐ Load shedding response value
I_{AW2} = ☐ A (50 to 150% x Ir)
$t_{AW2} = t_{AW1}$

☐ g-alarm

☐ ZSS "short-time grading control"

☐ with communication module

Schalter-Nr.:

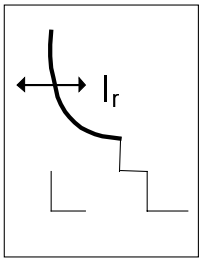
Einstellung des Überstromauslösers

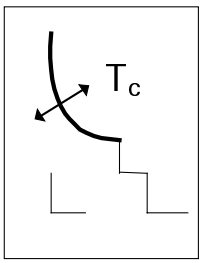
Schalter: 3WN6 ...-. ☐ ☐ ..-.... ; Auslöserausf. (10.Stelle Bestell. Nr.): ☐ (B...V)

Wandlernennstrom: ☐ A = I_N 3WN6 - -

9. Stelle Bestell-Nr.: A=315 A, B= 400 A, C= 500 A, D= 630 A, E= 800 A, F= 1000 A, G= 1250 A, H= 1600 A, J= 2000 A, K= 2500 A, M= 3200 A

Überlastschutz





Stromabhängig verzögerter Überlastauslöser "a" der Phasen

Einstellstom I_r = ☐ A , I_r = ☐ x I_N (Faktor: 40 ... 100%)

Trägheitsgrad der Überlastkennlinie T_c = Auslösezeit bei 6 x I_r

	fest eingestellt 10 s

bel.	einstellbar in s									
	2	3,5	6	8	10	14	17	20	24	30

Thermisches Gedächtnis nach Überlastauslösung, abschaltbar bei Auslöser: N und P. Einstellung: ☐ Ein ☐ Aus

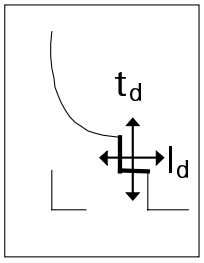
Phasenausfallempfindlichkeit,
- bei allen Auslösern mit Einstellung t_d = 20 ms
- zuschaltbar bei Auslöser: N, P. Einstellung: ☐ Ein ☐ Aus

Stromabhängig verzögerter Überlastauslöser "a" des N-Leiters

Einstellstrom I_N = ☐ % x I_r (Faktor: 50% / 100% oder 20...100%)

☐ Stromwandler im N-Leiter montiert 3WX36

Kurzschlußschutz



Kurzzeitverzögerter Kurzschlußauslöser "z"

Ansprechstrom I_d

1,25	1,5	2	3	4	5	6	8	10	12

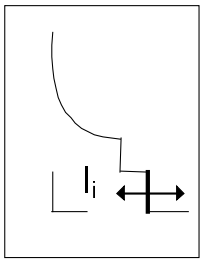
x Ir = ☐ Absolutwert A

Verzögerungszeit t_d

0	20	80	150	220	300	400	

ms

I^2t-abhängige Verzögerung (I^2t_d = konstant), anwählbar bei Auslöser: D, E, F .. N, P Einstellung: ☐ Ein ☐ Aus



Unverzögerter Kurzschlußauslöser "n"

Ansprechstrom I_i

1,5	2	3	4	5	6	8	10	12

x In = ☐ Absolutwert A

oder ☐ ∞ = abgeschaltet (I_{cu} = I_{cs} = I_{cw})

Schalter-Nr.:

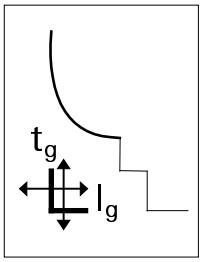
Einstellung des Erdschlußauslösers

Schalter: 3WN6 ..-.☐☐..-.... ; Auslöserausf. (10.Stelle Bestell. Nr.): ☐ (C, E bis P)

Wandlernennstrom: ☐ A = I_N 3WN6 - -

9. Stelle Bestell-Nr.: A=315 A, B= 400 A, C= 500 A, D= 630 A, E= 800 A, F= 1000 A, G= 1250 A, H= 1600 A, J= 2000 A, K= 2500 A, M= 3200 A

Erdschluß schutz



Erdschlußauslöser "g"

Ansprechstrom I_g

20 %	30 %	40 %	50 %	60 %

x In = ☐ A

Einstellung: ☐ Stromwandler im N-Leiter montiert oder

☐ Stromwandler im Sternpunkt des Trafos montiert

Verzögerungszeit t_g

100	200	300	400	500	

ms

Nach Ablauf der Verzögerungszeit erfolgt ein Alarm (LED) oder eine Auslösung (Trip); Einstellung: ☐ Alarm ☐ Trip

I^2t-abhängige Verzögerung (I^2t_d = konstant), Einstellung: ☐ Ein ☐ Aus

Zusatzfunktionen der Überstromauslöser

(8. Stelle der Bestell-Nr.: 2, 3, 6, 7)
Optokopplerausgänge werden umgesetzt und weiter verarbeitet.

☐ µP-Fehler

☐ Temperatur > 85°C und ☐ Phasenunsymmetrie

☐ voreilende Meld. Überlastauslösung oder Lastabwurf

☐ Lastüberwachung
Ansprechstrom I_{AW1} = ☐ A (50 bis 150% x I_r)
t_{AW1} = ☐ s (1 bis 15 s)

☐ Lastabwurf
Ansprechstrom I_{AW2} = ☐ A (50 bis 150% x I_r)
$t_{AW2} = t_{AW1}$

☐ g-Alarm

☐ ZSS „Zeitverkürzte Selektivitätssteuerung“

☐ mit Kommunikationsmodul

11. Operating instructions and planning tools

Item	Tongue	Order No.	Item	Tongue	Order No.
Circuit-breaker			General interlockings		
Circuit-breaker 3WN6 (fixed mounted and draw-out)	De-En	3ZX1812-0WN60-0AN0	Key switch "Mechanical OFF" Key switch "Mechanical ON"	De-En	3ZX1812-0WX36-4CN0
Guide frame 3WX36	De-En	3ZX1812-0WX36-0AN0	EMERGENCY STOP push button (mushroom head type)	De-En	3ZX1812-0WX36-8EN0
Overcurrent release					
Overcurrent release version B, V	De-En	3ZX1812-0WX36-7AN0	Mutual mechanical interlocking	De-En	3ZX1812-0WX36-5FN0
Overcurrent release version C/G	De-En	3ZX1812-0WX36-9EN1	Locking device for mechanical OFF	De-En	3ZX1812-0WX36-9CN0
Overcurrent release version D	De-En	3ZX1812-0WX36-8AN0	Sealing cap for mechanical and electrical ON/OFF pushbutton	De-En	3ZX1812-0WX36-3CN0
Test unit (except version N; P) 3WX3647-5 (also 3WN1, 3WS1)	De-En	3ZX1812-0WX36-1BN1	Operating cycles counter	De-En	3ZX1812-0WX36-8BN0
Handling			Accessories for fixed mounted version		
Unpacking and transportation	De-En-Fr-Es	3ZX1812-0WN60-0AA1	Support bracket for mounting the circuit-breaker	De-En-Fr-It-Sv	3ZX1812-0WX36-0AA0 (.....-.....-1AU0)
Removing draw-out circuit-breaker from the guide frame	De-En-Fr-It-Sv	3ZX1812-0WN60-1AA0	Door sealing frame	De-En	3ZX1812-0WX36-3AN0
Operating mechanism			Interlock against closing with	De-En-	3ZX1812-0WX36-
Motorised operating mechanism	De-En	3ZX1812-0WX36-9BN1	the cubicle door open	Fr-It	5AA0
Electrical accessories			Interlock against opening the	De-En-	3ZX1812-0WX36-
Shunt release (also electrical closing interlock) / closing solenoid	De-En	3ZX1812-0WX36-5BN0	cubicle door with the circuit-breaker closed	Fr-It	5AA0
Closing solenoid with pushbutton (electrical closing)	De-En	3ZX1812-0WX36-5EN0	Auxiliary connector (hand connector)	De-En	3ZX1812-0WX36-1CU0
Energy storage device for shunt release "fc"	De-En	3ZX1812-0WX31-4AN0	Connecting bars for the circuit-breaker	De-En	3ZX1812-0WX36-7AA0
Undervoltage release "r"	De-En	3ZX1812-0WX36-5EN0	Accessories for the draw-out version		
Auxiliary contacts	De-En	3ZX1812-0WX36-0CN0	Interlock against opening the cubicle door	De-En	3ZX1812-0WX36-0DN0
			Interlock against moving the circuit-breaker with the cubicle door open	De-En-Fr-Es-It-Sv	3ZX1812-0WX36-4AA0
Components subject to wear out			Mounting kit for cubicle door	De-En	3ZX1812-0WX36-6DN0
Replacing the arc chutes	De-En-Fr-Es	3ZX1812-0WX36-0AA0 .....-.....–4AU0	Auxiliary connector (draw-out connector)	De-En	3ZX1812-0WX36-2AA0
			Position signalling switches operated by the circuit-breaker	De-En	3ZX1812-0WX36-6AA0
			Door sealing frame	De-En	3ZX1812-0WX36-1AA0
			Coding device	De-En	3ZX1812-0WX36-6AN0
			Shutter 3WX31 84-3	De-En	SW9555
			Hand crank	De-En-Fr-Es-It-Sv	3ZX1812-0WX36-3AA0
			Connecting bars for the guide frame	De-En-Fr-Es	3ZX1812-0WX36-1CU0

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Brief explanation of technical terms

See Manual "Switching, Protection and Distribution in Low Voltage Networks".