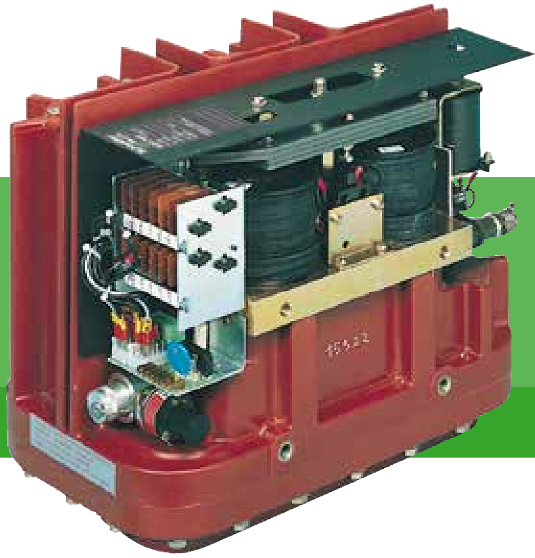
Catalogue 2016



Rollarc R400-R400D

SF6 Contactor up to 12 kV

Medium Voltage Distribution

Your requirements

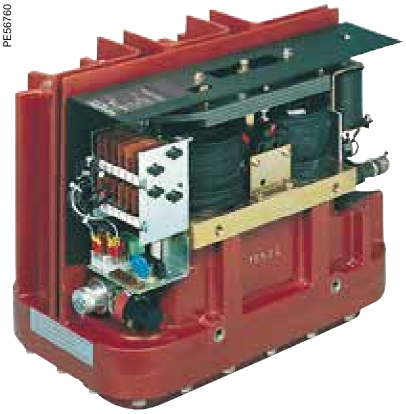
Continuity of service

Proven technology

Ease of installation

Our solution

PE56760



For over 45 years, Schneider Electric, leverages its experience to develop SF6 contactors and thus holds a unique know-how in various applications.

- Low level of SF6 pressure
- A safety membrane which, in very rare cases of an internal arc, will open in order to let the gas flow to the back of the circuit breaker
- Keeping at 0 bar of SF6:
  - The nominal performance
  - The capacity to break once at least 2,2 kA at 7.2 kV
  - The capacity to withstand at least 80 % of the insulating level
- Breaking all types of current without overvoltages

- Long experience of Schneider in manufacturing MV contactors in SF6 technology
- 70,000 Rollarc contactors installed with over 35 years of experience

- Compact dimensions
- Craddle version

PM104627

The advantages of a proven technology

A new path for achieving your electrical installations

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General Presentation

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The advantages of proven technology

Schneider Electric has developed a wide range of high performance and reliable devices operating faultlessly on all 5 continents.

Continuously increasing its performance, the company maintains a very high level of innovation in its offer.

Key Benefits

- No overvoltage during switching and breaking
- Field proven experience
- Continuous monitoring of the gas pressure inside pole

Safety

The breaking medium is sulfur hexafluoride (SF6) used at low pressure.
The insulating enclosure containing the contactor pole(s) is equipped with a safety membrane.
In addition, the rated characteristics, breaking the rated current under the rated voltage, are generally maintained at zero relative bars of SF6.

Reliability

Schneider Electric's mastery of design and the testing of sealed systems guarantees sustained device performance for at least 30 years.

Increased endurance

The mechanical and electrical endurance of Schneider Electric SF6 breaking devices are in conformity with the most demanding specifications recommended by the IEC.
These devices therefore meet requirements for even the most exposed of networks.

Environmentally-friendly

Schneider Electric devices have been designed to ensure protection of the environment:
- the materials used, both insulating and conductive, are identified and easy to separate and recycle,
- the SF6 gas is under control from production through to the contactor's end of life. In particular it can be recovered at the end of the contactor's life and re-used after treatment in line with the new European directive,
- an end of life manual for the product details procedures for dismantling and recycling components.

Quality Assurance

During production, each contactor undergoes systematic routine tests in order to check quality and conformity:
- pole sealing check
- checking the correct mechanical operation of the device, plus its associated locking mechanisms
- checking simultaneous closing of contacts
- checking power frequency insulation level
- checking main circuit resistance
- checking auxiliary circuit insulation
- measuring the switching times.

The results are recorded on the test certificate for each device which is initiated by the quality control department.

Certification

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The quality system for the design and production of Rollarc contactors is certified in conformity with ISO 9001: 2008 quality assurance standard requirements.

The environmental management system adopted by Schneider Electric production sites for the production of Rollarc contactors has been assessed and judged to be in conformity with requirements in standard ISO 14001.

Advantages of Rollarc

The Rollarc rotating arc contactor is a modern device with enhanced cooling of the arc by forced convection leading to the following advantages:

Long life

This results from:
- high product reliability
- very low wear of the active parts which require no maintenance
- the excellent sealing of the enclosure, eliminating the need for subsequent filling.

Mechanical endurance

The operating energy is reduced because arc rotation is directly created by the current to be interrupted.
Rollarc can withstand 300 000 operations for the R400 version and 100 000 operations for the R400D version.

Electrical endurance

The long life of the Rollarc is due to the negligible degeneration of the gas and to low wear of the contacts.
The energy dissipated in the arc is low due to:
- the intrinsic properties of the gas
- the short length of the arc
- the very short arcing time.

Wear of the arcing contacts can be checked without opening the poles. The unit is capable of breaking all load and short-circuit currents, even in the case of frequent operation. With very high breaking capacity for a contactor, the Rollarc can be used in a fuse-contactor assembly capable of protecting any circuit against all types of faults including overloads.

Low switching surges

The intrinsic properties of the gas and the soft break resulting from this technique means that switching surges are very low.
Concerning motor start-up, the unit is free from multiple prestrike and restrike phenomena which could damage the winding insulation.

Operating safety

The Rollarc contactor operates at a low relative pressure of 0,25 Mpa (2,5 bars).

Continuous monitoring of the contactor pressure

The pressure switch actuates a contact in case of an accidental drop of the SF6 gas pressure.

Insensitivity to external conditions

The Rollarc pole unit provides a totally gas-insulated system. It is a hermetically sealed enclosure filled with SF6 gas and housing the essential parts.
Rollarc is particularly suited to polluted environments such as mines, cement works, etc.

Scope of application and some references

Our Rollarc contactor adapts to all electrical power distribution requirements from 1 to 12 kV.

Rollarc contactor is an essential component of an indoor metal-enclosed device intended for the MV section of HV/MV substations and high power MV/MV substations.

■ Rollarc contactor offers you:
□ pre-engineered and adaptable solutions tailored to your specific requirements
□ significantly reduced maintenance
□ local support centres throughout the world

■ Rollarc contactor gives you the advantages of:
□ continuity of service for your networks;
□ enhanced safety for your staff and operations
□ optimised investment throughout the life of your installation
□ the possibility of integrating your medium voltage switchboard in a monitoring and control system

Rollarc contactor is present in all power distribution markets

Energy
■ Electric power stations (thermal, nuclear)
■ Auxiliary substations
■ Source substations

Industry
■ Oil & gas
■ Chemical industry
■ Paper mills
■ Metallurgy
■ Car industry
■ Mining
■ Cement plants…

Infrastructure
■ Airports
■ Ports
■ Hospitals
■ Water treatment…

Marine and Navy applications
■ Cruisers
■ Container ships
■ Tankers
■ Offshore platforms, fixed and mobile
■ LNG (Liquid Natural Gas)
■ Navy…

Scope of application and some references

(cont.)

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Marine

Jan de Nul	Belgium (MCset)
Zhen Hua Port Machinery	China (MCset)
FREMM	France (MCset)
Conti Rederei	Germany (MCset)
MSC	Italy (MCset)
M.O.L.	Japan (MCset)
STX Shipyard	Korea (MCset)
CPOC	Malaya (MCset)
Subsea	Norway (MCset)
Sovcomflot	Russia (MCset)
TMT	Taiwan (MCset)
British Gas	United Kingdom (MCset)
Norvegian Cruise Lines	USA (MCset)

PE58253

Industry

Algérienne des eaux	Algeria (MCset)
Water treatment, Degremont	Argentina (MCset)
Alcoa Aluminium	Australia (MCset)
Croesus Mining	Australia (MCset)
Rollestone Coal Pty LTD	Australia (MCset)
Ciment Karadag	Azerbaijan (MCset)
Volvo	Belgium (MCset)
Cement Lafarge	Equator - Turkey (MCset)
Cement Lafarge	France (MCset)
Ford	Germany (MCset)
Irak Traitement des eaux	Irak
Arab Union Contracting Company	Libya (MCset)
Arcelor	Luxemburg (MCset)
Opel	Russia (MCset)
Ciment Bastas	Turkey (MCset)

PE56579

Power generation

Sonelgaz	Algeria (MCset)
Moranbah Generation Facility	Australia (MCset)
China Nuclear Power programmes	China (MCset)
CEA Cadarache	France (MCset)
Enertherm	France (MCset)
Wind Turbines	France (MCset)
La Termica	Italy (MCset)
Al Fanar Electrical System	KSA (MCset)
Skagerak Nett AS	Norway (MCset)
EVN thermal power station	Vietnam (MCset)

PE58252

Oil and Gas

Girassol Mpg-Elf	Angola (MCset)
ONAL	Gabon (MCset)
Alya Co	Kazakhstan (MCset)
Tengiz Chevroil JV	Kazakhstan (MCset)
Occidental Mukhaizna LLC	Oman (MCset)
Qatar Petroleum	Qatar (MCset)
Repsol, Santander	Spain (MCset)
Syrian Gas Company	Syria (MCset)
Turkmengaz	Turkmenistan (MCset)
Abu Dhabi Oil Refining Company	United Arab Emirates (MCset)
Yemen LNG Company	Yemen (MCset)
Yemgas – Technip	Yemen (MCset)

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Infrastructure

Italian Railways	Italy (MCset)
Alicante airport	Spain (MCset)
Port of Laem Chabang	Thailand (MCset)

Operating conditions & Standards

PE58251

Operating conditions

Normal operating conditions, according to the IEC International Standards listed below, for indoor switchgear.

■ Ambient air temperature:
□ less than or equal to 40°C
□ less than or equal to 35°C on average over 24 hours
□ greater than or equal to – 25 °C

■ Altitude:
□ less than or equal to 1000 m;
□ above 1000 m, a derating coefficient is applied (please consult us)

■ Atmosphere:
no dust, smoke or corrosive or infl ammable gas and vapor, or salt

■ Humidity:
□ average relative humidity over a 24 hour period ≤ 95%
□ average relative humidity over a 1 month period ≤ 90%
□ average vapor pressure over a 24 hour period ≤ 2.2 kPa
□ average vapor pressure over a 1 month period ≤ 1.8 kPa

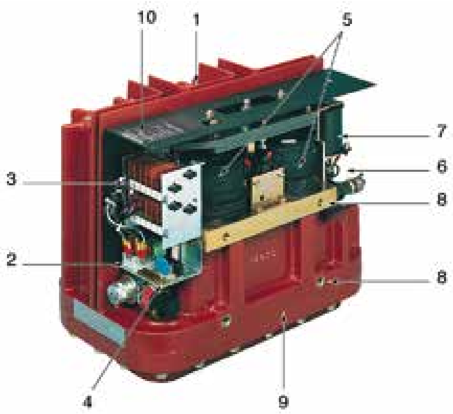
Storage conditions
In order to retain all of the functional unit's qualities when stored for prolonged periods, we recommend that the equipment is stored in its original packaging, in dry conditions, and sheltered from the sun and rain at a temperature ranging from - 40°C up to + 70°C.

PM104585

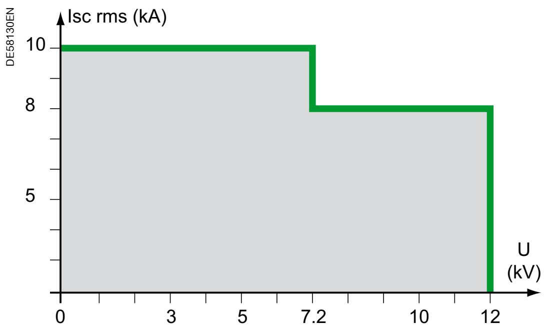
Standards

The Rollarc range meet the following international standards:
■ IEC 62271-106: Alternating current contactors, contactor based controllers and motor-starters
■ IEC 62271-1: High-voltage switchgear and controlgear: common specifications

Description, main advantages and field of application



1: MV connections	6: mechanical latching device (R400D)
2: LV connections	7: opening release
3: auxiliary contacts	8: fixation points
4: pressure switch	9: insulating enclosure
5: magnetic actuator	10: rating plate



Description

The Rollarc three-pole indoor contactor uses sulphur hexafluoride (SF6) gas for insulation and switching.
Switching is based on the rotating arc principle. The basic version is made up of three pole units installed in the same insulating enclosure. The part of the enclosure containing the active parts of the poles is filled with SF6 gas at a gauge pressure of 0.25 Mpa (2.5 bars) relative.
There are two types of Rollarc contactors:
- The R400, with magnetic holding
- The R400D, with mechanical latching.

Main advantages

- A modern and tested circuit-breaking technique featuring SF6 safety
- No maintenance for active parts
- High mechanical and electrical endurance
- Low switching surges without additional devices (surge arrester)
- Insensitivity to the environment
- Gas pressure is continuously monitored.

Field of application

Protection and control of:
- MV motors
- Capacitor banks
- Power transformers.

SF6 gas properties

The rotating arc technique

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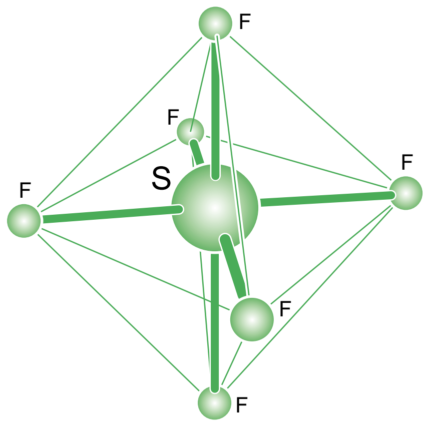

Sulphur hexafluoride (SF6) gas properties

SF6 is **non-inflammable**, very stable, **non-toxic gas**, five times heavier than air. Its dielectric strength is much higher than that of air at atmospheric pressure.

Gas for interruption

SF6 is “the” arc-interruption gas, combining the best properties:

■ **high capacity for carrying away the heat produced by the arc**.
The latter is rapidly cooled by convection during the arcing period.

■ **high radial thermal conduction and high electron capturing capacity**
When the current passes through zero, the arc is extinguished by the combination
of two phenomena:

□ SF6 permits rapid heat exchange from the center of the arc toward the exterior.

□ fluorine atoms, which are highly electronegative, act as veritable “traps” for electrons.

Since it is electrons which are mainly responsible for electric conduction in the gas, the gap between the contacts recovers its initial dielectric strength through this electron capture phenomenon at zero current.

■ **the decomposition of the SF6 molecule is reversible**
The same mass of gas is therefore always available, making the device self-sustained throughout its operating life.

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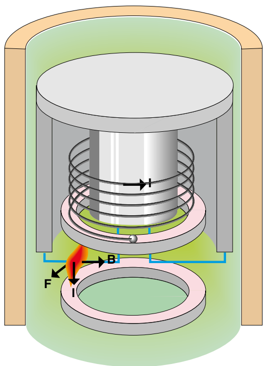


The rotating arc principle

The exceptional characteristics of SF6 gas are used to extinguish the electrical arc. Cooling is enhanced by the relative movement between the arc and the gas. In the rotating arc technique, the arc is set in motion between two circular arcing contacts (see figure opposite).
When the **arcing contacts** separate, the current to be interrupted flows through a solenoid, thus creating an electromagnetic field B.
When the **arcing contacts** separate, the arc appears between them. The arc is made to rotate between the two circular arcing contacts by force F, the combined result of the electromagnetic field and the current.
Force F is directly proportional to the square of the current to be interrupted.

This breaking technique therefore automatically adapts to the current to be interrupted:
When the current is high, the speed of rotation is high (speed of sound) and cooling is intense. Just before reaching zero current, the speed is still sufficient to make the arc rotate and thus contribute to the recovery of dielectric strength at zero current. Wear of the arcing contacts is very low.
When the current is low, the speed of rotation is also low.
This leads to very soft breaking of the arc without surges, comparable to the widely appreciated performances of the air breaking technique.

Soft breaking

Breaking of inductive or capacitive currents

The Rollarc contactor does not generate voltage surges.
On some switchgear such surges occur during the breaking of low inductive or capacitive currents and can damage the insulation of connected devices.
With the rotating arc technique, the rotation speed of the arc is low for low currents and breaking is soft under all conditions:

- current chopping: (arc interruption before zero current) the chopping current is always less than 1 A, i.e. the voltage surge is very low for the load.
- multiple prestrikes and restrikes

Other phenomena exist that are much more dangerous to the load than the voltage surges resulting from current chopping. Such phenomena occur if the device tries to break high frequency currents.
High frequency currents appear when there is a dielectric breakdown (opening of contacts is too close to zero current) and produce high frequency waves that are very dangerous for motor insulation.
Given the relatively slow dielectric regeneration between its arcing contacts, the Rollarc contactor avoids breaking high frequency currents and multiple prestrike and restrike phenomena are prevented.
The Rollarc is thus the perfect motor control contactor.
It provides the user and the network with total security without requiring additional accessories such as surge arresters or RC systems.

Results of tests on Rollarc

Motor starting current	Busbar capacitance (Cb)	Busbar capacitance and compensation (Cb+Cc)	Overvoltage Pu (1)			Multiple restrikes
			Average	Standard deviation	Max.	
100 A	0.05 mF		1.76	0.18	2.35	none
100 A		1.8 mF	1.88	0.13	2.23	none
300 A	0.05 mF		1.69	0.10	1.90	none
300 A		1.8 mF	1.79	0.09	1.91	none

(1) $PU = \dfrac{\text{measured peak voltage}}{\dfrac{U\sqrt{2}}{\sqrt{3}}}$

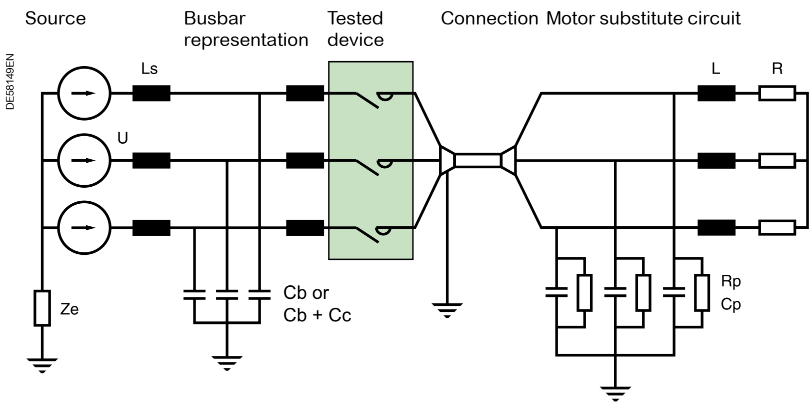
Example: peak voltage $7.2 \times 1.76 \dfrac{U\sqrt{2}}{\sqrt{3}} = 10.35$ kV

Test circuit diagram

100 A 7.2 kV and 300 A 7.2 kV

Tests according to IEC draft standard (17 A secretariat 291). Overvoltage levels depend on the breaking device, and also on the circuit. The IEC standard proposes
a standard motor breaking circuit.

Ze: earth impedance
Ls: power supply inductance
Cp: load parallel capacitance
U: power supply voltage
Cc: compensation capacitance
Rp: load parallel resistance
Cb: capacitance of the bars
Lb: inductance of the bars
L: load inductance
R: load resistance



The Rollarc range

The Rollarc R400 and R400D contactors are available in three versions:

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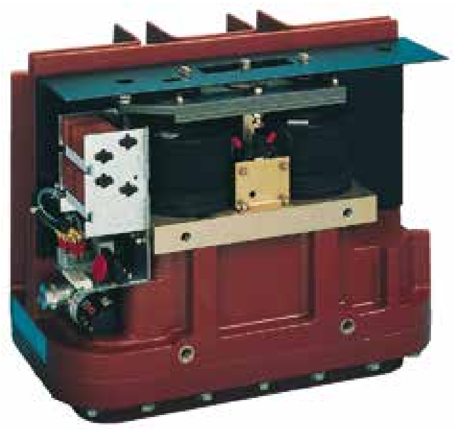

Basic version - Contactor alone

Comprises basic version 400 or 400D:

■ 3 poles integrated in a «sealed pressure system» type insulating enclosure. The sealed assembly is filled with SF6 gas at low relative pressure of 0,25 Mpa (2,5 bars) and equipped with a pressure switch.

■ A magnetic actuator: This gives the device and opening and closing speed that is independent of the operator. It enables reclosing cycles to be carried out.

■ Upstream and downstream terminals for the power circuit connection

■ A terminal block for connection of external auxiliary circuits.

Each device can also be fitted with the following options:

■ A 75 kV kit for 12 kV rated voltage

■ A mechanical interlock between 2 contactors

■ 2 threshold pressure switch: 0,15 Mpa (1,5 bars) - 0,05 Mpa (0,5 bar)

PE56762

Fixed version - The contactor with the control auxiliaries is mounted on a fixed frame

Fixed version comprises:

■ Basic frame equipped with a 42 pins, Socapex type Low Voltage connector

Each device can also be fitted in option with an interlocking in open position and may be equipped with fuses when the short-circuit current is greater than the contactor rating.

The fuses used are of the indoor Fusarc CF type with strikers that actuate the contactor opening mechanism.

■ Equipment for fuses (fuses to be ordered separately)

□ Length: 292 mm

□ Diameter : 86 mm

PE56763

Withdrawable version - The contactor with the control auxiliaries is mounted on a withdrawable cradle

Withdrawable version comprises:

■ A rolling frame equipped with a Low Voltage Socapex plug, 42 pins, and interlocks with cradle

■ A cradle with shutters

Each device can also be fitted in option with an interlocking in open position and may be equipped with fuses when the short-circuit current is greater than the contactor rating.

The fuses used are of the indoor Fusarc CF type with strikers that actuate the contactor opening mechanism.

■ Equipment for fuses (fuses to be ordered separately)

□ Length: 292 mm

□ Diameter : 86 mm

Description of the basic version

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Enclosure

The epoxy resin enclosure ensures:

■ high mechanical strength enabling use as a support for the active parts and resistance to electromechanical stress.

■ excellent dielectric strength due to the nature of the material and the design.

■ a very reliable seal (sealed pressure system in compliance with standard IEC 62271-1).

The filling pressure remains constant throughout the life of the contactor.

PE30251

Active parts and operating mechanism

The essential parts include the:

■ arc interruption device,

■ insulating rod which actuates the mobile contacts and the corresponding fixed terminal.

These parts are housed in an enclosure which is sealed for life and are thus totally insensitive to the environment. The resulting elimination of corrosion increases the reliability of the device.

PE56764

Magnetic actuator

Rollarc is actuated by closing coils that ensure closing and hold the device in the closed position.

PE30253

Auxiliary contacts

The auxiliary switch subassemblies are always mounted on the enclosure.

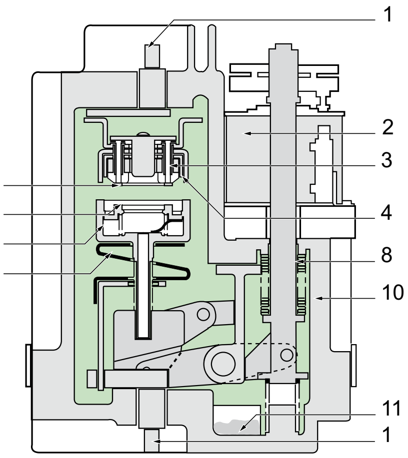
PE30254

Mechanical latching

The R400D is actuated by closing coils that ensure closing of the device and has a mechanical latching device which holds the contactor in the closed position without a continuous power supply.

A release is used to free the latching mechanism.

Description of the operation



1 - MV terminals
2 - Electromagnet
3 - Blowout coil
4 - Fixed main contact
5 - Fixed arcing contact
6 - Moving main contact
7 - Moving arcing contact
8 - Sealing bellows
9 - Flexible connector
10 - Enclosure
11 - Molecular sieve

Rollarc pole unit

Each pole unit consists of:

- **a main circuit** composed of a fixed main contact (4) and a moving main contact (6)
- **a breaking circuit** composed of a fixed arcing contact (5) and a moving arcing contact (7) that form two circular runners.

A blowout coil (3) is mounted in series in the circuit.
The main circuit that ensures the flow of the current is distinct from the breaking circuit in which the arc is produced.

- a transmission mechanism for the transfer of energy from the operating mechanism to the mobile contacts.

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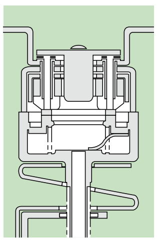
Fig. 1

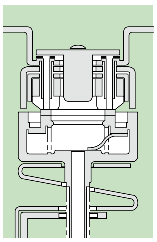
Fig. 2

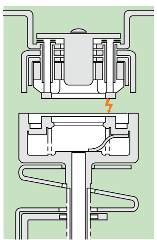
Fig. 3

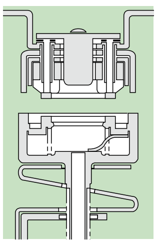
Fig. 4

Operation

Rollarc 400 is a magnetic device that uses the rotating arc technique to interrupt the current.

- at the beginning of an opening cycle, the main contacts and the arcing contacts are closed (fig.1).
- isolation of the main circuit is achieved by the separation of the main contacts (fig. 2). The arcing contacts are still closed. The current flows through the coil, the arcing contacts and the flexible connector.
- the arcing contacts open shortly after the main contacts. The resulting arc is made to rotate between the two circular runners of the arcing contacts by the electromagnetic field produced by the coil, the force of which depends on the current to be interrupted (fig. 3).

By design and due to phase shift between the current and the electromagnetic field, this force is still significant at zero current.

- at zero current, the gap between the contacts recovers its initial dielectric strength thanks to the inherent qualities of SF6 gas (fig. 4).

Notes

Characteristics

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Electrical characteristics

Electrical characteristics									
Rated voltage	Rated insulation level		Breaking capacity at U (kV)		Rated current [3]	Making capacity		Short time current	Mechanical endurance
Ur 50-60 Hz	impulse [1] 1.2/50 µs	1 min 50-60 Hz		With fuses [2]	Ir		With fuses (prospective current)	3 s	
kV	kV peak	kV rms	kA	kA	A	kA peak	kA	kA rms	
3.3 to 4.76	60	20	10	50	400	25	125	10	■ 300 000 operations (magnetic holding)
7.2	60	20	10	50	400	25	125	10	■ 100 000 operations (mechanical latching)
12	60	28	8	40	400	20	100	8	

Opening time at U	Breaking time	Closing time
Without relays: 20 to 40 ms	Without relays: 40 to 60 ms	Without relays: 75 to 145 ms
With relays: 30 to 50 ms	With relays: 50 to 70 ms	With relays: 85 to 155 ms

(1) Optional: 75 kV impulse/28 kV rms on basic version only

(2) Fusarc CF fuses: see sheet AC0479 (fuses 3-36 kV)

(3) 400 A continuous (no overload possible).

Control circuit		DC	AC
Rated supply voltage		48, 60, 110, 125, 220 V	110, 127, 220 V
Power consumption:	Pick-up	1050 W	900 VA
	Seal-in	30 W	40 VA
	Opening	80 W	100 VA

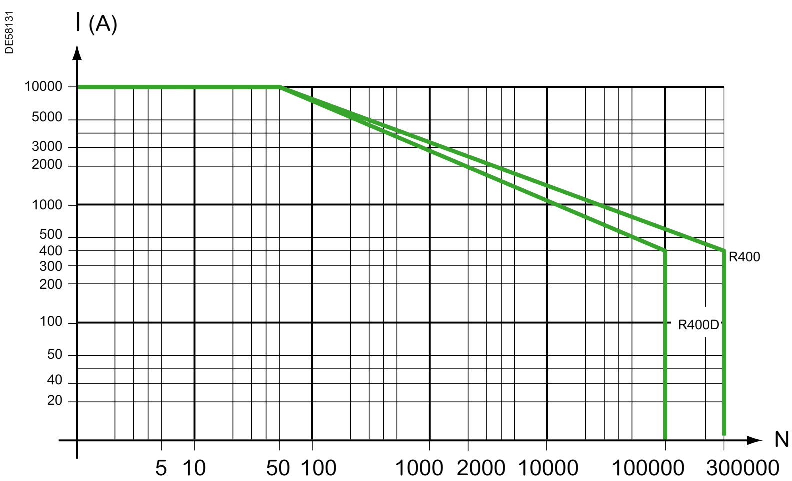
Auxiliary switches	
Rated current	10 A
Breaking capacity	DC: (L/R = 0.015 s) 0.5 A / 220 V AC: (p.f. = 0.3) 10 A / 220 V

Electrical endurance

This curve indicates the number of operations N according to the breaking current I, in class AC3 or AC4.

■ **R400**
- □ 300 000 operating cycles at 400 A
- □ 50 operating cycles at 10 000 A

■ **R400D**
- □ 100 000 operating cycles at 400 A
- □ 50 operating cycles at 10 000 A



Maximum switching capacities

When the contactor is used in conjunction with fuses, the maximum switching capacities may be determined using the fuse curves and by taking into account:

■ the characteristics of the load (motor starting currents, starting times, transformer inrush currents)

■ the amplitude of the limited interrupted current which is a function of the prospective fault current and the fuses employed. The limited interrupted current should not exceed the electrodynamic withstand capacity of the contactor.

For values less than those presented in the table below, see:

■ for motor control, page 37

■ for transformers, fuses catalogue AC0479EN.

Service voltage kV	Without fuses			With fuses						
	Motors (1) kW	Transfo. kVA	Capacitor banks kvar	Max. fuse rating see catalogue AC0479E (l = 292 mm)(2)	Motors in k (1)				Transformer (standard max. rating) kVA	Capacitors (single bank) Kvar
					5 s start Is/In = 6		10 s start Is/In = 6			
					Starts/h: 6	Starts/h: 12	Starts/h: 6	Starts/h: 12		
3.3	1560	1800	1255	250	1160	1060	1060	940	1000	790
3.6	1690	1965	1370	250	1260	1150	1150	1020	1250	865
4.16	1960	2270	1585	200	820	735	735	665	1000	800
6.6	3100	3600	2510	200	1295	1165	1165	1050	1600	1270
7.2	3380	3925	2740	200	1410	1270	1270	1145	1600	1385
10	4690	5455	3810	100	520	445	445	445	1250	960
12	5630	6545	4570	100	625	535	535	535	1600	1155

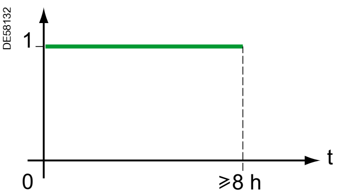
(1) With p.f. = 0.92 η = 0.94

(2) For higher fuse ratings, consult us

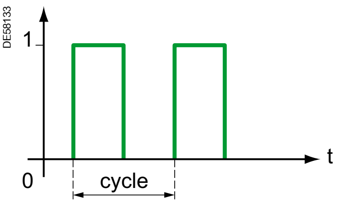
***Note:** fuse ratings depend on the maximum power.*
For lower powers, the correct fuse rating must be determined (see page 36).

Contactor operating conditions
(without fuses)

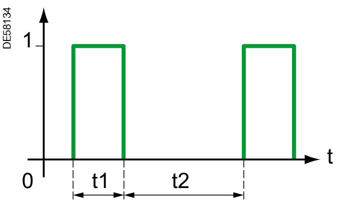
IEC 62271-106 defines three types of contactor operation:



■ **Continuous operation**
In position 1, the contactor equilibrium temperature is reached.



■ **Periodical intermittent operation** (or intermittent)
In position 1, the contactor equilibrium temperature is not reached.



■ **Short-time operation**
In position 1, the contactor equilibrium temperature is not reached.
t1: standardized values 10 min - 30 min - 60 min - 90 min
t2: time required for the contactor to cool to the temperature of the cooling medium.

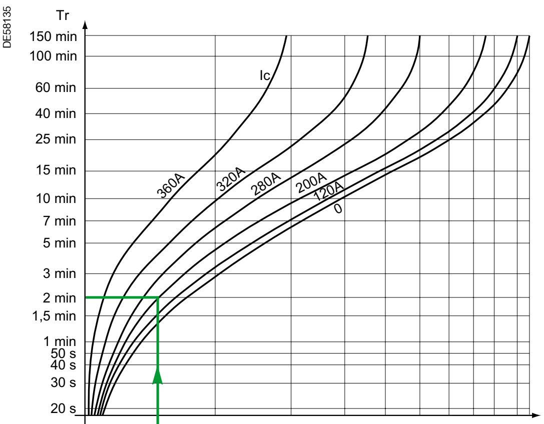


Fig. 2

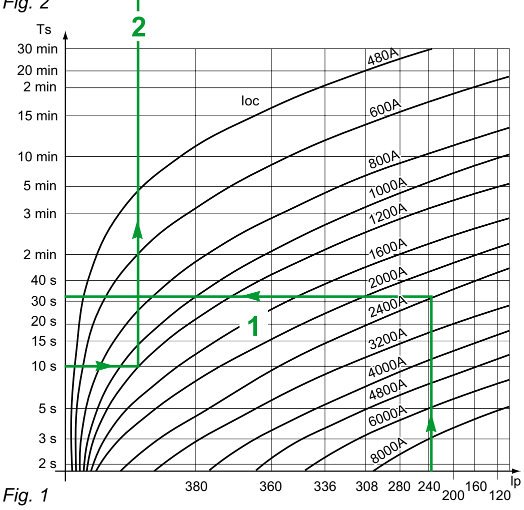


Fig. 1

Intermittent and short-time operation

Allowable overcurrents
The two sets of curves presented here can be used to determine allowable overcurrents in the Rollarc contactor.

■ The maximum value of an overcurrent and the cooling time
Using the permanent current value Ip, figure 1 can be used to determine the maximum duration of Toc along line 1.
The time required for cooling Tc to ensure that the equilibrium temperature is not exceeded may be determined using figure 2.
Example: a Rollarc contactor with a permanent operating current Ip = 240 A can withstand a temporary overload of 2400 A for 32 seconds.
The cooling time Tc is:
□ 25 minutes if the circuit is open
□ 28 minutes if a 120 A current flows through the contactor
□ 48 minutes if a 200 A current again flows through the contactor.

■ Cyclical overcurrent
the fourth parameter (see line 2 between figures 1 and 2) can be determined when three of the four below are known:
□ Ioc overcurrent
□ Toc duration of overcurrent
□ Ic cooling current
□ Tc duration of cooling.

Example:
Ioc 1200 A for 10 seconds
Tc 200 A for 2 minutes.

Operating mechanism and equipment

Rollarc operating mechanism

The contactor is closed by an electromagnet (pick-up coil YF).

■ for the magnetically held contactor R400, two seal-in coils (YM) are inserted in the circuit at the end of closing. The contactor is tripped by the opening of the holding circuit.

■ for the mechanically latched contactor R400D, the contactor is held in closed position by the mechanical latching system. The contactor is tripped by a shunt trip which releases the latching device.

Auxiliary switches

Rollarc contactors are equipped with ten changeover common point auxiliary switches. Consult the equipment selection table for information on the number of available switches.

Pressure switch

The pressure switch for alarm indications closes a changeover switch if the gas pressure drop below 0,15 Mpa (1,5 bars).

Contact breaking capacity:

■ AC (p.f. = 0.6) 2.2 A at 127 V

■ DC 0.5 A at 120 V - 0.4 A at 220 V

Selection of accessories	Code	R400 magnetically held contactor			R400D magnetically latched contactor		
		Basic version AC/DC	Fixed version AC/DC	Withdrawable version AC/DC	Basic version AC/DC	Fixed version AC/DC	Withdrawable version AC/DC
Closing electromagnet	YF	■	■	■	■	■	■
Holding electromagnet (seal-in)	YM	■	■	■			
Shunt trip	YD				■	■	■
Number of auxiliary switches available (1)	CA	9	9	9	8	8	8
Pressure switch	P	■	■	■	■	■	■
Anti-pumping relay	KN				▲	■	■
Closing relay	KMF	▲	■	■	▲	■	■
Opening relay	KMO	▲	■	■	▲	■	■
Operation counter (1)	PC		□	□		□	□
Interlocking auxiliary switch (*)	SE		■	■		■	■
Interlock			□	□		□	□
"Service position" indication	SQ2			■			■
Equipment for MV fuses (fixing and "fuse blown" contacts)			□	□		□	□
Withdrawable fixed frame (2)				□			□
75 kV kit		□			□		
Mechanical interlock		□			□		

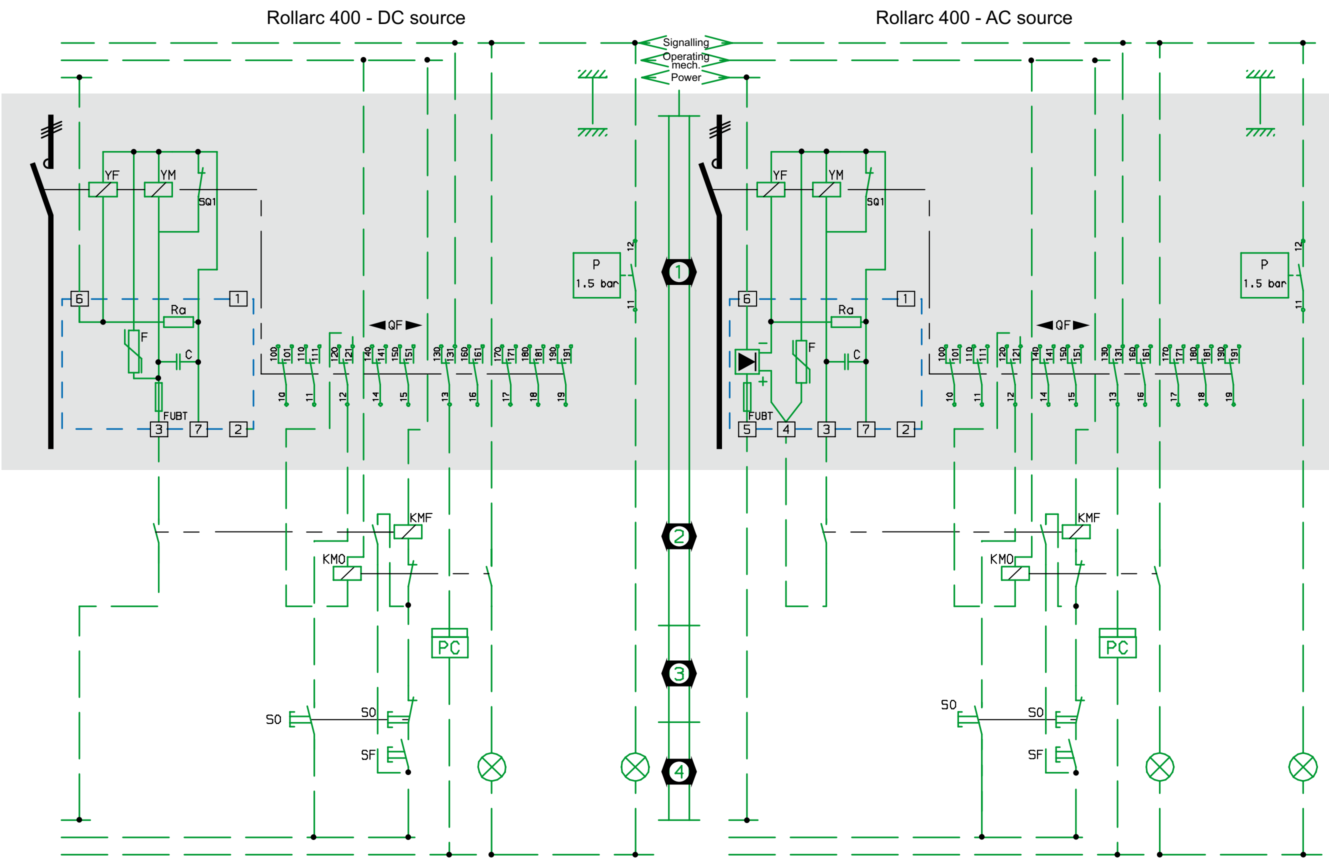
(1) The operations counter uses one auxiliary switch
(2) Device may be padlocked on the fixed frame (1 or 2 padlocks)
(*) The interlock switch is actuated by the operating handle

■ *Standard equipment*
▲ *Relay not supplied, wired by user (see diagrams)*
□ *Optional accessories*

Principle electrical diagram

Rollarc 400 basic version

DE58137EN



Standard Schneider Electric supply

1: control relay
2: recommended by Schneider Electric
3: options proposed by Schneider Electric
4: O/C control unit (not supplied by Schneider Electric)

— – — mechanical links
— — — Rollarc printed circuit alone
——— connections supplied
— — connections not supplied

YF: closing coils ⎓ 1050 W ∿ 900 VA
YM: seal-in-coils ⎓ 30 W ∿ 40 VA
SQ1: limit switch. Seal-in coils contact
C: capacitor C = Iμf x 2 Umax = 250 V
Ra: resistance R = 1.2 KΩ
F: varistor Urms = 250 V type : GE Mov
I: breaking ∿ (p.f. = 0.3) 10 A/220 V
⎓ (L/R = 0.15) 0.5 A/220 V
P: closing pressure switch ∿ 2.2 A/220 V
⎓ 0.4 A/220 V

SO: opening push button
SF: closing push button
PC: 6-digit operation counter

FUBT: low voltage fuse

Un (V)	48	60-72	100-127	220-250
Ia (A)	10	3.15	2.5	1.25

KN: end of closing relay
KMF: closing relay
KMO: opening relay

See table below

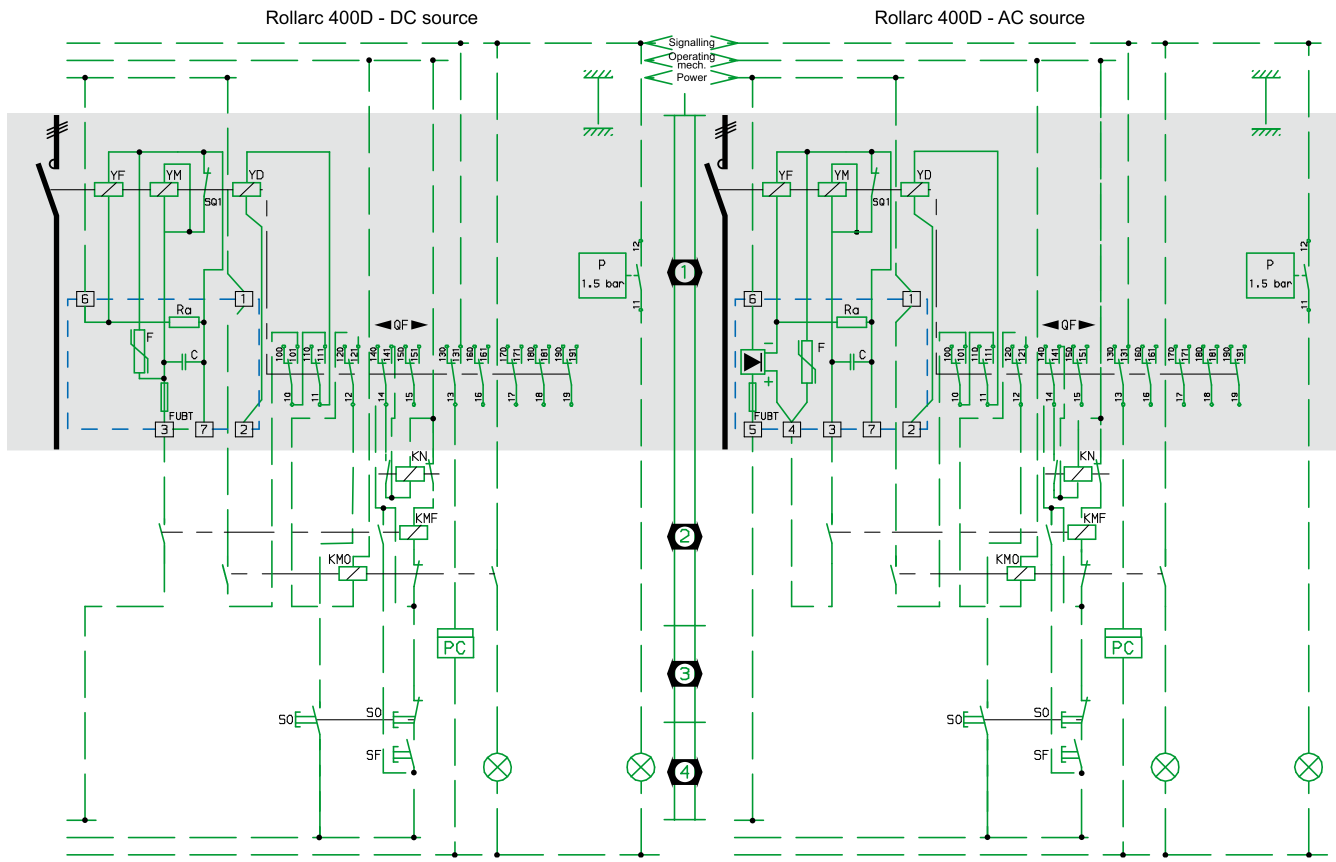
Un (V)	48	110	220
Ia (A)	10	10	10
p.f. = 0.4 ∿ (A)	1.1	0.4	0.24
L/R = 40 ms ⎓ (A)	0.8	0.3	0.18

Coil consumption ⎓ 3 W
∿ 4 VA

Principle electrical diagram

Rollarc 400D basic version

DE58138EN



Standard Schneider Electric supply

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3: options proposed by Schneider Electric
4: O/C control unit (not supplied by Schneider Electric)

— – — mechanical links
– – – Rollarc printed circuit alone
—— connections supplied
— — connections not supplied

YD : shunt trip ⎓ 80 W ∿ 100 VA
YF: closing coils ⎓ 1050 W ∿ 900 VA
YM: seal-in-coils ⎓ 30 W ∿ 40 VA
SQ1: limit switch. Seal-in coils contact
C: capacitor C = Iµf x 2 Umax = 250 V
Ra: resistance R = 1.2 KΩ
F: varistor Urms = 250 V type : GE Mov
I: breaking ∿ (p.f. = 0.3) 10 A/220 V
⎓ (L/R = 0.15) 0.5 A/220 V
P: closing pressure switch ∿ 2.2 A/220 V
⎓ 0.4 A/220 V
SO: opening push button
SF: closing push button
PC: 6-digit operation counter

FUBT: low voltage fuse

Un (V)	48	60-72	100-127	220-250
Ia (A)	10	3.15	2.5	1.25

KN: end of closing relay
KMF: closing relay
KMO: opening relay
} *See table below*

Un (V)	48	110	220
Ia (A)	10	10	10
p.f. = 0.4 ∿ (A)	1.1	0.4	0.24
L/R = 40 ms ⎓ (A)	0.8	0.3	0.18

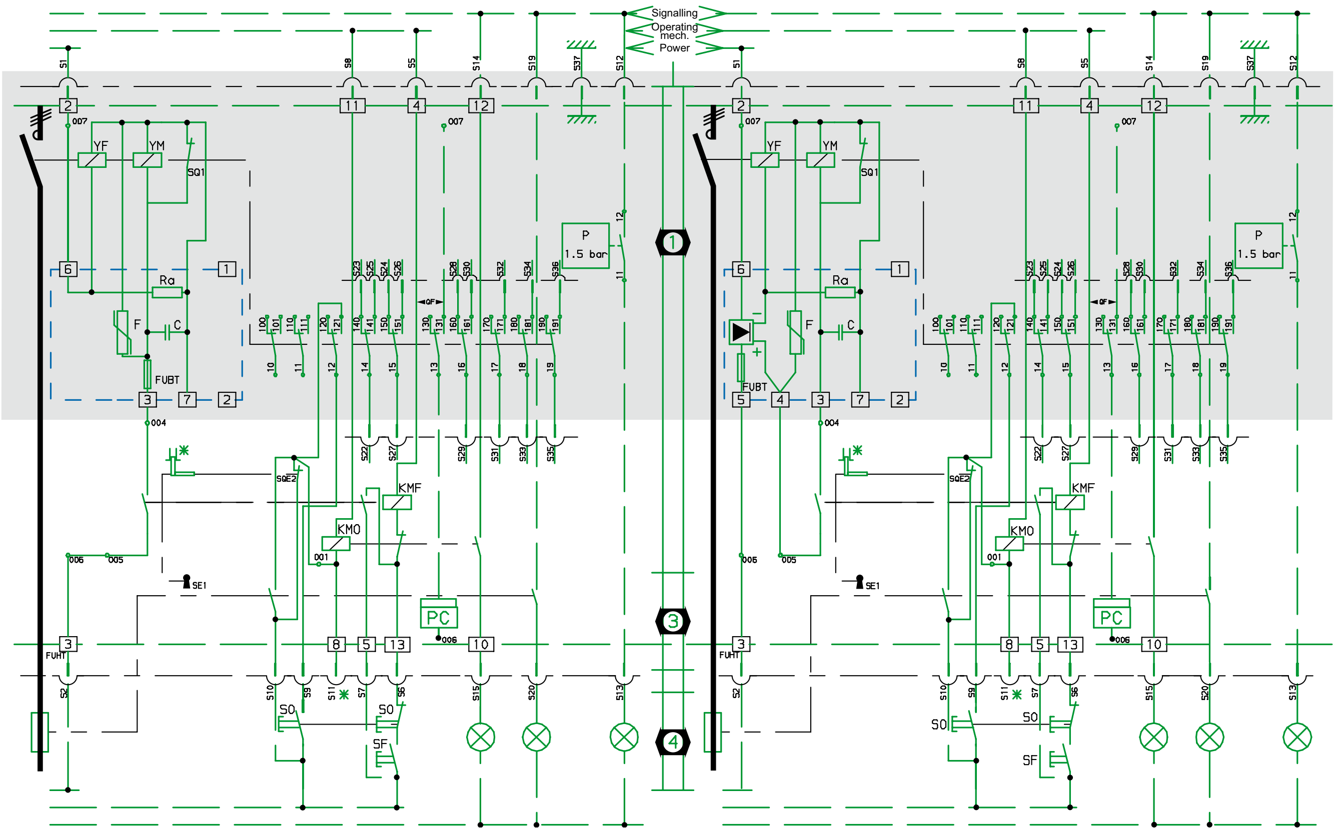
Coil consumption ⎓ 3 W
∿ 4 VA

Principle electrical diagram

Rollarc 400 fixed version with electrical auxiliaries

DE58139EN

Rollarc 400 - DC source | Rollarc 400 - AC source



Standard Schneider Electric supply

1: control relay
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3: options proposed by Schneider Electric
4: O/C control unit (not supplied by Schneider Electric)

— – — mechanical links
— — — Rollarc printed circuit alone
——— connections supplied
— — connections not supplied

YF: closing coils ⎓ 1050 W ∿ 900 VA
YM: seal-in-coils ⎓ 30 W ∿ 40 VA
SQ1: limit switch. Seal-in coils contact
C: capacitor C = Iµf x 2 Umax = 250 V
Ra: resistance R = 1.2 KΩ
F: varistor Urms = 250 V type : GE Mov
I: breaking ∿ (p.f. = 0.3) 10 A/220 V
⎓ (L/R = 0.15) 0.5 A/220 V
P: closing pressure switch ∿ 2.2 A/220 V
⎓ 0.4 A/220 V
SO: opening push button
SF: closing push button
PC: 6-digit operation counter

FUBT: low voltage fuse

Un (V)	48	60-72	100-127	220-250
Ia (A)	10	3.15	2.5	1.25

KN: end of closing relay
KMF: closing relay
KMO: opening relay
} *See table below*

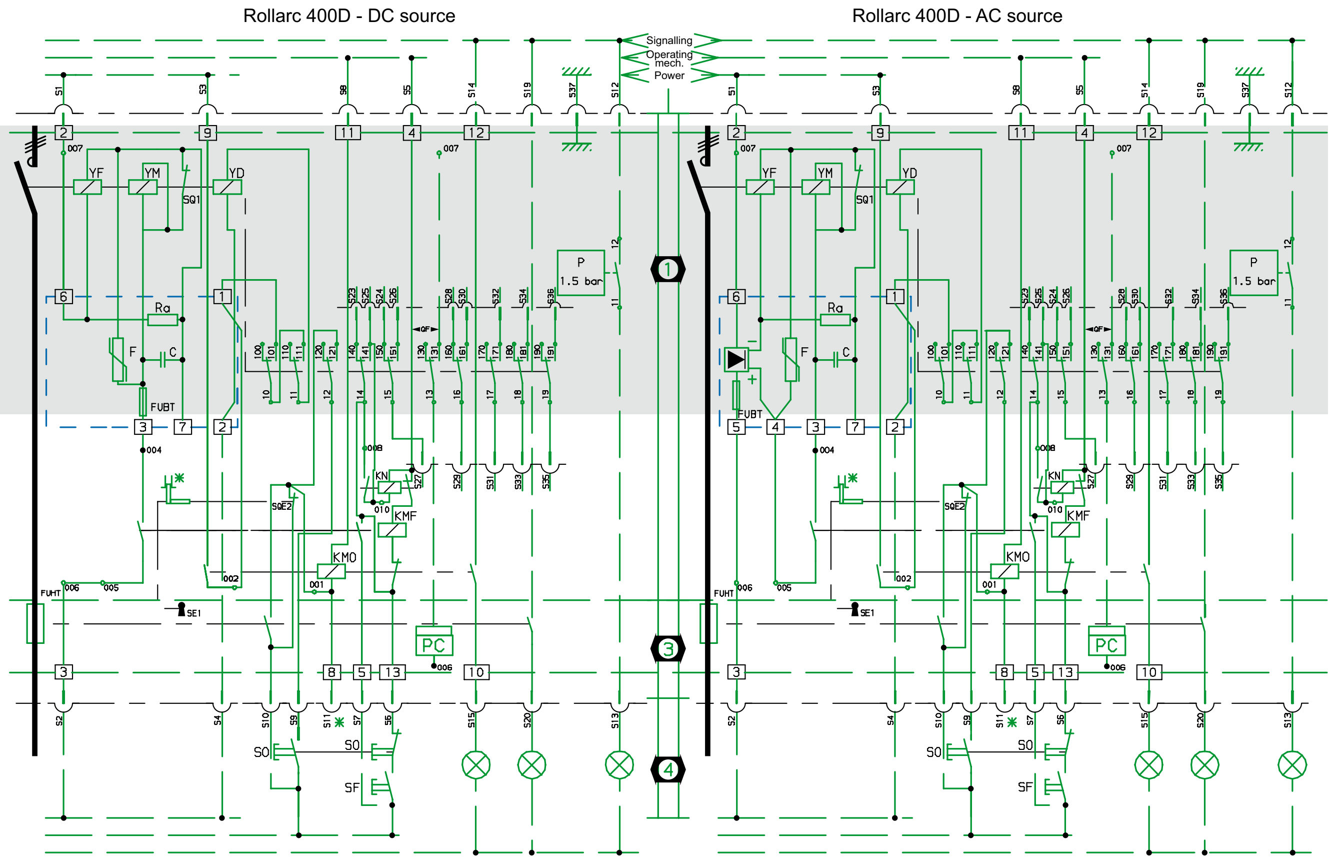
Un (V)	48	110	220
Ia (A)	10	10	10
p.f. = 0.4 ∿ (A)	1.1	0.4	0.24
L/R = 40 ms ⎓ (A)	0.8	0.3	0.18

Coil consumption ⎓ 3 W
∿ 4 VA

Principle electrical diagram

Rollarc 400D fixed version with electrical auxiliaries

DE58140EN



Standard Schneider Electric supply

1: control relay
2: recommended by Schneider Electric
3: options proposed by Schneider Electric
4: O/C control unit (not supplied by Schneider Electric)

— — — mechanical links
— — — Rollarc printed circuit alone
——— connections supplied
— — connections not supplied

YD : shunt trip ⎓ 80 W ~ 100 VA
YF: closing coils ⎓ 1050 W ~ 900 VA
YM: seal-in-coils ⎓ 30 W ~ 40 VA
SQ1: limit switch. Seal-in coils contact
C: capacitor C = Iμf x 2 Umax = 250 V
Ra: resistance R = 1.2 KΩ
F: varistor Urms = 250 V type : GE Mov
I: breaking ~ (p.f. = 0.3) 10 A/220 V
⎓ (L/R = 0.15) 0.5 A/220 V
P: closing pressure switch ~ 2.2 A/220 V
⎓ 0.4 A/220 V

SO: opening push button
SF: closing push button
PC: 6-digit operation counter

FUBT: low voltage fuse

Un (V)	48	60-72	100-127	220-250
Ia (A)	10	3.15	2.5	1.25

KN: end of closing relay
KMF: closing relay
KMO: opening relay

See table below

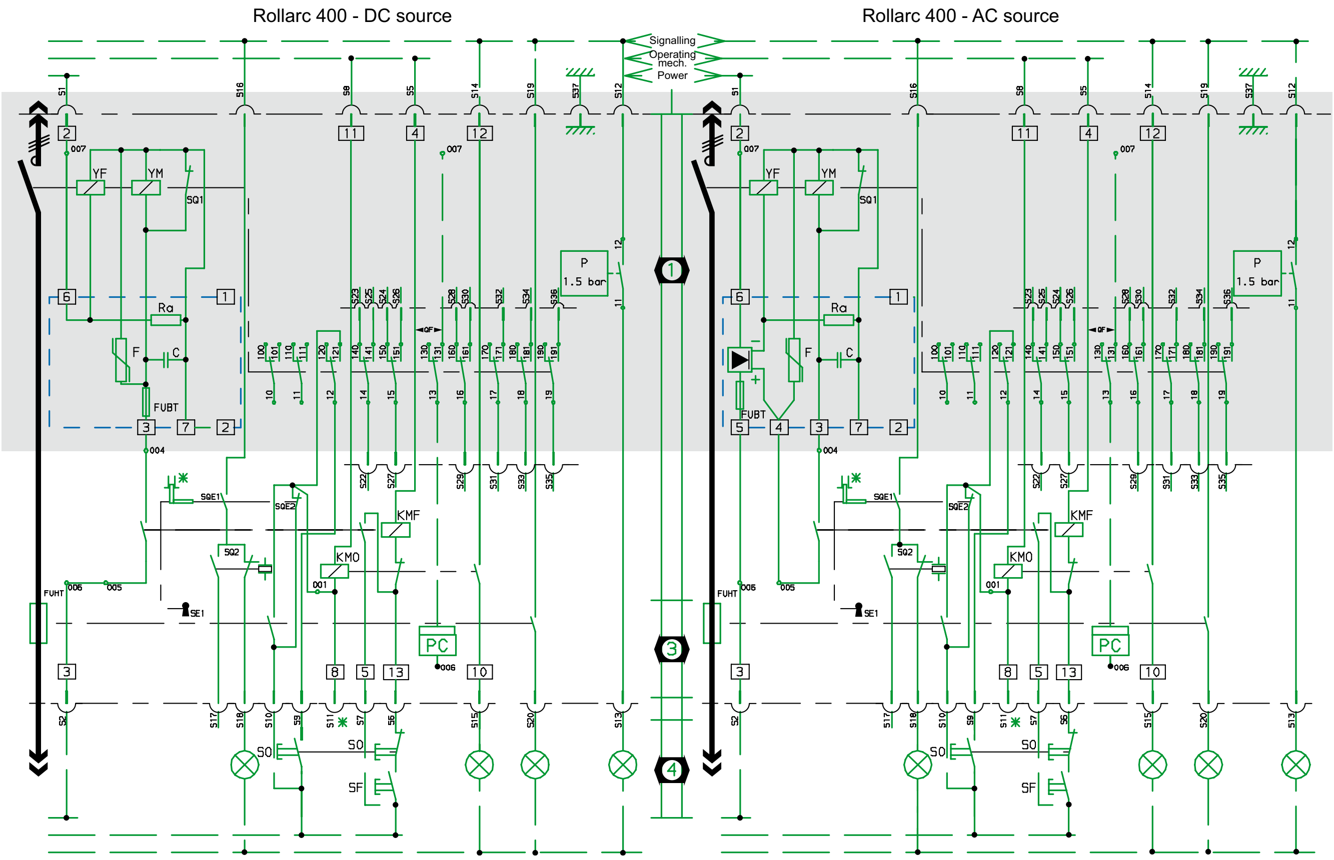
Un (V)	48	110	220
Ia (A)	10	10	10
p.f. = 0.4 ~ (A)	1.1	0.4	0.24
L/R = 40 ms ⎓ (A)	0.8	0.3	0.18

Coil consumption ⎓ 3 W
~ 4 VA

Principle electrical diagram

Rollarc 400 withdrawable version with electrical auxiliaries

DE58141EN



Standard Schneider Electric supply

1: control relay
2: recommended by Schneider Electric
3: options proposed by Schneider Electric
4: O/C control unit (not supplied by Schneider Electric)

— – — mechanical links
– – – Rollarc printed circuit alone
—— connections supplied
— — connections not supplied

YF: closing coils ⎓ 1050 W ∿ 900 VA
YM: seal-in-coils ⎓ 30 W ∿ 40 VA
SQ1: limit switch. Seal-in coils contact
C: capacitor C = Iμf x 2 Umax = 250 V
Ra: resistance R = 1.2 KΩ
F: varistor Urms = 250 V type : GE Mov
I: breaking ∿ (p.f. = 0.3) 10 A/220 V
⎓ (L/R = 0.15) 0.5 A/220 V
P: closing pressure switch ∿ 2.2 A/220 V
⎓ 0.4 A/220 V

SO: opening push button
SF: closing push button
PC: 6-digit operation counter

FUBT: low voltage fuse

Un (V)	48	60-72	100-127	220-250
Ia (A)	10	3.15	2.5	1.25

KN: end of closing relay
KMF: closing relay
KMO: opening relay
} *See table below*

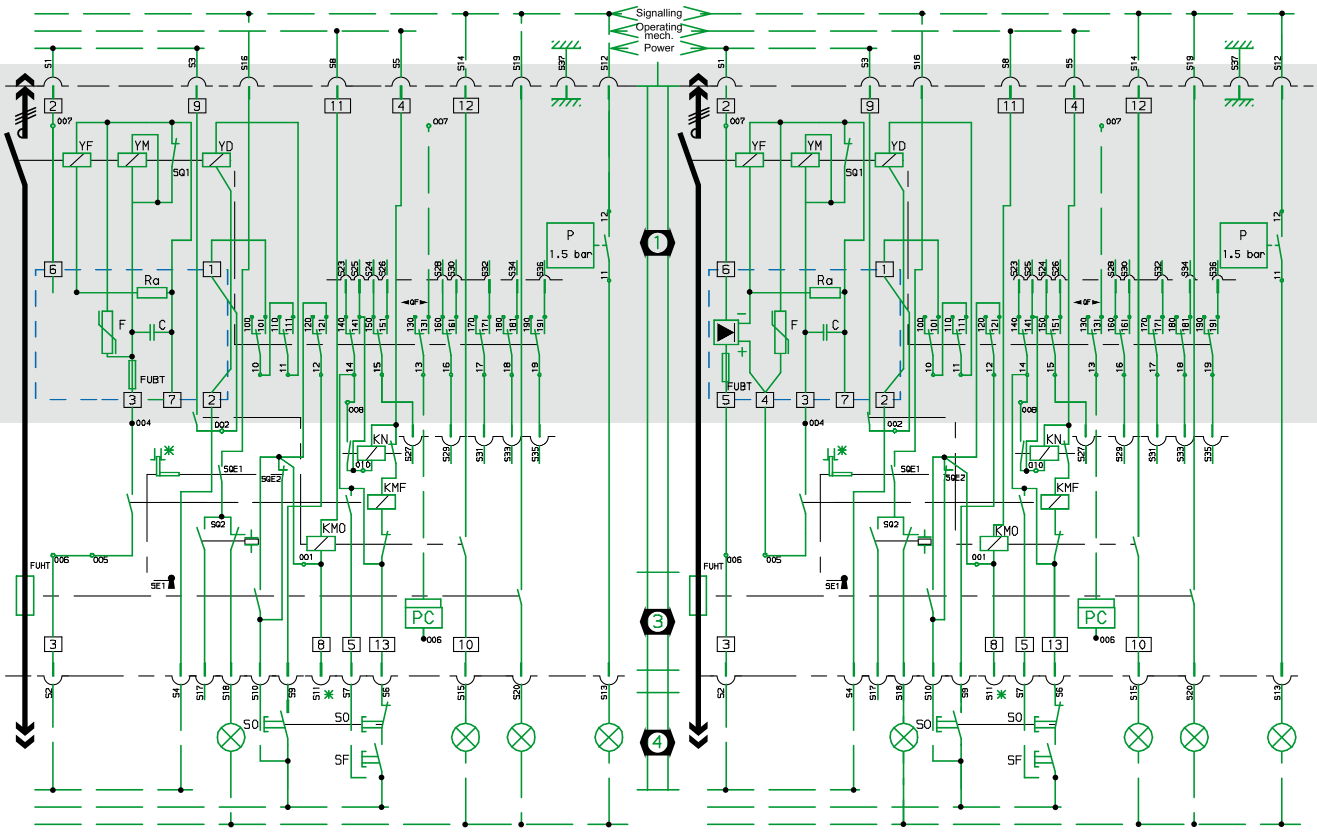
Un (V)	48	110	220
Ia (A)	10	10	10
p.f. = 0.4 ∿ (A)	1.1	0.4	0.24
L/R = 40 ms ⎓ (A)	0.8	0.3	0.18

Coil consumption ⎓ 3 W
∿ 4 VA

Principle electrical diagram

Rollarc 400D withdrawable version with electrical auxiliaries

DE58142EN



Standard Schneider Electric supply

1: control relay
2: recommended by Schneider Electric
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4: O/C control unit (not supplied by Schneider Electric)

— – — mechanical links
— — — Rollarc printed circuit alone
——— connections supplied
— — connections not supplied

YD : shunt trip	⎓ 80 W	∼ 100 VA
YF: closing coils	⎓ 1050 W	∼ 900 VA
YM: seal-in-coils	⎓ 30 W	∼ 40 VA

SQ1: limit switch. Seal-in coils contact
C: capacitor C = 1µf x 2 Umax = 250 V
Ra: resistance R = 1.2 KΩ
F: varistor Urms = 250 V type : GE Mov
I: breaking ∼ (p.f. = 0.3) 10 A/220 V
⎓ (L/R = 0.15) 0.5 A/220 V
P: closing pressure switch ∼ 2.2 A/220 V
⎓ 0.4 A/220 V
SO: opening push button
SF: closing push button
PC: 6-digit operation counter

FUBT: low voltage fuse

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Ia (A)	10	3.15	2.5	1.25

KN: end of closing relay
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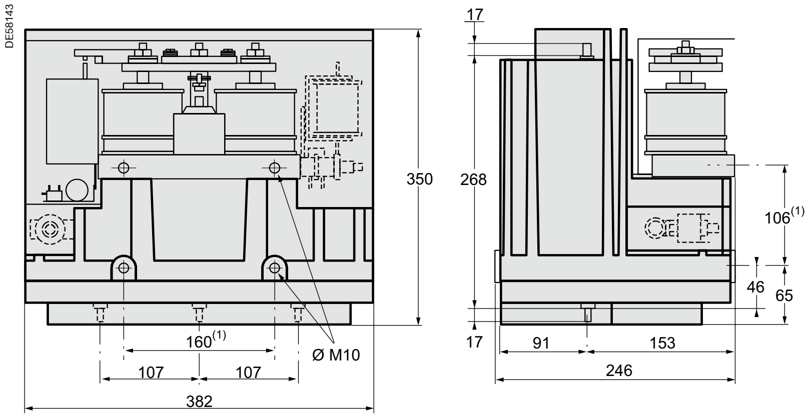
KMO: opening relay
} *See table below*

Un (V)	48	110	220
Ia (A)	10	10	10
p.f. = 0.4 ∼ (A)	1.1	0.4	0.24
L/R = 40 ms ⎓ (A)	0.8	0.3	0.18

Coil consumption ⎓ 3 W
∼ 4 VA

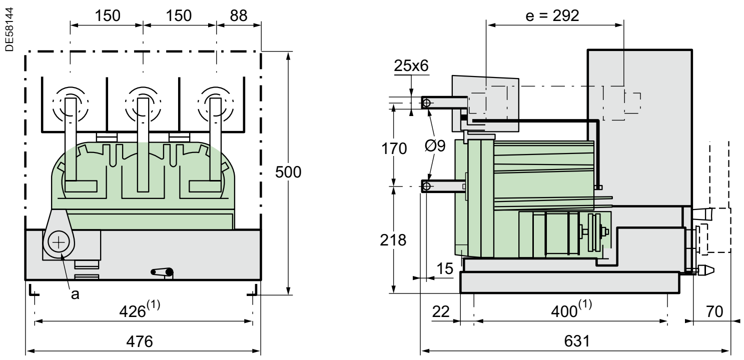
Dimensions

Basic version



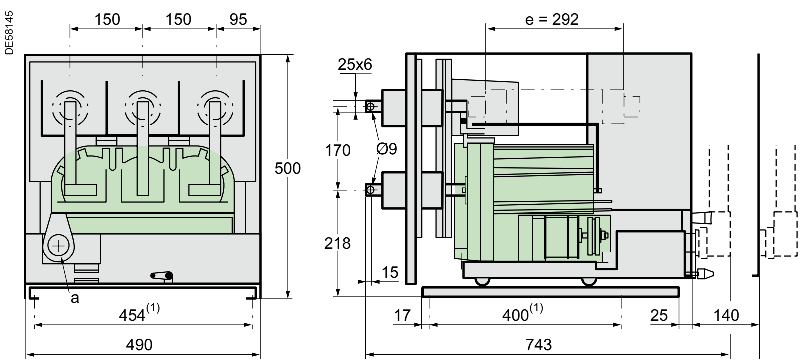
(1) Mounting dimensions
Approximative weight: 35 kg

Fixed version



a: LV connector
(1) Mounting dimensions
Approximative weight: 65 kg

Withdrawable version



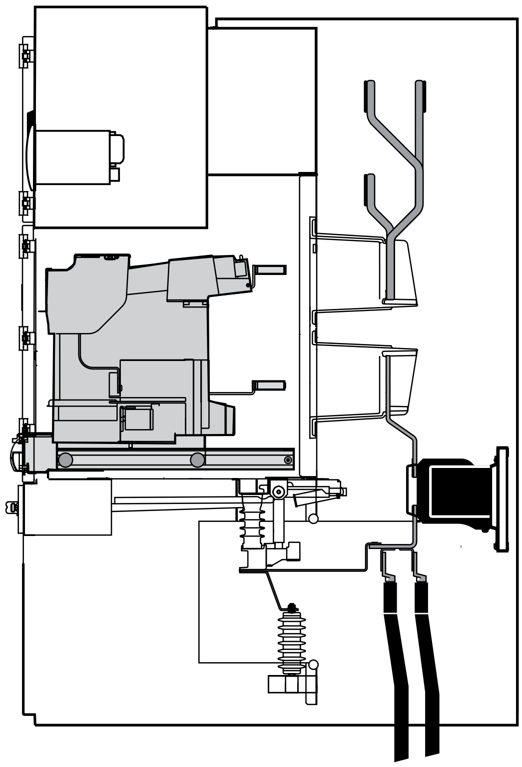
a: LV connector
(1) Mounting dimensions
Approximative weight: 85 kg

Cubicle installation

Withdrawable MCset factory-built cubicle

See catalogue NRJED312404EN.

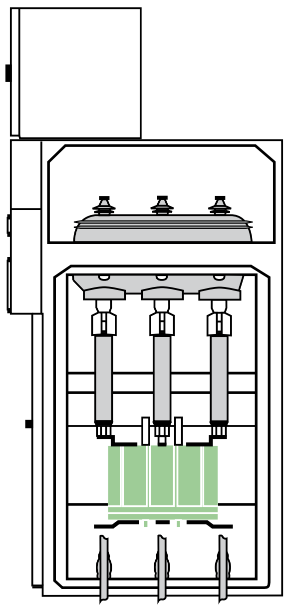
DM103524



SM6 factory-built cubicle

See catalogue AMTED398078EN.

DE58147



Fuse-contactor assembly

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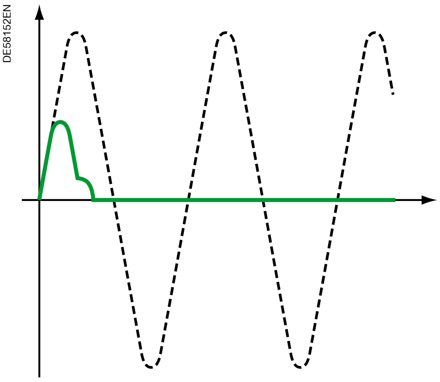
Utilisation guide



Limited interrupted current
Prospective current

Figure 1

Fuse-contactor combinations

Principle

The contactor switches the load on and off during normal operation or an overload. The fuse ensures correct interruption of short-circuit currents according to the network short-circuit level. A “fuse-blown” device causes contactor opening.

Economic advantages

For a short-circuit level of 500 MVA, or of 50 kA at 6 kV, the saving in switchgear costs is more than 50% compared to a circuit breaker solution.

Technical advantages

Contactor: high switching rates and greater mechanical endurance than a circuit breaker.
Fuse: current limitation that considerably reduces the thermal and electrodynamic effects of a fault (fig. 1).

Transformer control and protection

Select the fuse using the table below.

Selection table (ratings in A)(1)

Service voltage (kV)	Type of fuse	Transformer rating (kVA)														
		25	**50**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**	**1250**	**1600**
3	Fusarc CF	16	25	50	50	63	80	80	125	125	125	160	200	250		
3.3		16	25	40	50	50	80	80	100	100	125	160	200	250		
5.5		10	16	31.5	31.5	40	50	50	63	80	100	125	125	160	200	
6		10	16	25	31.5	40	50	50	63	80	80	125	125	125	160	200
6.6		10	16	25	31.5	40	50	50	63	80	80	100	125	125	160	200
10		6.3	10	16	20	25	31.5	40	50	50	63	80	80	100	100	

(1) Installation without transformer overload

Utilisation guide

(cont.)

Motor protection

The Fusarc CF fuse in association with a Rollarc contactor constitutes a particularly effective protection device for MV motors.

Fuse rating

The three charts given below enable the fuse rating to be determined when we know the motor power (P in kW) and its rated voltage (Ua in kV).

Chart 1: this gives the rated current In (A) according to P and Ua.
Chart 2: this gives the start-up current Id (A) according to In (A).
Chart 3: this gives the appropriate rating according Id and the start-up duration time td (s).

η = motor efficiency
Ua = rated motor voltage
Id = start up current
Td = start up time

Comments

■ Chart 1 is plotted for a power factor of 0.92 and an efficiency of 0.94.

□ For values different to this, use the following equation: $In = \frac{P}{\eta\ \sqrt{3}\ Ua\ .\ p.f.}$

■ Chart 3 is given in the case of 6 start-ups spread over an hour or 2 successive startups

□ For n successive start-ups (n > 6), multiply Td by $\frac{n}{6}$

□ For p successive start-ups (p > 2), multiply Td by $\frac{p}{2}$

□ In the absence of any information, take Td = 10 s

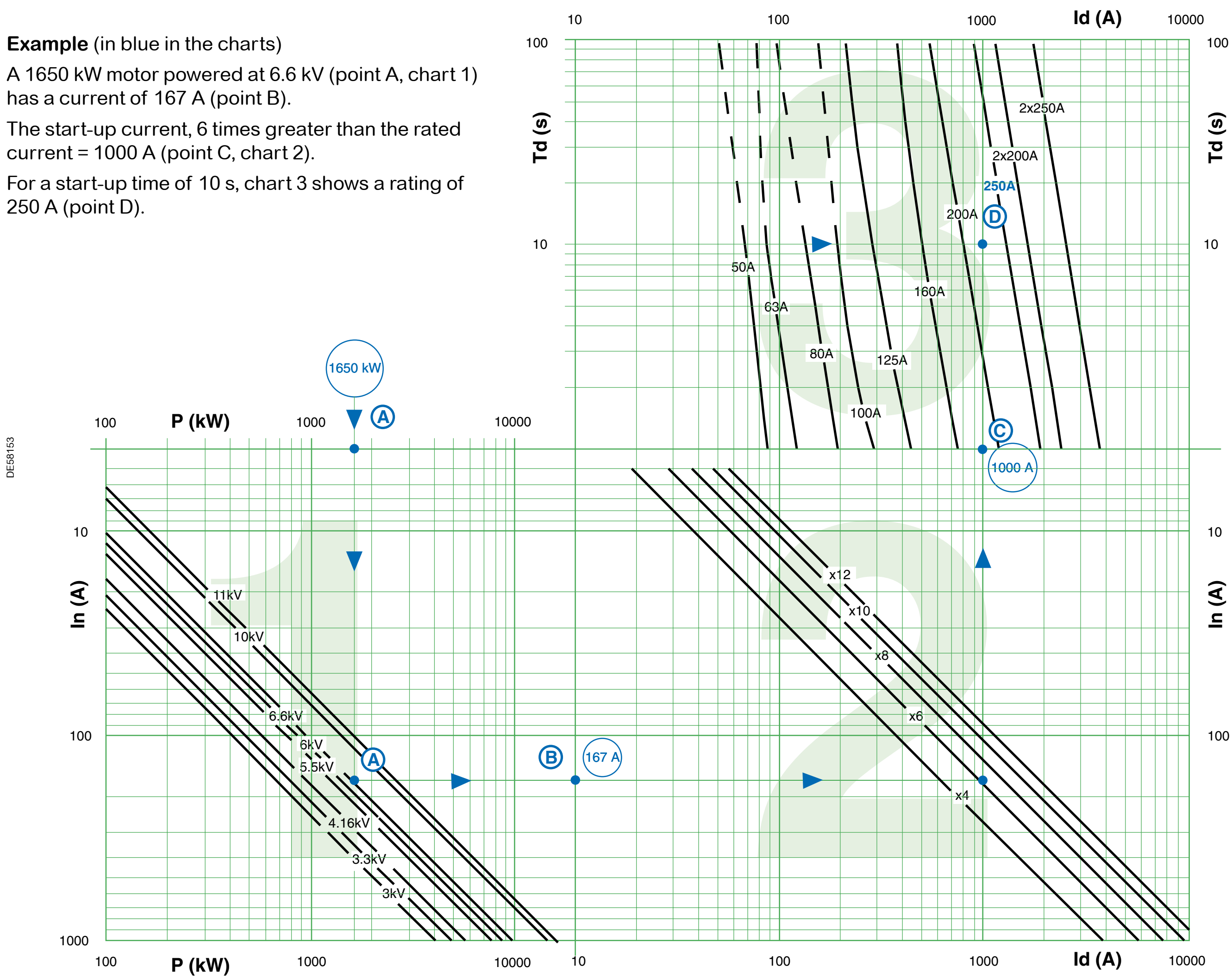
■ if the motor start-up is not direct, the rating obtained using the charts below may be less than the full load current of the motor. In this case, we have to choose a rating 20% over the value of this current, to take account of the cubicle installation.

Example (in blue in the charts)

A 1650 kW motor powered at 6.6 kV (point A, chart 1) has a current of 167 A (point B).

The start-up current, 6 times greater than the rated current = 1000 A (point C, chart 2).

For a start-up time of 10 s, chart 3 shows a rating of 250 A (point D).



Order Form

Contents

Contactor R400, R400D all versions **40**

Order form

Only one of the boxes (ticked X or filled ☐ by the needed value) have to be considered between each horizontal line.
Green box X corresponds to none priced functions.

Contactor R400, R400D

Quantity ☐

		R400 ☐		R400D ☐
Contactor type	Basic ☐	Fixed ☐		Withdrawable with cradle ☐
Characteristics		7.2 kV - 60 kVbil - 10 kA - 400 A ☐		12 kV - 60 kVbil - 8 kA - 400 A ☐
Closing trip release		48 Vdc ☐	110 Vdc ☐	220 Vdc ☐
		60 Vdc ☐	125 Vdc ☐	240 Vdc ☐
Relay 50 Hz	100 Vac ☐	110 Vac ☐	125-127 Vac ☐	220 Vac ☐
60 Hz	100 Vac ☐	110 Vac ☐		220 Vac ☐
50 Hz	100 Vac ☐	110 Vac ☐	125-127 Vac ☐	220 Vac ☐
60 Hz	100 Vac ☐	110 Vac ☐		220 Vac ☐
Opening trip release (only in R400D)			60 Vdc ☐	125 Vdc ☐
		48 Vdc ☐	110 Vdc ☐	220-240 Vdc ☐
50 Hz	100 Vac ☐	110 Vac ☐	125-127 Vac ☐	220 Vac ☐
60 Hz	100 Vac ☐	110 Vac ☐		220 Vac ☐

Options

For basic type

Mechanical interlocking between 2 contactors			
	500 mm ☐	650 mm ☐	800 mm ☐
Kit 75 kV	☐		☐
2 threshold pressure switch	☐		☐

For fixed or withdrawable type

HV fuses equipment (fuses no supplied)		☐
Interlocking in open position (without lock)	Ronis ☐	Profalux ☐
Leaflets language	French ☐	English ☐

Notes

Services

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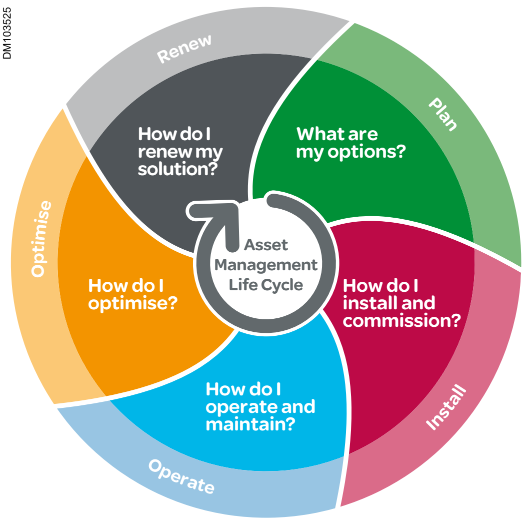
Schneider Electric Services

Peace of mind througout your installation life cycle

How can you cut costs and improve performance at the same time?

When it comes to your electrical distribution infrastructure, the answer is straight forward - get professional expertise.

DM103525



When it comes to your electrical distribution installation, we can help you:

- Increase productivity, reliability, and safety
- Mitigate risk and limit downtime
- Keep equipment up to date and extend lifespan
- Cut cost and increase savings
- Improve your return on investment

CONTACT US!

www.schneider-electric/electricaldistributionservices

Plan

Schneider Electric helps you to plan the full design and execution of your solution, looking at securing your process and optimising your time:
■ **Technical feasibility studies:** Accompany customer to design solution in his given environment.
■ **Preliminary design:** Accelerate turn around time to come to a fi nal solution design.

Install

Schneider Electric will help you to install effi cient, reliable and safe solutions based on your plans.
■ **Project Management:** Designed to help you complete your projects on time and within budget.
■ **Commissioning:** Ensures your actual performance versus design, through on site testing & commissioning, tools & procedures.

Operate

Schneider Electric helps you maximise your installation uptime and control your capital expenditures through its services offering.
■ **Asset Operation Solutions:** The information you need to increase safety, enhance installation training performance, and optimise asset maintenance and investment.
■ **Advantage Service Plans:** Customised services plans which cover preventive, predictive and corrective maintenance.
■ **On site Maintenance services:** Extensive knowledge and experience in electrical distribution maintenance. For Diagnosis services see pages ???
■ **Spare parts management:** Ensure spare parts availability and optimised maintenance budget of your spare parts.
■ **Technical Training:** To build up necessary skills and competencies. in order to properly operate your installations in safety.

Optimise

Schneider Electric propose recommendations for improved safety, availability, reliability & quality.
■ **MP4 Electrical Assessment:** Define improvement & risk management program.

Renew

Schneider Electric extends the life of your system while providing upgrades. Schneider Electric offers to take full responsibility for the end-of-life processing of old electrical equipments.
■ **ECOFIT™:** Keep up to date & improve performances of your electrical installations (LV,MV, Protection Relays…).
■ **MV product End of life:** Recycle & recover outdated equipment with end of life services.

Frequency of maintenance intervention

Schneider Electric equipment manufacturers recommend a schedule for maintenance activities to extend Electrical Distribution equipment performance over time. Frequencies under normal/healthy operation (minor equipment criticality and optimal environmental conditions) can be generally defined as follows:

Maintenance	Min. freq.(1)	Who		
		Manufacturer	Certified Partner	End user
Exclusive	every 4 years	■		
Advanced	every 2 years	■	■	
Light	every 1 year	■	■	■

(1) Recommended under normal operating conditions (minor equipment criticality and optimal environmental conditions).However, this recommended frequency should be increased according to: a) the level of criticality (low, major, critical) / b) the severity of environment conditions (i.e.corrosive, naval, offshore) following recommendations of Manufacturer's services.

ProDiag Breaker
Diagnosis of MV and LV Circuit Breakers

PM104628

ProDiag Breaker Objectives

Your priority is to enhance the reliability of your installation:
■ to ensure its continuity of service,
■ to minimize the time for maintenance & repair
■ to perform maintenance
■ Only on the equipment requiring it and only when necessary(conditional preventive maintenance)

What is ProDiag Breaker?

ProDiag Breaker is a Schneider Electric diagnosis tool.
ProDiag Breaker compares the mechanical and electrical parameters measured during the full operation of circuit breakers with the data collected from our production facilities. This allows detecting possible failure in advance. It measures, records and displays on a screen the key electrical parameters in MV and LV circuit breakers, relating to opening, closing and springloading operations.
All this data is automatically compared with the criteria for the circuit breaker designated in the software, which indicates which values are within the acceptable range, which are on the limit and which are outside it.
Two tests are always performed on each circuit breakers, one at minimum voltage and one at nominal voltage. A written report is generated and provided by Schneider Electric so that the customer can use it as a tool to define the necessary corrective action (maintenance, repair or replacement).

ProDiag Breaker is part is part of ProDiag preventive maintenance plan
Evaluation of circuit breakers using ProDiag Breaker includes:
■ Evaluation of the operating mechanism.
■ Measurement and comparison of the actual contact resistance with that specified by the manufacturer.
■ Measurement and comparison of the insulation resistance.
■ Evaluation of the general circuit breaker conditions based on the captured data.

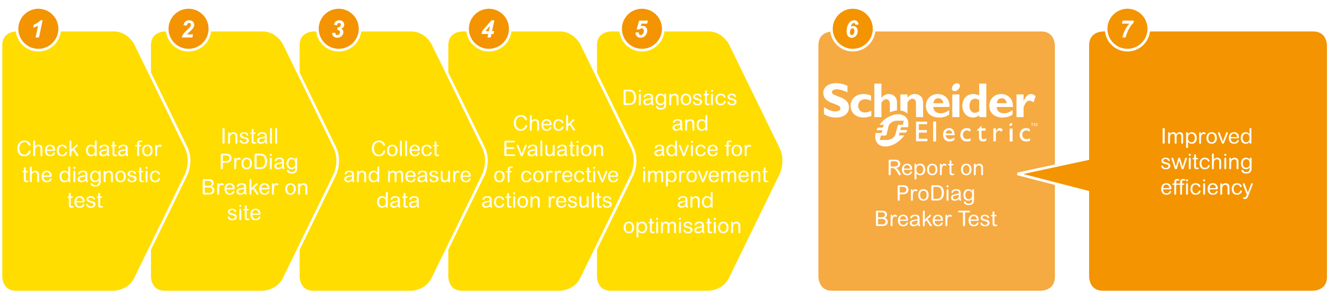
Moreover, analysis of the ProDiag Breaker time/ travel curve combined with the current curve of the coil and phase contact detects possible faults, such as:
■ Worn out latches and operating mechanisms.
■ Faulty coils.
■ Mechanical wear and tear and hardening of lubricating grease.
■ Defective shock absorbers.
■ Defective simultaneous contact operation (opening/closing).
Some maintenance programmes involve dismantling the circuit breaker mechanism to check its condition. ProDiag Breaker using signals captured from the circuit breaker operation, reduces maintenance costs compared with programs which check the circuit breakers manually.

Where can ProDiag Breaker reduce costs?

■ ProDiag Breaker significantly reduces the time taken to identify potential faults in a circuit breaker, using operational analysis rather than inspection and mechanical re-sets.
■ The software analyses the captured data and identifi es the specifi c problem area.
■ A device's normal operating life is increased by timely diagnostics of when and what repairs are necessary.
■ The tool comprises both hardware and software, resulting in a highly efficient predictive maintenance program.

Results

ProDiag Breaker provides a report of the complete nature of the circuit breaker, detailing: closing / opening time, contact simultaneity, bounce and resistance, mechanical closing and opening forces.
This report enables any required maintenance to be targeted and time in order to optimize the customer's maintenance plan.



Separated components

The following components can be ordered separately and can be adapted or replaced by the customer.

LV fuse

Label	References
Timed fuse 1,25A	29743212CN
Timed fuse 10A	29743112EE
Timed fuse 2,5A	29743212CZ
Timed fuse 2,5A	SPK0002SM6
Timed fuse 3,15A	SPK0015SM6
No-Timed fuse 2A	29743211CW
No-Timed fuse 4A	29743211DH
No-Timed fuse 8A	29743211EA

Fixed and withdrawable versions - Relay (KMO – KMF – KN)

Label	References
Relay 110 VCA	1REM008623
Relay 110VCC 5A	SPK0014SM6
Relay 120-137VCC	1REM008621
Relay 220VCA	1REM008625
Relay 220VCC	1REM008622
Relay 24-32VCC	1REM008617
Relay 48-60VCC	1REM008618
Relay 60VCC	1REM008619

Key lock

Label	References
Ronis lock	AAV86887
Profalux lock	AAV86892

Kit 75 kV impulse (basic version only)

Label	References
Kit 75 kV impulse	887824A

Mechanical interlocking between two contactors (basic version only)

Label	References
Y= 500mm	886818A
Y= 650mm	886818B
Y= 800mm	886818C

For other components please contact Schneider Electric services.

Notes

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