Medium Voltage Distribution

Rollarc R400 - R400D
Contactor 1 to 12 kV

Catalogue

2008
A new path for achieving your electrical installations

A comprehensive offer

The Rollarc range is part of a comprehensive offer of products that are perfectly coordinated to meet all medium and low voltage electrical distribution requirements. All of these products have been designed to work together: electrical, mechanical and communication compatibility.

The electrical installation is thus both optimised and has improved performance:

- better service continuity,
- increased personnel and equipment safety,
- guaranteed upgradeability,
- efficient monitoring and control.

You therefore have all the advantages at hand in terms of know-how and creativity for achieving optimised, safe, upgradeable and compliant installations.

Tools for facilitating the design and installation

With Schneider Electric, you have a complete range of tools to help you get to know and install the products whilst complying with current standards and good working practices. These tools, technical sheets and guides, design software, training courses, etc are regularly updated.

Schneider Electric is associating itself with your know-how and your creativity to produce optimised, safe, upgradeable and compliant installations

For a real partnership with you

A universal solution doesn’t exist because each electrical installation is specific. The variety of combinations on offer allows you to truly customise the technical solutions. You are able to express your creativity and put your know-how to best advantage when designing, manufacturing and exploiting an electrical installation.
## Contents

**Presentation**  
Field of application and utilisation range 2  
The Rollarc range 3  
Description of the basic version 4  
Description of the operation 5  

**Characteristics**  
Electrical characteristics 6  
Maximum switching capacities 7  
Contactor operating conditions 8  
Operating mechanism and equipment 9  
Principle electrical diagrams 10  
Basic versions 10-11  
Fixed versions 12-13  
Withdrawable versions 14-15  
Dimensions 16  
Cubicle installation 17  

**Rollarc technique**  
Advantages of Rollarc 18  
SF6 gas properties - Rotating arc technique 19  
Soft breaking 20  

**Fuse-contactor assembly**  
Utilisation guide 21  

**Order form**  

**Services**  

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*Rollarc R400 - R400D*
Description

The Rollarc three-pole indoor contactor uses sulphur hexafluoride (SF6) gas for insulation and circuit-breaking. Circuit-breaking 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 2.5 bars.

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 may be continuously monitored.

Field of application

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

Utilisation range

Standards

Rollarc complies with the following standards and specifications:
- IEC publication 60470
- IEC 62271-105.

Installation references

- Salmer, Michelin, Shell, Esso, CFR, Pechiney, Naphtachimie, Usinor, Sacilor, Sollac
- Nuclear and conventional thermal power stations
- Mines de Saar (Germany)
- Nokia (Finland), Kafak (Sweden).
The Rollarc R400 and R400D contactors are available in three versions:

**Basic version**
Contactor alone, without the cradle.

**Fixed version**
The contactor with the control auxiliaries is mounted on a fixed cradle.

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

Fixed and withdrawable versions 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.
Presentation

Description of the basic version

**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 60694).
The filling pressure remains constant throughout the life of the contactor.

**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.

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

**Auxiliary contacts**
The auxiliary switch subassemblies are always mounted on the enclosure.

**Mechanical latching**
The R400D is actuated by electromagnetic 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.
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.

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).
## Electrical characteristics

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Rated voltage</th>
<th>Rated insulation level</th>
<th>Breaking capacity at U (kV)</th>
<th>Rated current (3)</th>
<th>Making capacity</th>
<th>Short time current</th>
<th>Mechanical endurance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ur 50-60 Hz kV</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.3 to 4.76</td>
<td>60</td>
<td>20</td>
<td>10</td>
<td>50</td>
<td>400</td>
<td>25</td>
<td>100000 operations</td>
</tr>
<tr>
<td>7.2</td>
<td>60</td>
<td>20</td>
<td>10</td>
<td>50</td>
<td>400</td>
<td>25</td>
<td>100000 operations</td>
</tr>
<tr>
<td>12</td>
<td>60</td>
<td>28</td>
<td>8</td>
<td>40</td>
<td>400</td>
<td>20</td>
<td>100000 operations</td>
</tr>
<tr>
<td>(1) Optional: 75 kV impulse/28 kV rms on basic version only</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2) Fusarc CF fuses: see sheet AC0479 (fuses 3-36 kV)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(3) 400 A continuous (no overload possible).</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Opening time at U

<table>
<thead>
<tr>
<th></th>
<th>Without relays: 20 to 40 ms</th>
<th>Without relays: 40 to 60 ms</th>
<th>Without relays: 75 to 145 ms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without relays: 30 to 50 ms</td>
<td>With relays: 50 to 70 ms</td>
<td>With relays: 85 to 155 ms</td>
<td></td>
</tr>
</tbody>
</table>

### Breaking time

<table>
<thead>
<tr>
<th></th>
<th>DC</th>
<th>AC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated supply voltage</td>
<td>48, 60, 110, 125, 220 V</td>
<td>110, 127, 220 V (4)</td>
</tr>
<tr>
<td>Power consumption: Pick-up</td>
<td>1050 W</td>
<td>900 VA</td>
</tr>
<tr>
<td>Seal-in</td>
<td>30 W</td>
<td>40 VA</td>
</tr>
<tr>
<td>Opening</td>
<td>80 W</td>
<td>100 VA</td>
</tr>
</tbody>
</table>

(4) For other values, consult us

## Auxiliary switches

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Rated current</th>
<th>Breaking capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated current DC</td>
<td>10 A</td>
<td>DC: (L/R = 0.015 s) 0.5 A / 220 V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AC: (p.f. = 0.3) 10 A / 220 V</td>
</tr>
</tbody>
</table>

### 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 250 A
  - 50 operating cycles at 10 000 A.
- **R400D**
  - 100 000 operating cycles at 200 A
  - 50 operating cycles at 10 000 A.
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 22
- for transformers, technical sheet AC0479E.

### Characteristics

<table>
<thead>
<tr>
<th>Service voltage kV</th>
<th>Without fuses</th>
<th>With fuses</th>
<th>Motors in k (1)</th>
<th>Transformer (standard max. rating) kVA</th>
<th>Capacitors (single bank) kVar</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Motors (1) kW</td>
<td>Transfo. kVA</td>
<td>Capacitor banks kvar</td>
<td>Max. fuse rating see TS AC0479E (I = 292 mm)(2)</td>
<td>5 s start ls/In = 6</td>
</tr>
<tr>
<td>3.3</td>
<td>1560</td>
<td>1800</td>
<td>1255</td>
<td>250</td>
<td>1160</td>
</tr>
<tr>
<td>3.6</td>
<td>1690</td>
<td>1965</td>
<td>1370</td>
<td>250</td>
<td>1280</td>
</tr>
<tr>
<td>4.16</td>
<td>1960</td>
<td>2270</td>
<td>1585</td>
<td>200</td>
<td>820</td>
</tr>
<tr>
<td>6.6</td>
<td>3100</td>
<td>3600</td>
<td>2510</td>
<td>200</td>
<td>1296</td>
</tr>
<tr>
<td>7.2</td>
<td>3380</td>
<td>3925</td>
<td>2740</td>
<td>200</td>
<td>1410</td>
</tr>
<tr>
<td>10</td>
<td>4690</td>
<td>5455</td>
<td>3810</td>
<td>100</td>
<td>520</td>
</tr>
<tr>
<td>12</td>
<td>5630</td>
<td>6545</td>
<td>4570</td>
<td>100</td>
<td>525</td>
</tr>
</tbody>
</table>

(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 21).
IEC standard 60470 (chapter 2) 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.
  
  \[ t_1: \text{standardized values } 10 \text{ min} - 30 \text{ min} - 60 \text{ min} - 90 \text{ min} \]
  \[ t_2: \text{time required for the contactor to cool to the temperature of the cooling medium.} \]

**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 \( I_p \), figure 1 can be used to determine the maximum duration of \( T_{oc} \) along line 1.

The time required for cooling \( T_c \) to ensure that the equilibrium temperature is not exceeded may be determined using figure 2.

**Example:** a Rollarc contactor with a permanent operating current \( I_p = 240 \text{ A} \) can withstand a temporary overload of 2400 A for 32 seconds.

The cooling time \( T_c \) 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:

- \( I_{oc} \) overcurrent
- \( T_{oc} \) duration of overcurrent
- \( I_c \) cooling current
- \( T_c \) duration of cooling.

**Example:**

\( I_{oc} = 1200 \text{ A} \) for 10 seconds

\( T_c = 200 \text{ A} \) for 2 minutes.
**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 optional pressure switch for alarm indications closes a changeover switch if the gas pressure drop below 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

<table>
<thead>
<tr>
<th>Code</th>
<th>R400 magnetically held contactor</th>
<th>R400D magnetically latched contactor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Basic version</td>
<td>Fixed version</td>
</tr>
<tr>
<td></td>
<td>AC/DC</td>
<td>AC/DC</td>
</tr>
<tr>
<td>Closing electromagnet</td>
<td>YF</td>
<td>☐</td>
</tr>
<tr>
<td>Holding electromagnet (seal-in)</td>
<td>YM</td>
<td>☐</td>
</tr>
<tr>
<td>Shunt trip</td>
<td>YD</td>
<td>☐</td>
</tr>
<tr>
<td>Number of auxiliary switches available (1)</td>
<td>CA</td>
<td>9</td>
</tr>
<tr>
<td>Pressure switch</td>
<td>P</td>
<td>☐</td>
</tr>
<tr>
<td>Anti-pumping relay</td>
<td>KN</td>
<td>☐</td>
</tr>
<tr>
<td>Closing relay</td>
<td>KMF</td>
<td>☐</td>
</tr>
<tr>
<td>Opening relay</td>
<td>KMO</td>
<td>☐</td>
</tr>
<tr>
<td>Operation counter (1)</td>
<td>PC</td>
<td>☐</td>
</tr>
<tr>
<td>Interlocking auxiliary switch (1)</td>
<td>SE</td>
<td>☐</td>
</tr>
<tr>
<td>Interlock</td>
<td></td>
<td>☐</td>
</tr>
<tr>
<td>“Service position” indication</td>
<td>SQ2</td>
<td>☐</td>
</tr>
<tr>
<td>Equipment for MV fuses (fixing and “fuse blown” contacts)</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Withdrawable fixed frame (2)</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>75 kV kit</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Mechanical interlock</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

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

- Standard equipment
- ^ Relay not supplied, wired by user (see diagrams)
- ○ Optional accessories
Characteristics

Principle electrical diagram
Rollarc 400 basic version

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**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)

**FUBT: low voltage fuse**

<table>
<thead>
<tr>
<th>Un (V)</th>
<th>48</th>
<th>60-72</th>
<th>100-127</th>
<th>220-250</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ia (A)</td>
<td>10</td>
<td>3.15</td>
<td>2.5</td>
<td>1.25</td>
</tr>
</tbody>
</table>

**KN: end of closing relay**

<table>
<thead>
<tr>
<th>Un (V)</th>
<th>48</th>
<th>110</th>
<th>220</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ia (A)</td>
<td></td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>p.f. = 0.4</td>
<td>1.1</td>
<td>0.4</td>
<td>0.24</td>
</tr>
<tr>
<td>L/R = 40 ms</td>
<td>0.8</td>
<td>0.3</td>
<td>0.18</td>
</tr>
</tbody>
</table>

**Coil consumption**

<table>
<thead>
<tr>
<th></th>
<th>~3 W</th>
<th>~4 VA</th>
</tr>
</thead>
</table>

**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

**SO: opening push button**

**SF: closing push button**

**PC: 6-digit operation counter**
**Characteristics**

**Principle electrical diagram**

**Rollarc 400D basic version**

---

### 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
- \( \sim \) 100 VA

**YF**: closing coils
- 1050 W
- \( \sim \) 900 VA

**YM**: seal-in-coils
- 30 W
- \( \sim \) 40 VA

SQ1: limit switch. Seal-in coils contact
- C: capacitor \( C = \mu F \times 2 \)
- Umax = 250 V
- Ra: resistance \( R = 1.2 \, \Omega \)
- F: varistor \( U_{ms} = 250 \, V \) type : GE Mov
- I: breaking \( \sim (p.f. = 0.3) 10 \, \text{A/220 V} \)
- \( (L/R = 0.15) 0.5 \, \text{A/220 V} \)
- P: closing pressure switch
- \( \sim 2.2 \, \text{A/220 V} \)
- \( \sim 0.4 \, \text{A/220 V} \)
- SO: opening push button
- SF: closing push button
- PC: 6-digit operation counter

**FUBT**: low voltage fuse

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</tbody>
</table>

**KN**: end of closing relay

<table>
<thead>
<tr>
<th>Un (V)</th>
<th>48</th>
<th>110</th>
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</tr>
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<tr>
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<td>10</td>
<td>10</td>
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</table>

<table>
<thead>
<tr>
<th>p.f. = 0.4 ( \sim (A) )</th>
<th>1.1</th>
<th>0.4</th>
<th>0.24</th>
</tr>
</thead>
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<th>L/R = 40 ms ( \sim (A) )</th>
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<th>0.3</th>
<th>0.18</th>
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</table>

**Coil consumption**
- 3 W
- \( \sim 4 \, \text{VA} \)
Characteristics

Principle electrical diagram
Rollarc 400 fixed version
with electrical auxiliaries

---

**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

<table>
<thead>
<tr>
<th>YF: closing coils</th>
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<th>~ 900 VA</th>
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<tbody>
<tr>
<td>YM: seal-in-coils</td>
<td>30 W</td>
<td>~ 40 VA</td>
</tr>
</tbody>
</table>

SQ1: limit switch, Seal-in coils contact
C: capacitor \[ C = \frac{I_f}{U_f} \times 2 \] \[ U_{\text{max}} = 250 \text{ V} \]
Ra: resistance \[ R = 1.2 \text{ K} \Omega \]
F: varistor \[ U_{\text{rms}} = 250 \text{ V} \] type: GE Mov
I: breaking \( \sim (\text{p.f.} = 0.3) 10 \text{ A/220 V} \)
\[ \sim (L/R = 0.15) 0.5 \text{ A/220 V} \]
P: closing pressure switch \( \sim 2.2 \text{ A/220 V} \)

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

---

**FUBT: low voltage fuse**

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<tr>
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</tr>
</tbody>
</table>

**Coil consumption** \( \sim 3 \text{ W} \) ~ 4 VA

---

---
**Characteristics**

**Principle electrical diagram**
Rollarc 400D fixed version
with electrical auxiliaries

---

**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)

---

<table>
<thead>
<tr>
<th>Component</th>
<th>Symbol</th>
<th>Power (W)</th>
<th>VA</th>
<th>Current (A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>YD: shunt trip</td>
<td></td>
<td>30</td>
<td>40</td>
<td>0.18</td>
</tr>
<tr>
<td>YF: closing coils</td>
<td></td>
<td>1050</td>
<td>900</td>
<td>0.4</td>
</tr>
<tr>
<td>YM: seal-in-coils</td>
<td></td>
<td>30</td>
<td>40</td>
<td>0.3</td>
</tr>
</tbody>
</table>

SQ1: limit switch, Seal-in-coils contact
C: capacitor $C = I_{uf} \times 2$, $U_{max} = 250$ V
R: resistance $R = 1.2$ KΩ
F: varistor $U_{rms} = 250$ V, type: GE Mov
I: breaking $I_{p.f.} = 0.3 \times 10$ A/220 V
$P = 0.15 \times 0.5$ A/220 V
P: closing pressure switch
SO: opening push button
SF: closing push button
PC: 6-digit operation counter

---

FUBT: low voltage fuse

<table>
<thead>
<tr>
<th>Un (V)</th>
<th>48</th>
<th>60-72</th>
<th>100-127</th>
<th>220-250</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ia (A)</td>
<td>10</td>
<td>3.15</td>
<td>2.5</td>
<td>1.25</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Un (V)</th>
<th>48</th>
<th>110</th>
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</tr>
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<td>10</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

p.f. = 0.4 $I_{L/R} = 0.15$ A
L/R = 40 ms

Coil consumption $c$ 3 W $\sim 4$ VA

---
Characteristics

Principle electrical diagram
Rollarc 400 withdrawable version
with electrical auxiliaries

### Standard Schneider Electric supply

<table>
<thead>
<tr>
<th>1: control relay</th>
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<td></td>
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<td></td>
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</tr>
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</table>

---

<table>
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<tr>
<th></th>
<th>FUBT: low voltage fuse</th>
<th>KN: end of closing relay</th>
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<tr>
<td>Un (V)</td>
<td>48 60-72 100-127 220-250</td>
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<td>See table below</td>
<td></td>
</tr>
<tr>
<td>la (A)</td>
<td>10 3.15 2.5 1.25</td>
<td>10 10 10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>p.f.</td>
<td>0.4</td>
<td>0.4</td>
<td>0.24</td>
<td></td>
</tr>
<tr>
<td>L/R = 40 ms</td>
<td>(A)</td>
<td>0.8 0.3 0.18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coils consumption</td>
<td>~ 3 W</td>
<td>~ 4 VA</td>
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---

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

Principle electrical diagram
Rollarc 400D withdrawable version
with electrical auxiliaries

---

**Standard Schneider Electric supply**

1: control relay
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---

- **mechanical links**
- Rollarc printed circuit alone
- connections supplied
- connections not supplied

---

**YD**: shunt trip
c: 80 W ～ 100 VA
a: 1050 W ～ 900 VA
YM: seal-in-coils
c: 30 W ～ 40 VA

**SQ1**: limit switch. Seal-in coils contact
C: capacitor  C = μF x 2  Umax = 250 V
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
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**FUBT**: low voltage fuse

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<td>10</td>
</tr>
<tr>
<td>p.f. = 0.4 ～ (A)</td>
<td>1.1</td>
<td>0.4</td>
<td>0.24</td>
</tr>
<tr>
<td>L/R = 40 ms ～ (A)</td>
<td>0.8</td>
<td>0.3</td>
<td>0.18</td>
</tr>
</tbody>
</table>

**Coil consumption** ～ 3 W
～ 4 VA
Characteristics

Dimensions

Basic version

(1) Mounting dimensions
Approximative weight: 35 kg

Fixed version

(1) Mounting dimensions
Approximative weight: 65 kg

Withdrawable version

(1) Mounting dimensions
Approximative weight: 85 kg
**Characteristics**

**Cubicle installation**

**Withdrawable MCset factory-built cubicle**

See technical sheet AC0467EN.

**SM6 factory-built cubicle**

See technical sheet AMTED398078EN.
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.
The Rollarc contactor can do 300,000 operations in R400 version and 100,000 operations in 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 2.5 bars.

**Continuous monitoring of the contactor pressure** (optional)
A pressure switch actuates a contact in the event of an accidental drop in the pressure of the SF6 gas in the Rollarc unit.

**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.
**Rollarc technique**

**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.

**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.
**Rollarc 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

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

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

Example: peak voltage \( 7.2 \times 1.76 \frac{U^2}{\sqrt{3}} = 10.35 \text{ kV} \)

### 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
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)$^{(1)}$

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

$^{(1)}$ Installation without transformer overload
Fuse-contactor assembly

Utilisation guide (continued)

\[ \eta = \text{motor efficiency} \]
\[ U_a = \text{rated motor voltage} \]
\[ I_d = \text{start up current} \]
\[ T_d = \text{start up time} \]

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

**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:

\[ I_n = \frac{P}{\eta} \sqrt[3]{U_a \cdot \text{p.f.}} \]

- 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 \( T_d = 10 \) 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).
## Contactor R400, R400D

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>R400</th>
<th>R400D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contactor type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Withdrawable with cradle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Characteristic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.2 kV - 60 kVb1 - 10 kA - 400 A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 kV - 60 kVb1 - 8 kA - 400 A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closing trip release</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50 Hz 100 Vac</td>
<td>48 Vdc</td>
<td>60 Vdc</td>
</tr>
<tr>
<td>60 Hz 100 Vac</td>
<td>110 Vdc</td>
<td>125-127 Vac</td>
</tr>
<tr>
<td>Relay</td>
<td>50 Hz 100 Vac</td>
<td>110 Vdc</td>
</tr>
<tr>
<td>60 Hz 100 Vac</td>
<td>110 Vdc</td>
<td>220 Vac</td>
</tr>
<tr>
<td>Opening trip release (only in R400D)</td>
<td>60 Vdc</td>
<td>60 Hz 100 Vac</td>
</tr>
<tr>
<td>50 Hz 100 Vac</td>
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<td>125-127 Vac</td>
</tr>
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## Options

### For basic type
- Mechanical interlocking between 2 contactors
  - 500 mm | 650 mm | 800 mm |

### For fixed or withdrawable type
- HV fuses equipment (fuses no supplied)
- Interlocking in open position (without lock)
  - Ronis | Profalux |

### Leaflets language
- French | English |

---

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.
For “Spare parts”,
contact Schneider Electric Services.