3TL Vacuum Contactors
General Description

3TL81 Vacuum Contactors
as Economy Contactors

3TL6 Vacuum Contactors
as Universal Contactors

3TL71 Vacuum Contactors
as Special Vacuum Contactors
Application

3TL vacuum contactors are 3-pole contactors with electromagnetically-operated mechanism for medium-voltage switchgear. They are load-break switchgear with a limited short-circuit making and short-circuit breaking capacity and are used for high switching frequencies (> 10,000 operating cycles).

The vacuum contactors are suitable for operational switching of AC loads in indoor and can perform, for example, the following switching duties:

- Switching of three-phase motors in AC-3 and AC-4 operation
- Switching of transformers
- Switching of reactors
- Switching of ohmic loads (e.g. arc furnaces)
- Switching of capacitors

With reversing contactor combinations, only one contactor is required for each direction of rotation, if HV HRC fuses are used for short-circuit protection.

Application examples

- Conveyor and lift systems
- Pump stations
- Ventilation and heating
- Systems for reactive-power compensation

for the following branches of industry:

- Mining
- Steel
- Gas and petrochemicals
- Paper
- Cement
3TL Vacuum Contactors

General Description

Application

**Versions**

**3TL81 vacuum contactor**
as economy contactor
- Up to 1 mill. mechanical operating cycles
- Up to 7.2 kV

**3TL6 vacuum contactor**
as universal contactor
- Up to 3 mill. mechanical operating cycles
- Up to 12 kV

**3TL71 vacuum contactor**
as special contactor
- Up to 1 mill. mechanical operating cycles
- Up to 24 kV
### Fields of application

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<td>![Symbol]</td>
<td>● up to 7.2 kV/400 A up to 12 kV/450 A up to 24 kV/800 A</td>
<td>● 3TL81, 1 mill. 3TL6, 3 mill. 3TL71, 1 mill.</td>
<td>Conveyor and lift systems, compressors, pump stations, ventilation and heating</td>
</tr>
<tr>
<td>Transformers</td>
<td>![Symbol]</td>
<td>● up to 7.2 kV/400 A up to 12 kV/450 A up to 24 kV/800 A</td>
<td>● 3TL81, 1 mill. 3TL6, 3 mill. 3TL71, 1 mill.</td>
<td>Secondary distribution switchgear, industrial network distribution systems</td>
</tr>
<tr>
<td>Reactors</td>
<td>![Symbol]</td>
<td>● up to 7.2 kV/400 A up to 12 kV/450 A up to 24 kV/800 A</td>
<td>● 3TL81, 1 mill. 3TL6, 3 mill. 3TL71, 1 mill.</td>
<td>Industrial network distribution systems, DC link reactors, reactive-power compensation systems</td>
</tr>
<tr>
<td>Ohmic loads</td>
<td>![Symbol]</td>
<td>● up to 7.2 kV/400 A up to 12 kV/450 A up to 24 kV/800 A</td>
<td>● 3TL81, 1 mill. 3TL6, 3 mill. 3TL71, 1 mill.</td>
<td>Heating resistors, arc furnaces</td>
</tr>
<tr>
<td>Capacitors</td>
<td>![Symbol]</td>
<td>● up to 7.2 kV/250 A up to 12 kV/250 A up to 24 kV/400 A</td>
<td>● 3TL81, 1 mill. 3TL6, 3 mill. 3TL71, 1 mill.</td>
<td>Reactive-power compensation systems, capacitor banks</td>
</tr>
</tbody>
</table>

### Features

#### Quality standard
DIN EN ISO 9001

3TL vacuum contactors are routine tested to specifications that go beyond those laid down by the relevant standards:
- Continuous testing during manufacturing processes
- Several operating cycles per routine test
- Current measured-value acquisition - such as, for example, operating speed and contact travel - compared with the values from the long-term tests.

Other features:
- Stable measured values with tight tolerances
- Low power loss
- Constant long-term thermal stability.

#### Freedom from maintenance

3TL vacuum contactors are maintenance-free
- Under normal ambient conditions according to IEC 60694 and DIN EN 60694 in the temperature range stated
- Through to the end of the vacuum interrupters’ service life.

#### Environmental compatibility
DIN EN ISO 14001

3TL vacuum contactors are
- Environmentally compatible with respect to the materials used and manufacturing processes
- Environmentally neutral with respect to how they operate and during switching operations
- Simple to dispose of at the end of their service life.
Construction principle in comparison

The 3TL vacuum contactors are made up of the following modules:

- **Medium-voltage section** with
  - Vacuum interrupters
  - Main conductor terminals

- **Low-voltage section** with
  - Operating mechanism (magnetic system)
  - Electronic module (electronic economy circuit)
  - Mechanical closing latching
  - Auxiliary contact block.
3TL Vacuum Contactors

General Description

Construction principle in comparison

3TL71 vacuum contactor (side view)
Vacuum interrupter

Arc-quenching system
As the contacts open, the current that is to be interrupted initiates a metal-vapor arc discharge. Current continues flowing through the metal-vapor plasma until the next current zero. The arc extinguishes at approximately current zero. The metal vapor loses its conductivity within a few microseconds, which very quickly reestablishes the dielectric strength of the contact gap.

A certain minimum current is needed in order to maintain the metal-vapor arc discharge. The arc will be chopped before the natural current zero if the current falls below this value.

In order to prevent impermissible overvoltages when performing switching operations in inductive circuits, the chopping current must be limited to the lowest possible value. Due to the use of a special contact material, the chopping current in the vacuum contactors 3TL is only $\leq 5$ A.

Due to the rapid recovery of the dielectric strength of the contact gap, the arc is safely quenched even in cases where contact separation occurs immediately before a current zero. Consequently, the arcing time of the last poles to clear is no more than 15 ms.

With AC circuit-breakers, the actual task of the arc-quenching system is to deionize the contact gap immediately after current zero.

In the cases of all the conventional methods of arc-quenching this means that the arc is being cooled even before the minimum quenching gap and the subsequent current zero are reached. As a result, the arc power is unintentionally increased to a considerable degree.

With the vacuum contactors, on the other hand, the arc is not cooled. The metal-vapor plasma has a high conductivity which results in an extremely low arc voltage with values from only 20 to 50 V.

For this reason, and due to the short arcing times, the amount of energy conversion in the contact gap is very low. This relatively low stress level means that the quenching system is maintenance-free and allows up to 1 million electrical operating cycles.

Due to the very low pressures of less than $10^{-9}$ bar in the interrupter under steady-state conditions, contact gaps of only 5 to 7 mm are required to achieve a high dielectric strength in 3TL vacuum contactors.
### General Description

#### 3TL Vacuum Contactors

**3TL81 vacuum contactor**
- Rated voltage: up to 7.2 kV
- Rated normal current: 400 A
- Service life - contactor: operating cycles mech. service life: 1 mill.
  - electr. service life: 0.25 mill.
- Chopping current: ≤ 0.6 A
- Auxiliary contacts: positively driven auxiliary contacts 4 NO, 4 NC
- Operating mechanism: underneath to the vacuum interrupters
- Type of construction: slimline
- Main conductor terminals: at rear on the vacuum interrupters
- Auxiliary conductor terminals: direct tapping at the terminals (optional: wiring of the auxiliary contacts on the central terminal block)
- Additional modules: mechanical closing latching, long operating mechanism shaft for powerless, external built-on accessories

**3TL6 vacuum contactor**
- Rated voltage: up to 12 kV
- Rated normal current: up to 450 A
- Service life - vacuum interrupter: operating cycles mech. service life: 3 mill.
  - electr. service life: 2 mill.
- Chopping current: < 5 A
- Auxiliary contacts: positively driven auxiliary contacts 6 NO, 5 NC
- Operating mechanism: at rear to the vacuum interrupters
- Type of construction: compact
- Main conductor terminals: at front on the vacuum interrupters
- Auxiliary conductor terminals: terminal block with testing options in installed state (optional: withdrawable terminal block)
- Additional modules: mechanical closing latching, mechanical closing lock-out, extension or reduction of the break time

**3TL71 vacuum contactor**
- Rated voltage: up to 24 kV
- Rated normal current: 800 A
- Service life - contactor: operating cycles mech. service life: 1 mill.
  - electr. service life: 1 mill.
- Chopping current: < 5 A
- Auxiliary contacts: positively driven auxiliary contacts 8 NO, 8 NC
- Operating mechanism: underneath to the vacuum interrupters
- Type of construction: slimline
- Main conductor terminals: at rear on the vacuum interrupters
- Auxiliary conductor terminals: wiring of the auxiliary contacts on the central plug connector
- Additional modules: on request

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**Technical data in comparison**

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<tr>
<td>Rated voltage</td>
<td>up to 7.2 kV</td>
<td>up to 12 kV</td>
<td>up to 24 kV</td>
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<tr>
<td>Rated normal current</td>
<td>400 A</td>
<td>up to 450 A</td>
<td>800 A</td>
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<tr>
<td>Switching frequency</td>
<td>up to 1200 operating cycles/h</td>
<td>up to 1200 operating cycles/h</td>
<td>up to 60 operating cycles/h</td>
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<tr>
<td>Service life - contactor</td>
<td>operating cycles</td>
<td>operating cycles</td>
<td>operating cycles</td>
</tr>
<tr>
<td>- vacuum interrupter</td>
<td>mech. service life: 1 mill.</td>
<td>mech. service life: 3 mill.</td>
<td>mech. service life: 1 mill.</td>
</tr>
<tr>
<td></td>
<td>electr. service life: 0.25 mill.</td>
<td>electr. service life: 2 mill.</td>
<td>electr. service life: 1 mill.</td>
</tr>
<tr>
<td>Chopping current</td>
<td>≤ 0.6 A</td>
<td>&lt; 5 A</td>
<td>&lt; 5 A</td>
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<tr>
<td>Electronic economy circuit</td>
<td>classification into voltage ranges 24 V 48 V to 60 V 110 V to 250 V irrespective of DC or AC operation</td>
<td>none</td>
<td>none</td>
</tr>
<tr>
<td>Auxiliary contacts</td>
<td>positively driven auxiliary contacts 4 NO, 4 NC</td>
<td>positively driven auxiliary contacts 6 NO, 5 NC</td>
<td>positively driven auxiliary contacts 8 NO, 8 NC</td>
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<tr>
<td>Operating mechanism</td>
<td>underneath to the vacuum interrupters</td>
<td>at rear to the vacuum interrupters</td>
<td>underneath to the vacuum interrupters</td>
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<tr>
<td>Type of construction</td>
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<td>compact</td>
<td>slimline</td>
</tr>
<tr>
<td>Main conductor terminals</td>
<td>at rear on the vacuum interrupters</td>
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<td>at rear on the vacuum interrupters</td>
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<tr>
<td>Auxiliary conductor terminals</td>
<td>direct tapping at the terminals (optional: wiring of the auxiliary contacts on the central terminal block)</td>
<td>terminal block with testing options in installed state (optional: withdrawable terminal block)</td>
<td>wiring of the auxiliary contacts on the central plug connector</td>
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<td>Additional modules</td>
<td>mechanical closing latching, long operating mechanism shaft for powerless, external built-on accessories</td>
<td>mechanical closing latching, mechanical closing lock-out, extension or reduction of the break time</td>
<td>on request</td>
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**Nameplate**

![Nameplate Image](image-url)
Switching duties

Cases of switching line and load-side operating states

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<td>Transformers in rush</td>
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<td>Motors during operation</td>
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<td>Back-to-back switching of capacitors</td>
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<table>
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<th>Switching in case of short-circuit</th>
<th>Fault making</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Locked rotor motor</td>
</tr>
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</table>

| Switching under earth-fault conditions | Fault on the line side:                              |
|                                       | - unloaded cables, overhead lines                    |
|                                       | - loaded cables, overhead lines                      |
|                                       | Fault on the load side:                              |
|                                       | - unloaded cables, overhead lines                    |
|                                       | - loaded cables, overhead lines                      |

1) Limited fault breaking capacity.

Switchgear used with vacuum contactors

Switching of motors

3TL vacuum contactors are particularly suitable for frequent switching of motors. As the chopping current of the contactors is ≤ 5 A, no impermissibly high overvoltages occur in the operational switching of started-up motors. If, however, high-voltage motors with a starting current of ≤ 600 A are switched off during start-up, overvoltages may occur. The level of these overvoltages can be reduced to safe values by means of special surge limiters.

The 3EF surge limiters are preferably arranged in the cable connection compartment parallel to the cable sealing end.

The surge limiters are made up of non-linear discharge resistors (SIOV metal-oxide varistors) and a series-connected spark gap.

Care must be taken during installation that for mechanical reasons the surge limiter is connected flexibly on one side.
### General Description

#### Circuit examples for overvoltage protection for three-phase motors with starting current ≤ 600A

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<td>Switching of started-up motors</td>
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<tr>
<td><img src="image2" alt="Occasional switching of motors just started-up (on fault)" /></td>
<td>Occasional switching of motors just started-up (on fault)</td>
</tr>
<tr>
<td><img src="image3" alt="Frequent switching during AC-4 operation" /></td>
<td>Frequent switching during AC-4 operation</td>
</tr>
</tbody>
</table>

Legend: 1 with surge limiter

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**Switching of transformers**

In case of switching of inductive currents, current chopping at the contact gap may give rise to overvoltages. However due to the special contact material used in 3TL contactors, the chopping current is limited to ≤ 5 A. This means that no dangerous overvoltages develop when unloaded transformers are switched off.

**Switching of capacitors**

3TL vacuum contactors can, at rated voltages up to 12 kV, cut off capacitive currents of up to 250 A without restrike and therefore without overvoltages.

**Overvoltage protection by means of limiters**

Overvoltages can be caused by multiple re-ignition or virtual current chopping, for example when switching stalled motors or motors in the course of start-up. Endangered are motors under switching of a starting current of ≤ 600 A. Surge limiters assure positive protection against overvoltage; see above for circuit examples.
Short-circuit protection

The 3TL vacuum contactors are not designed to switch short-circuit currents. It is therefore absolutely essential to provide short-circuit protection.

The best protection is provided by HV HRC fuses, but circuit-breakers can also be used subject to the described conditions “short-circuit protection by means of circuit-breakers”.

Short-circuit protection by means of HV HRC fuses

HV HRC fuses have a current-limiting effect with high short-circuit currents, i.e. the fuse limits the short-circuit current to the cut-off current.

When the fuses are selected, the type of load must be taken into account, for example, motor, transformer or capacitors.

For an example of coordination of an HV HRC fuse with overcurrent-time protection, see the chart below.

Example for coordination of a 125 A HV HRC fuse characteristic with a motor characteristic

Legend

1 Characteristic of HV HRC fuse 3GD1125-4D
2 Characteristic of maximum-current/time protection device
3 Motor starting time
4 Motor starting current

Coordination of the motor circuit components

- The time/current characteristic must be at the right of the motor starting current (point A).
- The rated current of the HV HRC fuse link must exceed the normal current of the motor.
- The current that prevails at the point of intersection B of the HV HRC fuse link’s characteristic and the characteristic of the maximum-current/time protection device must be greater than the lowest breaking current of the HV HRC fuse link.
- If this cannot be achieved, make sure that overload currents lower than the lowest breaking current of the HV HRC fuse link are cut off by the switchgear by means of the striker. This prevents thermal overloading of the HV HRC fuse link, which would otherwise destroy it.
- The HV HRC fuse link selected limits the sustained symmetrical short-circuit current $I_k$ to the cut-off current $I_D$ which must be taken from the current limiting characteristic chart (for $I_D$ as a factor of $I_k$ for the HV HRC fuse links of different rated currents). The maximum permissible cut-off current is $I_D = 50$ kA.

Requirements

- The cut-off current $I_D$ must not exceed 50 kA at 7.2 kV.
- With an LV power supply via a control power transformer, short-circuit currents must be interrupted between the switching capacity limit (5 kA) and $30 \times I_e$ (12 kA) within 80 ms. This stipulation does not apply if
  - there is mechanical latching or
  - the opening times have been extended so much that in the above-mentioned current range the contactor cannot open until the fuse has interrupted the current.
- When the motors are energized, the HV HRC fuse is loaded most by the motor starting current that occurs. It must neither blow nor become damaged under these loads.
- Other factors that influence loading of the HV HRC fuses are the starting time and starting frequency of the motors.
Short-circuit protection for “Class E2 controller” in accordance with UL / CSA C22.2

When using 3TL vacuum contactors as “Class E2 controllers” for 7.2 kV, Siemens fuses of type 3GD1 150-4D (7.2 kV/250 A) or other fuses with a comparable current/time characteristic must be used to provide short-circuit protection.

If 2 fuse links are connected in parallel, the symmetrical short-circuit current measured is divided by 2 and this value is used to determine the cut-off current for one fuse link. This value must then be multiplied by 2 in order to arrive at the total cut-off current, which must not exceed the permissible value for the vacuum contactor.

Parallel connection should be configured such that the resistance in the two branches is, if possible, identical.

When the fuses blow, this must result in the vacuum contactor being opened. An appropriate device that is actuated by the release bolt of the HV HRC fuse link must be installed.

Fuse monitoring

The fuse bases can be supplied with a fuse monitor in order to prevent a three-phase load (e.g. a motor) from being supplied on only two phases when a fuse blows. This fuse monitor can be used either to initiate an alarm signal or to open the vacuum contactor.

Short-circuit protection by means of circuit-breakers

Loads for which no suitable fuses are available can also be protected by means of circuit-breakers.

Due to the longer break time of the circuit-breakers (maximum permissible 120 ms), the short-circuit current must not exceed the maximum permissible value for the vacuum contactor (20 kA at 7.2 kV, 15 kA at 12 kV).

As a result of the longer break time, the interrupters must be replaced immediately in the case where the maximum permissible short-circuit current value has been reached, since this causes a severe reduction in their service life.
### Design
3TL vacuum contactors are of an open design, degree of protection IP00 according to DIN EN 60529 and IEC 60529. They comply with the standards for high-voltage AC contactors of between 1 kV and 12 kV:
- IEC 60470 - 2000
- DIN EN 60470
- UL Standard 347
- CSA C22.2
- Vacuum contactors 3TL71 are carried out following the standards for high-voltage AC contactors of between 1 kV and 12 kV according to IEC 60470 - 2000, DIN EN 60470.

### Tests
We have our own accredited test bays which we can use to develop and type-test high-capacity switchgear in accordance with the relevant standards:
- High power electrical testing
- Testing of:
  - Mechanical operation
  - Reliability
  - Insulating capacity
  - Temperature rise
  - Climatic withstand capability.

Extensive series of tests are carried out for the type-tests specified in the relevant standards in order to achieve reliable results.

If a customer requests tests that are to be conducted in test bays not owned by Siemens, there are other accredited testing institutes available.

The tests encompass switching capacity, current-carrying capacity and, where applicable, insulating capacity. The fees for these tests are charged by PEHLA according to their current price schedule.

### Insulating capacity
3TL vacuum contactors are suitable for site altitudes between 1250 m below sea level and 2500 m above sea level.

The specified insulating capacity values are referred to sea level. When installed at altitudes above 1000 m, an allowance must be made for the resulting decrease in insulating capacity (see correction factor a in the diagram below).

The following expression thus applies for the selection of the devices and equipment:

\[
\frac{\text{Rated lightning impulse withstand voltage}}{\text{Required rated lightning impulse withstand voltage}} \geq 1 - a
\]

1) Rated lightning impulse withstand voltage; rated power-frequency withstand voltage.
2) Lightning impulse withstand voltage; power frequency withstand voltage.

If, however, the actual insulating capacity must be determined at the installation site - the withstand voltage - the reduction of the insulating capacity from that for an altitude of 0 m (sea level) must be calculated as follows:

\[
\text{Withstand voltage} = a \times \text{rated withstand voltage}
\]

Definitions:
- Rated………withstand voltage = target value according to VDE, IEC etc. referred to sea level.
- ……withstand voltage = actual value at the respective height.

### Ambient conditions
Vacuum contactors can be used in buildings with low thermal insulation or low heat storage capacity, heated or cooled, without temperature monitoring. The heating or cooling may fail for a period of several days.

The vacuum contactors fulfill the following ambient conditions in accordance with IEC 60721 - 1996:
- Climatic:
  - Class 3K4 (minimum temperature limit -25 °C)
  - Class 3K6 (without ice formation and wind-driven precipitation)
  - Class 3Z2
  - Class 3Z5
- Biological:
  - Class 3B1
- Chemically active materials:
  - Class 3C2 (without occurrence of saline fog with simultaneous moisture condensation)
- Mechanically active materials:
  - Class 3S2 (restriction acc. to operating instructions: clean insulating components)
- Mechanical:
  - Class 3M2.

### Ambien temperature

<table>
<thead>
<tr>
<th>Temperature value</th>
<th>for vacuum contactor</th>
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<tbody>
<tr>
<td>3TL81</td>
<td>3TL6</td>
</tr>
<tr>
<td>Maximum value</td>
<td>+65 °C</td>
</tr>
<tr>
<td>Maximum value of 24-hour mean</td>
<td>+60 °C</td>
</tr>
<tr>
<td>Minimum value</td>
<td>-25 °C</td>
</tr>
</tbody>
</table>

### Relative humidity (measured averages):
- Over 24 hours: max. 95 %
- Over 1 month: max. 90 %

Condensation may occasionally occur under these conditions. Occasional exposure to condensation once per month for approximately 2 hours is permitted (tested according to DIN 50016, FW24).

The ambient air must not be contaminated with excessive amounts of dust, smoke, corrosive or flammable gases, vapors or salt.

For further information regarding the ambient conditions, see “Technical data”.

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**Standards**
Application

3TL81 vacuum contactors are 3-pole contactors with electromagnetically-operated mechanism for medium-voltage switchgear.

They are load-break switchgear with a limited short-circuit making and short-circuit breaking capacity and are used for high switching frequencies (> 10,000 operating cycles).

The vacuum contactors are suitable for operational switching of AC loads in indoor switchgear and can perform, for example, the following duties:

- Switching of three-phase motors in AC-3 and AC-4 operation
- Switching of transformers
- Switching of reactors
- Switching of ohmic loads (e.g. arc furnaces)
- Switching of capacitors

With reversing contactor combinations, only one contactor is required for each direction of rotation, if HV HRC fuses are used for short-circuit protection.

Application examples

- Conveyor and lift systems
- Pump stations
- Ventilation and heating
- Systems for reactive-power compensation

for the following branches of industry:

- Mining
- Steel
- Gas and petrochemicals
- Paper
- Cement

Features

- Rated voltage up to 7.2 kV
- Maintenance-free through to the end of the vacuum interrupters’ service life
- Mechanical service life of the contactor: 1 mill. operating cycles
- Suitable for switching, for example:
  - Transformers
  - Capacitors
  - Filter circuits
  - Motors
  - Reactors
  - Ohmic loads
Construction and mode of operation

Construction
The 3TL81 vacuum contactor consists of:
- Medium-voltage section with
  - Insulating plastic housing (1)
  - Vacuum interrupters (2)
  - Main conductor terminals (8 and 9)
- Low-voltage section with
  - Magnetic system (11)
  - Electronic economy circuit (14)
  - Auxiliary contact blocks (12 and 13)
  - Mechanical closing latching (6) as an additional module

Mode of operation
The magnetic system (11) of the 3TL81 vacuum contactor opens and closes the contacts of the vacuum interrupters (2). Due to the use of the electronic economy circuit (14), the magnetic system (11) is independent of the voltage type and level across a wide range.

Mechanical closing latching
The mechanical closing latching (6) holds the vacuum contactor in the closed position even without excitation of the magnetic system (11). The latching module of the mechanical closing latching (6) is fitted inside the mechanism housing (5). When the magnetic system (11) is excited, the vacuum interrupter (2) is latched mechanically by means of a lever and roller system into the “CLOSED” position. The contactor is unlatched electrically by means of an unlatching solenoid or mechanically by means of a release bolt (the coupling has to be provided by the customer).

The command duration for the unlatching solenoid must be between 100 ms and 1 s. An external command ending unit must be provided.
Construction and mode of operation

Legend
1 Insulating plastic housing
2 Vacuum interrupter*
3 Position indicator O - I
4 Operating shaft (short or long version)
5 Mechanism housing
6 Mechanical closing latching * (optional) with rectifier module * for AC operation
7 Terminal block (optional)
8 Top main conductor terminal
9 Bottom main conductor terminal
10 Mechanical connection between medium and low-voltage sections
11 Magnetic system (solenoid *)
12 Top auxiliary contact block *
13 Bottom auxiliary contact block *
14 Electronic module * (electronic economy circuit) with terminals

* Also available as spare part.
**Medium-voltage section**

- **Rated voltage** $U_{i}$: 7.2 kV
- **Rated frequency**: 50 to 60 Hz
- **Rated continuous current** $I_{th}$: according to DIN EN 60694, IEC 60694
- **Rated operational current** $I_{e}$: according to utilization categories AC-1, AC-2, AC-3 and AC-4
  - At ambient temperatures up to +55 °C: 400 A
  - At ambient temperatures up to +65 °C: 360 A
- **Switching capacity**
  - Rated making current: 4000 A
  - Rated breaking current: 3200 A
- **Max. permissible switching capacity**: 5 kA
- **Rated short-time withstand current 1 s (r.m.s. value)**: 8 kA
- **Switching of capacitors**
  - Rated capacitor current: 250 A
  - Max. permissible making current peak: 10 kA
- **Switching frequency**
  - Without mechanical closing latching: 1200 operating cycles/h
- **Mechanical service life of contactor**
  - For AC and DC operation: 0.25 mill. operating cycles
  - For AC and DC operation without mechanical closing latching: 0.25 mill. operating cycles
- **Electrical service life of the vacuum interrupter**
  - At rated operational current: 1 mill. operating cycles
- **Dielectric strength**
  - Rated lightning impulse withstand voltage: 60 kV
  - 40 kV
  - To earthed parts and between poles
  - Across the open contact gap
  - Rated power-frequency withstand voltage 50 Hz (r.m.s.):
  - 20 kV
  - 20 kV
  - To earthed parts and between poles
  - Across the open contact gap
- **Cross-sections of the main conductor terminals**
  - Terminal screw: M10
  - Stranded conductors with cable lug: 50 to 240 mm²
  - Copper rail to DIN 43671: 30 x 5 mm
  - Aluminum rail to DIN 43670: 20 x 10 mm

**Low-voltage section**

- **Power consumption of the solenoid**
  - (AC and DC operation): 600 W
  - Pickup power: 90 W
- **Voltage range of the solenoid**
  - Operating voltage (AC and DC operation): 0.85 to 1.1 $U_{i}$
  - Holding power: 0.85 to 1.1 $U_{i}$
- **Minimum closing command**
  - For the solenoid: 300 ms
  - (AC and DC operation 110 V to 250 V): 325 ± 75 ms or ≤ 50 ms
- **Break time**
  - (AC and DC operation 110 V to 250 V) depending on the electronic economy circuit: 0.2 to max. 1 s
- **Mechanical closing latching (optional)**
  - (AC and DC operation): 100,000 operating cycles
  - 60 operating cycles/h
- **Switching frequency 4)**
  - (AC and DC operation 110 V to 250 V): 0.2 to max. 1 s
  - Break time: < 50 ms
- **Cross-sections of the auxiliary contacts**
  - (screw terminal, two-wire connection possible)
  - Solid: 0.6 to 4 mm²
  - Finely stranded with end sleeve: 0.5 to 2.5 mm²
- **Ambient conditions**
  - **Ambient temperature**
    - Storage: at -40 to +65 °C
    - Operation: at -5 to +65 °C
  - Site altitude: 200 m below sea level to 1250 m above sea level
- **Shock resistance (square impact)**
  - 5 x g, 10 ms or 10 x g, 5 ms
- **Rated continuous current** $I_{th}$: 10 A
- **Rated operational current** $I_{e}$
  - Utilization category for AC-11 at rated voltage:
    - 125 V AC, 10 A
    - 230 V AC, 10 A
    - 500 V AC, 4 A
    - 600 V AC, 2 A
  - Utilization category for DC-11 at rated voltage:
    - 24 V DC, 10 A
    - 110 V DC, 5 A
    - 125 V DC, 0.9 A
    - 220 V DC, 0.45 A
    - 440 V DC, 0.25 A
    - 600 V DC, 0.2 A

**Technical data**

<table>
<thead>
<tr>
<th>Medium-voltage section</th>
<th>Low-voltage section</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rated voltage</strong> $U_{i}$</td>
<td>7.2 kV</td>
</tr>
<tr>
<td><strong>Rated frequency</strong></td>
<td>50 to 60 Hz</td>
</tr>
<tr>
<td><strong>Rated continuous current</strong> $I_{th}$</td>
<td>400 A</td>
</tr>
<tr>
<td><strong>Rated operational current</strong> $I_{e}$</td>
<td>according to DIN EN 60694, IEC 60694</td>
</tr>
<tr>
<td><strong>At ambient temperatures up to +55 °C</strong></td>
<td>400 A</td>
</tr>
<tr>
<td><strong>At ambient temperatures up to +65 °C</strong></td>
<td>360 A</td>
</tr>
<tr>
<td><strong>Switching capacity</strong></td>
<td>without mechanical closing latching</td>
</tr>
<tr>
<td><strong>Rated making current</strong></td>
<td>4000 A</td>
</tr>
<tr>
<td><strong>Rated breaking current</strong></td>
<td>3200 A</td>
</tr>
<tr>
<td><strong>Max. permissible switching capacity</strong></td>
<td>5 kA</td>
</tr>
<tr>
<td><strong>Rated short-time withstand current 1 s (r.m.s. value)</strong></td>
<td>8 kA</td>
</tr>
<tr>
<td><strong>Switching of capacitors</strong></td>
<td>without mechanical closing latching</td>
</tr>
<tr>
<td><strong>Rated capacitor current</strong></td>
<td>250 A</td>
</tr>
<tr>
<td><strong>Max. permissible making current peak</strong></td>
<td>10 kA</td>
</tr>
<tr>
<td><strong>Switching frequency</strong></td>
<td>1200 operating cycles/h</td>
</tr>
<tr>
<td><strong>Mechanical service life of contactor</strong></td>
<td>0.25 mill. operating cycles</td>
</tr>
<tr>
<td><strong>Mechanical service life of the vacuum interrupter</strong></td>
<td>0.25 mill. operating cycles</td>
</tr>
<tr>
<td><strong>Dielectric strength</strong></td>
<td>60 kV</td>
</tr>
<tr>
<td><strong>To earthed parts and between poles</strong></td>
<td>40 kV</td>
</tr>
<tr>
<td><strong>Across the open contact gap</strong></td>
<td>20 kV</td>
</tr>
<tr>
<td><strong>To earthed parts and between poles</strong></td>
<td>20 kV</td>
</tr>
<tr>
<td><strong>Across the open contact gap</strong></td>
<td>20 kV</td>
</tr>
<tr>
<td><strong>Cross-sections of the main conductor terminals</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Terminal screw</strong></td>
<td>M10</td>
</tr>
<tr>
<td><strong>Stranded conductors with cable lug</strong></td>
<td>50 to 240 mm²</td>
</tr>
<tr>
<td><strong>Copper rail to DIN 43671</strong></td>
<td>30 x 5 mm</td>
</tr>
<tr>
<td><strong>Aluminum rail to DIN 43670</strong></td>
<td>20 x 10 mm</td>
</tr>
<tr>
<td><strong>Low-voltage section</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Power consumption of the solenoid</strong></td>
<td>600 W</td>
</tr>
<tr>
<td><strong>(AC and DC operation)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Pickup power</strong></td>
<td>90 W</td>
</tr>
<tr>
<td><strong>Voltage range of the solenoid</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Operating voltage (AC and DC operation)</strong></td>
<td>0.85 to 1.1 $U_{i}$</td>
</tr>
<tr>
<td><strong>Holding power</strong></td>
<td>0.85 to 1.1 $U_{i}$</td>
</tr>
<tr>
<td><strong>Minimum closing command</strong></td>
<td></td>
</tr>
<tr>
<td><strong>For the solenoid</strong></td>
<td>300 ms</td>
</tr>
<tr>
<td><strong>Make time</strong></td>
<td>200 ms at 0.85 x 110 V</td>
</tr>
<tr>
<td><strong>(AC and DC operation 110 V to 250 V)</strong></td>
<td>150 ms at 1.0 x 110 V</td>
</tr>
<tr>
<td><strong>Break time</strong></td>
<td>50 ms at 1.1 x 250 V</td>
</tr>
<tr>
<td><strong>Break time</strong></td>
<td>325 ± 75 ms or ≤ 50 ms</td>
</tr>
<tr>
<td><strong>Mechanical closing latching (optional)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>(AC and DC operation)</strong></td>
<td>100,000 operating cycles</td>
</tr>
<tr>
<td><strong>Switching frequency 4)</strong></td>
<td>60 operating cycles/h</td>
</tr>
<tr>
<td><strong>(AC and DC operation 110 V to 250 V)</strong></td>
<td>0.2 to max. 1 s</td>
</tr>
<tr>
<td><strong>Break time</strong></td>
<td>&lt; 50 ms</td>
</tr>
<tr>
<td><strong>Number of auxiliary contacts</strong></td>
<td>2NO/2NC or 4NO/4NC</td>
</tr>
<tr>
<td><strong>Rated continuous current</strong> $I_{th}$</td>
<td>10 A</td>
</tr>
<tr>
<td><strong>Rated operational current</strong> $I_{e}$</td>
<td></td>
</tr>
<tr>
<td><strong>Utilization category for AC-11 at rated voltage</strong></td>
<td></td>
</tr>
<tr>
<td><strong>125 V AC, 10 A</strong></td>
<td></td>
</tr>
<tr>
<td><strong>230 V AC, 10 A</strong></td>
<td></td>
</tr>
<tr>
<td><strong>500 V AC, 4 A</strong></td>
<td></td>
</tr>
<tr>
<td><strong>600 V AC, 2 A</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Utilization category for DC-11 at rated voltage</strong></td>
<td></td>
</tr>
<tr>
<td><strong>24 V DC, 10 A</strong></td>
<td></td>
</tr>
<tr>
<td><strong>110 V DC, 5 A</strong></td>
<td></td>
</tr>
<tr>
<td><strong>125 V DC, 0.9 A</strong></td>
<td></td>
</tr>
<tr>
<td><strong>220 V DC, 0.45 A</strong></td>
<td></td>
</tr>
<tr>
<td><strong>440 V DC, 0.25 A</strong></td>
<td></td>
</tr>
<tr>
<td><strong>600 V DC, 0.2 A</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Cross-sections of the auxiliary contacts</strong></td>
<td></td>
</tr>
<tr>
<td><strong>(screw terminal, two-wire connection possible)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Solid</strong></td>
<td>0.6 to 4 mm²</td>
</tr>
<tr>
<td><strong>Finely stranded with end sleeve</strong></td>
<td>0.5 to 2.5 mm²</td>
</tr>
<tr>
<td><strong>Ambient conditions</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Ambient temperature</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Storage</strong></td>
<td>at -40 to +65 °C</td>
</tr>
<tr>
<td><strong>Operation</strong></td>
<td>at -5 to +65 °C</td>
</tr>
<tr>
<td><strong>Ambient temperature</strong></td>
<td>20 years</td>
</tr>
<tr>
<td><strong>Site altitude</strong></td>
<td>200 m below sea level to 1250 m above sea level</td>
</tr>
<tr>
<td><strong>Shock resistance (square impact)</strong></td>
<td>5 x g, 10 ms or 10 x g, 5 ms</td>
</tr>
</tbody>
</table>
# 3TL81 Vacuum Contactors as Economy Contactors

## Selection and ordering data

<table>
<thead>
<tr>
<th>Rated voltage $U_i$</th>
<th>Rated lightning impulse withstand voltage to earth $U_{li}$</th>
<th>Rated power-frequency withstand voltage across open contact gap $U_{a}$</th>
<th>Rated operational current $I_{e}$</th>
<th>Order No.</th>
<th>Order code</th>
</tr>
</thead>
<tbody>
<tr>
<td>$kV$</td>
<td>$kV$</td>
<td>$kV$</td>
<td>$kA$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.2</td>
<td>60</td>
<td>40</td>
<td>20</td>
<td>400</td>
<td>3TL81 10</td>
</tr>
</tbody>
</table>

### Versions

- Short operating shaft
- Long operating shaft for powerless external built-on accessories

### Auxiliary contacts, additional modules

<table>
<thead>
<tr>
<th>Description</th>
<th>Order code</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 NO + 2 NC, without auxiliary contact wiring/without additional modules</td>
<td>0</td>
</tr>
<tr>
<td>4 NO + 4 NC, without auxiliary contact wiring/without additional modules</td>
<td>1</td>
</tr>
<tr>
<td>4 NO + 4 NC, with closing latching/without auxiliary contact wiring</td>
<td>2</td>
</tr>
<tr>
<td>4 NO + 4 NC, with closing latching, auxiliary contacts wired to terminal strip</td>
<td>3</td>
</tr>
<tr>
<td>4 NO + 4 NC, auxiliary contacts wired to terminal strip, without closing latching</td>
<td>5</td>
</tr>
</tbody>
</table>

### Operating voltages for solenoid

- 24 V AC/DC: A
- 110 to 250 V AC/DC: B
- 48 to 80 V AC/DC: D

### Operating voltages for releasing the mechanical closing latching

- Without mechanical closing latching: A
- 24 V DC: B
- 30 V DC: C
- 48 V DC: D
- 60 V DC: E
- 110 V DC: F
- 125 V DC: G
- 220 to 250 V DC: H
- 110/115 V AC, 50/60 Hz: L
- 120/127 V AC, 50/60 Hz: M
- 220/240 V AC, 50/60 Hz: N
- 380 V AC, 50/60 Hz: P

### Break time

- Without mechanical closing latching: 325 ± 75 ms
- With mechanical closing latching: 50 ms, (external auxiliary contactor provided by the customer): 5

### Operating instructions/language

- Without routine test certificate German / English: 0
- Without routine test certificate French / Spanish: 1
- With routine test certificate German / English: 5
- With routine test certificate French / Spanish: 6

### Special version

- Conductors halogen-free and flame-resistant: Z A 1 0
### Spare parts and accessories (When ordering, please also state type and serial number of the vacuum contactor)

<table>
<thead>
<tr>
<th>Scope of delivery</th>
<th>Operating voltage or contacts</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vacuum interrupter</strong></td>
<td>24 V AC/DC 48 V - 60 V AC/DC 110 V - 250 V AC/DC</td>
<td>3TY5 810-0AA0 (up to serial No. 31 670 935) 3TY5 810-1AA0 (as of serial No. 31 670 936)</td>
</tr>
<tr>
<td><strong>Auxiliary contact block</strong></td>
<td>Top 2 NO + 2 NC bottom 2 NO + 2 NC</td>
<td>3TY7 561-1SA0 3TY7 561-1NA0</td>
</tr>
<tr>
<td><strong>Solenoid</strong></td>
<td>24 V AC/DC 48 V - 60 V AC/DC 110 V - 250 V AC/DC</td>
<td>3TY5 811-0AA0 3TY5 811-0DA0 3TY5 811-0BA0</td>
</tr>
<tr>
<td><strong>Electronic module</strong></td>
<td>24 V AC/DC 48 V - 60 V AC/DC 110 V - 250 V AC/DC</td>
<td>3TY5 812-0AA0 3TY5 812-0DA0 3TY5 812-0BA0</td>
</tr>
<tr>
<td><strong>Mechanical closing latching (accessory)</strong></td>
<td>110 V - 115 V AC, 50/60 Hz 120 V - 127 V AC, 50/60 Hz 220 V - 240 V AC, 50/60 Hz 380 V AC, 50/60 Hz 24 V DC 30 V DC 48 V DC 60 V DC 110 V DC 125 V DC 220 V - 250 V DC</td>
<td>3TY5 892-0AG7 3TY5 892-0AL7 3TY5 892-0AN7 3TY5 892-0AQ2 3TY5 892-0BB4 3TY5 892-0BC4 3TY5 892-0BD4 3TY5 892-0BE4 3TY5 892-0BF4 3TY5 892-0BG4 3TY5 892-0BM4</td>
</tr>
<tr>
<td><strong>Rectifier module (accessory) for mechanical closing latching</strong></td>
<td></td>
<td>3AX15 25-1F</td>
</tr>
</tbody>
</table>
AC operation
- Voltage range
  - 24 V to 250 V AC
- Without mechanical closing latching:
  - Opening delay ≤ 50 ms by means of external circuit
  - Opening delay
    325 ± 75 ms
- Auxiliary contact block
  - 2 NO + 2 NC
  - Optional: 4 NO + 4 NC
- Optional: with mechanical closing latching (+K2S) (only in conjunction with auxiliary contact block 4 NO + 4 NC) and with rectifier

DC operation
- Voltage range
  - 24 V to 250 V DC
- Without mechanical closing latching:
  - Opening delay ≤ 50 ms by means of external circuit
  - Opening delay
    325 ± 75 ms
- Auxiliary contact block
  - 2 NO + 2 NC
  - Optional: 4 NO + 4 NC
- Optional: with mechanical closing latching (+K2S) (only in conjunction with auxiliary contact block 4 NO + 4 NC)
AC and DC operation
- Without mechanical closing latching
Opening delay
  \(- \leq 50 \text{ ms} \) by means of external circuits
  \(- 325 \pm 75 \text{ ms} \)

Circuit diagrams (examples)

**Momentary-contact control**

- Without time-delay relay for minimum motor starting time, opening delay \(- 50 \text{ ms} \)

**Maintained-contact control**

- Without time-delay relay for minimum motor starting time, opening delay \(- 50 \text{ ms} \)

Legend

- **F** Fuse
- **K1** Vacuum contactor
- **K2E** External contactor relay
- **K1M** Solenoid-operated mechanism
- **SOQ** External "OPEN" pushbutton
- **S1Q** External "CLOSED" pushbutton

Fig. 1

Fig. 2

Fig. 3

Fig. 4
3TL81 Vacuum Contactors

as Economy Contactors

Dimensions and weights

- For AC and DC operation
- Weight 30 kg

3TL8 100 vacuum contactor with short operating shaft

3TL8 101 vacuum contactor with long operating shaft

* Fixing dimensions
# 3TL81 Vacuum Contactors

## as Economy Contactors

### Shipping

### Packaging

The 3TL81 vacuum contactors are packed in accordance with the customer’s order specifications and shipped anywhere in the world in the mode determined by the customer.

If the customer has not specified the manner of packaging and mode of shipping, the most economic option is chosen depending on the size of the lot ordered.

### Shipping dimensions and weights

#### Shipping by truck and rail

<table>
<thead>
<tr>
<th>Package type</th>
<th>Destination</th>
<th>for no. of vacuum contactors</th>
<th>Length / Width / Height (mm / mm / mm)</th>
<th>Volume (m³)</th>
<th>Gross weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardboard box with inner box to suit unit</td>
<td>Germany</td>
<td>1</td>
<td>490 / 300 / 400</td>
<td>0.059</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>800 / 780 / 670</td>
<td>0.42</td>
<td>62</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3-4</td>
<td>1020 / 620 / 670</td>
<td>0.42</td>
<td>100 - 130</td>
</tr>
<tr>
<td>Cardboard box with sealed packaging and inner box to suit unit</td>
<td>Europe</td>
<td>1-2</td>
<td>800 / 780 / 670</td>
<td>0.42</td>
<td>45 - 70</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3-4</td>
<td>1020 / 620 / 670</td>
<td>0.42</td>
<td>105 - 135</td>
</tr>
<tr>
<td>Skeleton container with cardboard boxes and inner box to suit unit</td>
<td>Overseas</td>
<td>3-12</td>
<td>1200 / 800 / 800</td>
<td>0.77</td>
<td>125 - 360</td>
</tr>
<tr>
<td>Plywood box + cardboard boxes with sealed packaging and inner box to suit unit</td>
<td>Overseas/ Europe</td>
<td>1-3</td>
<td>920 / 620 / 720</td>
<td>0.41</td>
<td>50 - 100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7-10</td>
<td>1020 / 1020 / 1020</td>
<td>1.06</td>
<td>240 - 310</td>
</tr>
</tbody>
</table>

#### Shipping by sea freight

<table>
<thead>
<tr>
<th>Package type</th>
<th>for no. of vacuum contactors</th>
<th>Length / Width / Height (mm / mm / mm)</th>
<th>Volume (m³)</th>
<th>Gross weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardboard box with inner box to suit unit</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Cardboard box with sealed packaging and inner box to suit unit</td>
<td>-</td>
<td>800 / 780 / 670</td>
<td>0.42</td>
<td>45 - 70</td>
</tr>
<tr>
<td>Skeleton container with cardboard boxes and inner box to suit unit</td>
<td>-</td>
<td>1020 / 620 / 670</td>
<td>0.42</td>
<td>105 - 135</td>
</tr>
<tr>
<td>Plywood box + cardboard boxes with sealed packaging and inner box to suit unit</td>
<td>-</td>
<td>920 / 620 / 720</td>
<td>0.41</td>
<td>50 - 100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1020 / 1020 / 1020</td>
<td>1.06</td>
<td>240 - 310</td>
</tr>
</tbody>
</table>

#### Shipping by air freight

<table>
<thead>
<tr>
<th>Package type</th>
<th>for no. of vacuum contactors</th>
<th>Length / Width / Height (mm / mm / mm)</th>
<th>Volume (m³)</th>
<th>Gross weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardboard box with inner box to suit unit</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Cardboard box with sealed packaging and inner box to suit unit</td>
<td>-</td>
<td>800 / 780 / 670</td>
<td>0.42</td>
<td>45 - 70</td>
</tr>
<tr>
<td>Skeleton container with cardboard boxes and inner box to suit unit</td>
<td>-</td>
<td>1020 / 620 / 670</td>
<td>0.42</td>
<td>105 - 135</td>
</tr>
<tr>
<td>Plywood box + cardboard boxes with sealed packaging and inner box to suit unit</td>
<td>-</td>
<td>920 / 620 / 720</td>
<td>0.41</td>
<td>50 - 100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1020 / 1020 / 1020</td>
<td>1.06</td>
<td>240 - 310</td>
</tr>
</tbody>
</table>
3TL6 vacuum contactors are 3-pole contactors with electromagnetically-operated mechanism for medium-voltage switchgear. They are load-break switchgear with a limited short-circuit making and short-circuit breaking capacity and are used for high switching frequencies (> 10,000 operating cycles).

The vacuum contactors are suitable for operational switching of AC loads in indoor switchgear and can perform, for example, the following duties:

- Switching of three-phase motors in AC-3 and AC-4 operation
- Switching of transformers
- Switching of reactors
- Switching of ohmic loads (e.g. arc furnaces)
- Switching of capacitors

With reversing contactor combinations, only one contactor is required for each direction of rotation, if HV HRC fuses are used for short-circuit protection.

Application examples

- Conveyor and lift systems
- Pump stations
- Ventilation and heating
- Systems for reactive-power compensation
- for the following branches of industry
  - Mining
  - Steel
  - Gas and petrochemicals
  - Paper
  - Cement

Features

- Rated voltages up to 12 kV
- Maintenance-free through to the end of the vacuum interrupters’ service life
- Mechanical service life of the contactor up to 3 mill. operating cycles
- Suitable for switching, for example:
  - Transformers
  - Capacitors
  - Filter circuits
  - Motors
  - Reactors
  - Ohmic loads
3TL6 Vacuum Contactors

as Universal Contactors

Construction and mode of operation

Construction
The 3TL6 vacuum contactor consists of:
- Medium-voltage section:
  - Insulating housing (15)
  - Vacuum interrupters (13)
  - Main conductor terminals (12 and 14)
- Low-voltage section:
  - Mechanism housing (1) made of sheet steel
  - Magnetic system (2)
  - Central terminal block (3) for auxiliary and control circuits
  - Contactor relay (external)
  - Auxiliary contact blocks
  - Mechanical closing latching (7 to 9) and mechanical closing lock-out (5) as additional modules
  - Integral rocker (10) as connection between the magnetic system and the vacuum interrupters.

Mode of operation
The atmospheric pressure exerts a force on the metal bellows of the vacuum interrupter. Without the influence of the operating mechanism, the contact gap would close. The opening springs (6) keep the moving contact piece in the open position by means of the integral rocker (10).

To close the vacuum contactor, the pressure force of the opening springs (6) is overcome by the magnetic system (2). The solenoid armature (4) is attracted and thereby moves the integral rocker (10) which releases the moving interrupter contact piece from the open position. The atmospheric pressure closes the contact pieces. The integral rocker (10) then presses the contact pressure springs (16) together and produces the necessary contact force.

After de-energization of the electromagnetic excitation, the opening springs (6) open the contact gap by means of the integral rocker (10) and the moving interrupter contact piece.

The DC magnetic system functions as an economy circuit. This leads to a longer mechanical service life and reduces pickup and holding power.

Legend
see page 25

Permissible installation positions

Wall assembly
vertical layout
vertical layout
(rotated through 180°)

Floor assembly
horizontal layout

* Position of the main conductor terminals
  - Position of the terminal block
Construction and mode of operation (continued)

Adapting to the site altitude
The vacuum contactor is factory-set for a site altitude between 200 m below and 1250 m above sea level. If it is to be used at altitudes not within this range, the altitude range must be adapted by means of adjusting controls at the rear of the end unit.

Adjusting ranges above sea level:
- + 1250 m to + 2500 m
- - 200 m to + 1250 m
- - 1250 m to + 200 m.

Mechanical closing latching
The latching lever (7) holds the vacuum contactor in the closed state even without excitation of the magnetic system. When the magnetic system is excited, the integral rocker is latched mechanically by means of a lever and roller system into the “CLOSED” position. The contactor is unlatched electrically by means of an unlatching solenoid (9) or mechanically by means of the release bolt (8).

Mechanical closing lock-out
The mechanical closing lock-out (5) prevents unintentional closing of the vacuum contactor, for example, due to vibrations or whenever the withdrawable unit is moved. This lock remains inoperative during operational switching.

Blocking element for interlocking of two contactors
A mechanically functioning blocking element is available on request (for rated voltages up to 7.2 kV only) for mutual interlocking of two contactors in reversing operation. The blocking element is fixed between the two contactors and intervenes in a mutually controlling and blocking manner in the movement of the integral rocker of both contactors. This rules out a phase short-circuit as a result of simultaneous activation of both directions of rotation in the event of mechanical impact and electrical maloperations.

Legend
1 Mechanism housing
2 Magnetic system (solenoid *) with rectifier* (optional) and economy resistor*
3 Terminal block (optional: withdrawable from side)
4 Solenoid armature
5 Mechanical closing lockout *
6 Opening spring
7 Mechanical closing latching (7 to 9)
8 Latching lever
9 Unlatching solenoid * with rectifier and varistor modules * (optional)
10 Integral rocker
11 Position indicator O - I
12 Top main conductor terminal
13 Vacuum interrupter *
14 Bottom main conductor terminal
15 Insulating plastic housing
16 Contact pressure spring

* Also available as spare part.
### Technical data

#### Medium-voltage section

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage $U_1$</td>
<td>7.2 kV</td>
</tr>
<tr>
<td>Rated frequency</td>
<td>50 to 60 Hz</td>
</tr>
<tr>
<td>Rated continuous current $I_{Ph}$</td>
<td>450 A</td>
</tr>
<tr>
<td>Rated operational current $I_{o}$ according to utilization categories AC-1, AC-2, AC-3 and AC-4</td>
<td>450 A</td>
</tr>
<tr>
<td>at ambient temperatures up to + 55 °C</td>
<td>315 A</td>
</tr>
<tr>
<td>Switching capacity according to utilization category AC-4 (p.f. = 0.3)</td>
<td>8 kA</td>
</tr>
<tr>
<td>Rated making current</td>
<td>4500 A</td>
</tr>
<tr>
<td>Rated breaking current</td>
<td>3600 A</td>
</tr>
<tr>
<td>Max. permissible switching capacity</td>
<td>5 kA</td>
</tr>
<tr>
<td>Rated short-time withstand current 1 s (r.m.s. Value)</td>
<td>250 A</td>
</tr>
<tr>
<td>for short-time current for longer periods, see short-time current load-period characteristic</td>
<td>10 kA</td>
</tr>
<tr>
<td>Switching frequency (AC and DC operation)</td>
<td>600 operating cycles/h</td>
</tr>
<tr>
<td>Switching frequency without mechanical closing latching</td>
<td>1200 operating cycles/h</td>
</tr>
<tr>
<td>Mechanical service life of the contactor</td>
<td>3 million operating cycles</td>
</tr>
<tr>
<td>Mechanical service life of the vacuum interrupter</td>
<td>2 million operating cycles</td>
</tr>
<tr>
<td>Electrical service life of the vacuum interrupter at rated normal current</td>
<td>1 million operating cycles</td>
</tr>
<tr>
<td>Dielectric strength</td>
<td>60 kV</td>
</tr>
<tr>
<td>Rated lightning impulse withstand voltage (according to DIN EN 60069, IEC 60069-4) to earthed parts and between poles across the open contact gap</td>
<td>40 kV</td>
</tr>
<tr>
<td>Rated power-frequency withstand voltage 50 Hz (r.m.s.) to earthed parts and between poles across the open contact gap</td>
<td>20 kV</td>
</tr>
<tr>
<td>Cross-sections of the main conductor terminals</td>
<td>Terminal screw</td>
</tr>
<tr>
<td>Stranded conductors with cable lug</td>
<td>M10 30 x 5 mm² 20 x 10 mm</td>
</tr>
<tr>
<td>Copper rail to DIN 43671</td>
<td>M10 30 x 5 mm 20 x 10 mm</td>
</tr>
<tr>
<td>Aluminium rail to DIN 43670</td>
<td>M10 50 to 240 mm²</td>
</tr>
<tr>
<td>30 x 5 mm 20 x 10 mm</td>
<td></td>
</tr>
</tbody>
</table>

#### Low-voltage section

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power consumption of the solenoid (AC and DC operation)</td>
<td>690 W</td>
</tr>
<tr>
<td>Pickup power</td>
<td>650 W</td>
</tr>
<tr>
<td>Voltage range of the solenoid (Operating voltage (AC and DC operation))</td>
<td>0.8 to 1.1 $U_1$</td>
</tr>
<tr>
<td>Minimum closing command for the solenoid</td>
<td>100 ms</td>
</tr>
<tr>
<td>Make time (AC and DC operation)</td>
<td>100 ms at 0.8 x $U_1$ 80 ms at 1.0 x $U_1$ 60 ms at 1.1 x $U_1$</td>
</tr>
<tr>
<td>Break time (AC and DC operation), other opening delay times possible as special version</td>
<td>30 ms at 0.8 x $U_1$ 50 ms at 1.0 x $U_1$ 50 ms at 1.1 x $U_1$</td>
</tr>
<tr>
<td>Mechanical closing latching (optional) (AC and DC operation)</td>
<td>100,000 operating cycles 60 operating cycles/h</td>
</tr>
<tr>
<td>Service life</td>
<td>800 W</td>
</tr>
<tr>
<td>Switching frequency</td>
<td>0.85 to 1.1 $U_1$</td>
</tr>
<tr>
<td>Voltage range of unloading solenoid</td>
<td>Break time</td>
</tr>
</tbody>
</table>

#### Auxiliary contacts

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of auxiliary contacts</td>
<td>4 NO + 3 NC (optional: 6 NO + 5 NC)</td>
</tr>
<tr>
<td>Rated continuous current $I_{th}$</td>
<td>10 A</td>
</tr>
<tr>
<td>Rated operational current $I_{o}$</td>
<td>10 A</td>
</tr>
<tr>
<td>Utilization category for AC-11 at rated voltage</td>
<td>125 V AC, 10 A 230 V AC, 10 A 500 V AC, 4 A 600 V AC, 2 A 24 V DC, 10 A 110 V DC, 5 A 125 V DC, 0.9 A 220 V DC, 0.45 A 440 V DC, 0.25 A 600 V DC, 0.2 A</td>
</tr>
<tr>
<td>Utilization category for DC-11 at rated voltage</td>
<td>220 V DC, 0.45 A 440 V DC, 0.25 A 600 V DC, 0.2 A</td>
</tr>
<tr>
<td>Cross-sections of the auxiliary contacts according to DIN EN 60947 Part 1 (screw terminal, two-wire connection possible)</td>
<td>Solid</td>
</tr>
<tr>
<td>Finely stranded with end sleeve</td>
<td>0.6 to 4 mm² 0.5 to 2.5 mm²</td>
</tr>
</tbody>
</table>

#### Ambient conditions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient temperature</td>
<td>20 years 20 years 20 years 20 years 20 years</td>
</tr>
<tr>
<td>Storage at - 40 to + 65 °C</td>
<td>20 years</td>
</tr>
<tr>
<td>Site altitude (adjustable)</td>
<td>1250 m below sea level to 2500 m above sea level</td>
</tr>
<tr>
<td>Shock resistance (square impact)</td>
<td>5 g, 10 ms or 10 g, 5 ms</td>
</tr>
</tbody>
</table>

---

1. Make time = Time from the instant of application of a control pulse (command) to the instant when the contacts touch.
2. Break time = Time from the instant of application of the “OPEN” control pulse to the instant of contact separation.
Selection and ordering data

<table>
<thead>
<tr>
<th>Rated voltage</th>
<th>Rated lightning impulse withstand voltage</th>
<th>Rated power-frequency withstand voltage</th>
<th>Rated operational current</th>
<th>Order No.</th>
<th>Order code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ur</td>
<td>to earth</td>
<td>across open contact gap</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>kV</td>
<td>kV</td>
<td>kV</td>
<td>A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.2</td>
<td>60</td>
<td>40</td>
<td>20</td>
<td>450</td>
<td>3TL6 1</td>
</tr>
<tr>
<td>12</td>
<td>75</td>
<td>60</td>
<td>28</td>
<td>400</td>
<td>3TL6 5</td>
</tr>
</tbody>
</table>

Terminal strip
- Central: 4 NO + 3 NC
- Central: 6 NO + 5 NC
- Withdrawable: 6 NO + 5 NC

Auxiliary contacts
- Without additional modules: 0
- Mechanical closing latching: 1 NO assigned
- Closing latch and closing lock-out: 1 NO assigned

Additional modules
- Without additional modules
- Mechanical closing latching
- Closing latch and closing lock-out

Type of operation
- for solenoid and mechanical closing latching
  - AC operation: A
  - DC operation: B

Operating voltages
- 110 V AC, 50/60 Hz: G 2
- 115 V AC, 50/60 Hz: J 2
- 120 V AC, 50/60 Hz: K 2
- 220 V AC, 50/60 Hz: N 2
- 230 V AC, 50/60 Hz: L 2
- 240 V AC, 50/60 Hz: P 2
- 24 V DC: B 4
- 60 V DC: E 4
- 110 V DC: F 4
- 125 V DC: G 4
- 220 V DC: M 4

Other operating voltages
- for solenoid and mechanical closing latching: 1) Z 0 K 1 Y

Operating instructions
- German / English (standard)
- French / Spanish
- Operating instructions: Z L 01

Routine test certificate
- German / English
- Routine test certificate: Z F 20

Special versions
- Break time
  - ≤ 40 ms: Z G 01
  - ≤ 120 ms: Z G 02
  - 250 ± 70 ms: Z G 03
  - 300 ms: Z G 04
  - 120/50 ms: Z G 08

Overvoltage protection circuitry in secondary circuit
- Varistor module: Z A 00
- Rectifier module: Z A 01

Wiring
- Conductors halogen-free and flame-resistant: Z A 10

Note!
Due to a lack of space the internal command ending unit cannot be installed in 3TL6 vacuum contactors with withdrawable terminal strip.
Order number: 3TL6 133 and 3TL6 535.

1) Ordering data: in addition to the Order No., state the required operating voltage from the above table in plain text (please make inquiry).
2) Other languages on request.
# 3TL6 Vacuum Contactors

## as Universal Contactors

Spare parts and accessories (When ordering, please also state type and serial number of the vacuum contactor)

<table>
<thead>
<tr>
<th>Spare part</th>
<th>Scope of delivery</th>
<th>Operating voltage or contacts</th>
<th>Order No.</th>
<th>Operating voltage or contacts</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vacuum interrupter</strong></td>
<td></td>
<td>7.2 kV, 450 A, VS 7202</td>
<td>3TY5 610 -2AA0</td>
<td>3TY5 650 -1AA0</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>12 kV, 400 A, VS 12003</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Auxiliary contact block</strong></td>
<td>left 2NO + 2NC</td>
<td>3TY7 661 -1NA0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>left 3NO + 3NC</td>
<td>3TY7 661 -1QA0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>right 2NO + 2NC</td>
<td>3TY7 661 -1PA0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>right 3NO + 3NC</td>
<td>3TY7 661 -1RA0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Solenoid</strong></td>
<td>from year of manufacture 10.90</td>
<td>110/115 V AC, 50/60 Hz</td>
<td>3TY5 651 -0AG7</td>
<td>3TY5 651 -0AU7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>from serial No. 31 375 035</td>
<td>120 V AC, 50/60 Hz</td>
<td>3TY5 651 -0AL7</td>
<td>3TY5 651 -0BB4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>125/127 V AC, 50 Hz</td>
<td>3TY5 651 -0AN2</td>
<td>3TY5 651 -0BE4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>220 V AC, 50/60 Hz</td>
<td>3TY5 651 -0AN7</td>
<td>3TY5 651 -0BF4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>230/240 V AC, 50/60 Hz</td>
<td>3TY5 651 -0AQ2</td>
<td>3TY5 651 -0BG4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>380 V AC, 50 Hz</td>
<td>3TY5 651 -0AR7</td>
<td>3TY5 651 -0BM4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>400/415 V AC, 50 Hz</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>440 V AC, 50/60 Hz</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Resistor for economy circuit</strong></td>
<td>from year of manufacture 10.90</td>
<td>110/115 V AC</td>
<td>3TY5 664 -1DA0</td>
<td>3TY5 664 -1KA0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>from serial No. 31 375 035</td>
<td>120 V AC</td>
<td>3TY5 664 -1EA0</td>
<td>3TY5 664 -0AA0</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>125/127 V AC</td>
<td>3TY5 664 -1FA0</td>
<td>3TY5 664 -0CA0</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>120/125/127 V AC</td>
<td>3TY5 664 -1GA0</td>
<td>3TY5 664 -0DA0</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>220 V AC</td>
<td>3TY5 664 -1HA0</td>
<td>3TY5 664 -0EA0</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>230 V AC</td>
<td>3TY5 664 -1JA0</td>
<td>3TY5 664 -0FA0</td>
<td></td>
</tr>
<tr>
<td><strong>Contactor relay</strong></td>
<td></td>
<td>110 V AC, 50/60 Hz</td>
<td>SWB: 47496</td>
<td>500 V AC, 50 Hz</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>115 V AC, 50/60 Hz</td>
<td>SWB: 47497</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>120 V AC, 50/60 Hz</td>
<td>SWB: 47498</td>
<td>24 V DC</td>
<td>3TY5 664 -1KA0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>125/127 V AC, 50 Hz</td>
<td>SWB: 47499</td>
<td>60 V DC</td>
<td>3TY5 664 -0AA0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>220 V AC</td>
<td>SWB: 47502</td>
<td>110 V DC</td>
<td>3TY5 664 -0CA0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>230 V AC, 50/60 Hz</td>
<td>SWB: 47501</td>
<td>125 V DC</td>
<td>3TY5 664 -0DA0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>240 V AC, 50/60 Hz</td>
<td>SWB: 47503</td>
<td>220 V DC</td>
<td>3TY5 664 -0EA0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>400 V AC, 50 Hz</td>
<td>SWB: 47493</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>415 V AC, 50 Hz</td>
<td>SWB: 47494</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>440 V AC, 50/60 Hz</td>
<td>SWB: 47504</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mechanical closing latching</strong></td>
<td></td>
<td>110/115 V AC, 50/60 Hz</td>
<td>3TY5 692 -0AG7</td>
<td>3TY5 692 -0AU7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(accessory)</td>
<td>120 V AC</td>
<td>3TY5 692 -0AL7</td>
<td>3TY5 692 -0BB4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>125/127 V AC, 50 Hz</td>
<td>3TY5 692 -0AN2</td>
<td>3TY5 692 -0BC4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>220 V AC, 50/60 Hz</td>
<td>3TY5 692 -0AN7</td>
<td>3TY5 692 -0BE4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>230/240 V AC, 50/60 Hz</td>
<td>3TY5 692 -0AQ2</td>
<td>3TY5 692 -0BF4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>380 V AC, 50 Hz</td>
<td>3TY5 692 -0AR7</td>
<td>3TY5 692 -0BG4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>400/415 V AC, 50 Hz</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>440 V AC, 50/60 Hz</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mechanical closing lock-out</strong></td>
<td></td>
<td>-</td>
<td>3TY5 693 -0AA0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(accessory)</td>
<td></td>
<td>-</td>
<td>3TX5 111 -0AA0</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Blocking element</strong></td>
<td>(accessory for mechanical interlocking of two 3TL6 contactors up to 7.2 kV)</td>
<td>-</td>
<td>3AX15 25 -1F</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Rectifier module with varistor</strong></td>
<td>(accessory)</td>
<td>-</td>
<td>3AX15 26 -0F</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Rectifier</strong></td>
<td>-</td>
<td>-</td>
<td>3TY5 694 -2AA0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Internal connection diagrams

AC operation

- Voltage range
  110 V to 500 V AC
  50/60 Hz
- Opening delay
  \( \leq 40 \text{ ms} \)
  approximately 50 ms
  \( 250 \pm 70 \text{ ms} \)
- Rectifier
- Resistor for economy circuit
- Auxiliary contact block
  - 4 NO + 3 NC or
  - 6 NO + 5 NC
- Optional: rectifier module
- Optional: with mechanical closing latching

DC operating

- Voltage range
  24 V to 220 V DC
- Operating delay
  \( \leq 40 \text{ ms} \)
  approximately 50 ms
  \( 250 \pm 70 \text{ ms} \)
- Resistor for economy circuit
- Auxiliary contact block
  - 4 NO + 3 NC or
  - 6 NO + 5 NC
- Optional: with mechanical closing latching
- Optional: \( \geq 60 \text{ V DC} \) with varistor module

Legend

- G Rectifier module
- H1 Right-hand auxiliary contact block
- H2 Left-hand auxiliary contact block
- K1 Vacuum contactor
- K1E Contactor relay for economy circuit
- K1M Solenoid-operated mechanism for vacuum contactor
- K2E External contactor relay
- K2S Unlatching solenoid (optional)
- R Economy resistor
- X Terminal block for auxiliary contactor connection
**AC operation**
- Without mechanical closing latching
- Opening delay
  - ≤ 40 ms
  - approximately 50 ms
  - 250 ± 70 ms
- Rectifier
- Resistor for economy circuit

**DC operation**
- Without mechanical closing latching
- Opening delay
  - ≤ 40 ms
  - approximately 50 ms
  - 250 ± 70 ms
- Optional: ≥ 60V DC with varistor module
- Resistor for economy circuit

---

**Legend**
- F Fuse
- K1 Vacuum contactor
- K2E External contactor relay
- K1E Internal contactor relay
- K1M Solenoid-operated mechanism
- R Economy resistor
- G Rectifier
- D Free-wheeling diode
- S0Q External “OPEN” pushbutton
- S1Q External “CLOSED” pushbutton

---

**Circuit diagrams (examples)**

**Momentary-contact control**

**Maintained-contact control**
### Dimensions and weights

#### Weights

<table>
<thead>
<tr>
<th>Rated voltage (kV)</th>
<th>Vacuum contactor type</th>
<th>Weight approx. (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.2</td>
<td>3TL61</td>
<td>28</td>
</tr>
<tr>
<td>12</td>
<td>3TL65</td>
<td>30</td>
</tr>
</tbody>
</table>

#### Legend

1. Travel of the integral rocker during switching operation for external interlock and position indicator; max. permissible counterforce 10 N.
2. Opening for insertion of auxiliary wires into central terminal block.
3. Mechanical unlatching, bolt with internal thread M5 x 10.
4. Terminal block withdrawn.

*) Fixing dimensions
### Shipping

#### Packaging

The 3TL61 and 3TL65 vacuum contactors are packed in accordance with the customer’s order specifications and shipped anywhere in the world in the mode determined by the customer.

If the customer has not specified the manner of packaging and mode of shipping, the most economic option is chosen depending on the size of the lot ordered.

#### Shipping dimensions and weights

**Shipping by truck or rail**

<table>
<thead>
<tr>
<th>Package type</th>
<th>Destination</th>
<th>for no. of vacuum contactors</th>
<th>Length / Width / Height</th>
<th>Volume m³</th>
<th>Gross weight kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardboard box with inner box to suit unit</td>
<td>Germany</td>
<td>1-2</td>
<td>500 / 400</td>
<td>0.08</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>Europe</td>
<td>3-4</td>
<td>840 / 570</td>
<td>0.3</td>
<td>87</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5-8</td>
<td>920 / 620</td>
<td>0.7</td>
<td>137 - 170</td>
</tr>
<tr>
<td></td>
<td>Overseas</td>
<td>1-2</td>
<td>500 / 400</td>
<td>0.08</td>
<td>92</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3-4</td>
<td>840 / 570</td>
<td>0.3</td>
<td>142 - 175</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5-8</td>
<td>920 / 620</td>
<td>0.7</td>
<td>202 - 298</td>
</tr>
<tr>
<td>Cardboard box with sealed packaging and inner box to suit unit</td>
<td>Germany</td>
<td>1-2</td>
<td>840 / 570</td>
<td>0.3</td>
<td>92</td>
</tr>
<tr>
<td></td>
<td>Europe</td>
<td>3-4</td>
<td>920 / 620</td>
<td>0.7</td>
<td>142 - 175</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5-8</td>
<td>1120 / 820</td>
<td>0.87</td>
<td>202 - 298</td>
</tr>
<tr>
<td></td>
<td>Overseas</td>
<td>1-2</td>
<td>840 / 570</td>
<td>0.3</td>
<td>92</td>
</tr>
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<td></td>
<td></td>
<td>3-4</td>
<td>920 / 620</td>
<td>0.7</td>
<td>142 - 175</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5-8</td>
<td>1120 / 820</td>
<td>0.87</td>
<td>202 - 298</td>
</tr>
<tr>
<td>Skeleton container with cardboard boxes and inner box to suit unit</td>
<td></td>
<td>3-8</td>
<td>1200 / 800</td>
<td>0.77</td>
<td>176 - 333</td>
</tr>
<tr>
<td>Plywood box + cardboard boxes with sealed packaging and inner box to suit unit</td>
<td></td>
<td>1-2</td>
<td>920 / 620</td>
<td>0.38</td>
<td>59 - 91</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3-4</td>
<td>920 / 820</td>
<td>0.7</td>
<td>141 - 173</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5-8</td>
<td>1120 / 860</td>
<td>1.0</td>
<td>205 - 305</td>
</tr>
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</table>

**Shipping by sea freight**

<table>
<thead>
<tr>
<th>Package type</th>
<th>for no. of vacuum contactors</th>
<th>Length / Width / Height</th>
<th>Volume m³</th>
<th>Gross weight kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardboard box with inner box to suit unit</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cardboard box with sealed packaging and inner box to suit unit</td>
<td></td>
<td>1-2</td>
<td>840 / 570</td>
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<td></td>
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<td>3-4</td>
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<td>0.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5-8</td>
<td>1120 / 820</td>
<td>0.87</td>
</tr>
<tr>
<td>Skeleton container with cardboard boxes and inner box to suit unit</td>
<td></td>
<td>1-2</td>
<td>920 / 620</td>
<td>0.38</td>
</tr>
<tr>
<td></td>
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<td>3-4</td>
<td>920 / 820</td>
<td>0.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5-8</td>
<td>1120 / 860</td>
<td>1.0</td>
</tr>
</tbody>
</table>

**Shipping by air freight**

<table>
<thead>
<tr>
<th>Package type</th>
<th>for no. of vacuum contactors</th>
<th>Length / Width / Height</th>
<th>Volume m³</th>
<th>Gross weight kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardboard box with inner box to suit unit</td>
<td></td>
<td>1-2</td>
<td>500 / 400</td>
<td>0.08</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3-4</td>
<td>840 / 570</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5-8</td>
<td>920 / 620</td>
<td>0.7</td>
</tr>
<tr>
<td>Cardboard box with sealed packaging and inner box to suit unit</td>
<td></td>
<td>1-2</td>
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<td>920 / 620</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>5-8</td>
<td>1120 / 820</td>
<td>0.87</td>
</tr>
<tr>
<td>Skeleton container with cardboard boxes and inner box to suit unit</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plywood box + cardboard boxes with sealed packaging and inner box to suit unit</td>
<td></td>
<td>1-2</td>
<td>920 / 620</td>
<td>0.38</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3-4</td>
<td>920 / 820</td>
<td>0.7</td>
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<td></td>
<td></td>
<td>5-8</td>
<td>1120 / 860</td>
<td>1.0</td>
</tr>
</tbody>
</table>
Application

3TL71 vacuum contactors are 3-pole contactors with electromagnetically operated mechanism for medium-voltage switchgear.

They are load-break switchgear with a limited short-circuit making and short-circuit breaking capacity and are used for high switching frequencies (> 10,000 operating cycles).

The vacuum contactors are suitable for operational switching of AC loads in indoor switchgear.

Applications for switching of, e.g.
- Filter circuits
- Motors
- Reactors
- Ohmic loads
- Reactive-power compensation systems
- Transformers and capacitors

Features

- High number of operating cycles thanks to their proven vacuum switchgear technology
- Unrestricted ON duration
- Maintenance-free through to the end of the vacuum interrupters’ service life
- Universal application for many switching duties, particularly for capacitors
- Can be mounted on different switchgear racks in almost all mounting positions
- Rated voltage up to 24 kV
- Mechanical service life of the contactor up to 1 mill. operating cycles
- High reliability and availability
- Compact, rugged design

Application examples

- Conveyor and lift systems, pump stations
- Secondary distribution switchgear, industrial network distribution systems
- DC link reactors, stators
- Heating resistors
- Capacitor banks

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<tr>
<td>Application examples</td>
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<td>Construction and mode of operation</td>
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<td>Technical data</td>
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<td>Selection and ordering data</td>
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<tr>
<td>Spare parts and accessories</td>
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<tr>
<td>Internal connection diagram</td>
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<tr>
<td>Dimensions and weights</td>
</tr>
<tr>
<td>Shipping</td>
</tr>
</tbody>
</table>
Construction and mode of operation

**Construction**

The 3TL71 vacuum contactor has slimline pole shells positioned above the operating mechanism. The vacuum interrupters are secured between two pole half-shells. This type of construction means that the unit can be mounted easily and universally on the various frames.

The low-voltage section contains the electromagnetically-operated mechanism, contactor relay and auxiliary contacts. A mechanical latch can be installed as an expansion module.

**Mode of operation**

The electromagnetically-operated mechanism of the 3TL71 vacuum contactor opens and closes the contacts of the vacuum interrupters. Thanks to the use of a special double coil, the electromagnetically operated mechanism is designed for closing and holding operation.

Mechanical latch between the withdrawable module and the vacuum contactor:

A link is attached to the operating shaft used to transmit signaling commands, in order to create a mechanical latching mechanism between the withdrawable switchgear module and the vacuum contactor.

---

**Legend**

1. Pole
2. Vacuum interrupter
3. Operating part
4. Auxiliary plug
5. Top main conductor terminals
6. Bottom main conductor terminals
7. Mechanical connection between medium and low-voltage section
8. Operating shaft
9. Auxiliary contact block
10. Magnetic system (solenoid)
Medium-voltage data

Technical data

See short-time current load-period characteristic value; (for short-time current for longer periods, Copper rail to DIN 43671. Strand conductor with cable lug. Terminal screw terminals.

Cross-sections of the main conductor across the open contact gap (r.m.s.)

Rated power-frequency withstand voltage 50 Hz across the open contact gap and between poles (according to DIN EN 60694, IEC 60694):

Dielectric strength

Rated lightning impulse withstand voltage according to DIN EN 60694, IEC 60694:

To earthed parts and between poles across the open contact gap.

To earthed parts and between poles across the open contact gap.

Max. permissible switching capacity

Rated short-time withstand current 1 s (r.m.s., variable for short-time current for longer periods, see short-time current load-period characteristic.

Switching of capacitors

Rated capacitor current

Switching frequency (AC and DC operation) without mechanical closing latching

Mechanical service life of the contactor:

1 mill. operating cycles

Mechanical service life of the vacuum interrupter:

1 mill. operating cycles

Electrical service life of the vacuum interrupter at rated operational current:

0.5 mill. operating cycles

Dielectric strength

Rated lightning impulse withstand voltage according to DIN EN 60694, IEC 60694:

To earthed parts and between poles across the open contact gap.

To earthed parts and between poles across the open contact gap.

Cross-sections of the main conductor terminals

Terminal screw

Stranded conductors with cable lug.

Copper rail to DIN 43671.

Low-voltage section

Power consumption of the solenoid (AC/DC operation)

Pickup power

Holding power

Voltage range of the solenoid

Operating voltage (AC and DC operation)

Minimum closing command for the solenoid

Make time (AC and DC operation)

Break time

≤ 100 ms

Auxiliary contacts

Number of auxiliary contacts

4 NO + 4 NC

6 NO + 6 NC

8 NO + 8 NC

Rated operational current Ia

Utilization category for AC-11 at rated voltage

Utilization category for DC-11 at rated voltage

Cross-sections of the auxiliary contacts (screw terminal, two-wire connection possible)

Solid

Finely stranded with end sleeve

0.5 to 2.5 mm²

0.5 to 2.5 mm²

Ambient conditions

Ambient temperature

Storage: at -40 to +65 °C

Operation: at -5 to +65 °C

at +5 to -25 °C

20 years

1 mill. operating cycles

0.5 mill. operating cycles

Site altitude

50 m below sea level

to 1250 m above sea level

Degree of protection according to DIN EN 60529 and IEC 60529:

IP00

3TL71 Vacuum Contactors

as Special Vacuum Contactors
### Selection and ordering data

<table>
<thead>
<tr>
<th>Rated voltage $U_r$</th>
<th>Rated lightning withstand voltage to earth</th>
<th>Rated power-frequency withstand voltage across open contact gap</th>
<th>Rated operational current $I_{e}$</th>
<th>Order No</th>
<th>Order code</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 kV</td>
<td>95 kV</td>
<td>75 kV</td>
<td>50 kV</td>
<td>800 A</td>
<td>3TL71</td>
</tr>
</tbody>
</table>

- **Rated voltage 24 kV**
- **Rated operational current 800 A**

#### Auxiliary contacts
- 4 NO + 4 NC: 5
- 6 NO + 6 NC: 6
- 8 NO + 8 NC: 8

#### Type of operation
- AC operation: A
- DC operation: B

#### Operating voltage for solenoid

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Operating code</th>
</tr>
</thead>
<tbody>
<tr>
<td>110 V AC, 50 Hz</td>
<td>L2</td>
</tr>
<tr>
<td>230 V AC, 50 Hz</td>
<td>L2</td>
</tr>
<tr>
<td>110 V DC</td>
<td>F4</td>
</tr>
<tr>
<td>220 V DC</td>
<td>M4</td>
</tr>
</tbody>
</table>

#### Operating instructions
- German / English: 0

#### Design / Version
- Standard: 0
- With insulating board: 1

#### Site altitude
- 0 to 1250 m above sea level: A

---

1) Other voltages on request.

2) Note!
- Reduction of insulation capacity (!)
- Other site altitudes on request.
### Spare parts and accessories

<table>
<thead>
<tr>
<th>Component</th>
<th>Scope of delivery</th>
<th>Operating voltage or contacts</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auxiliary contact block</td>
<td>5 NC/5 NO</td>
<td>110 V AC, 50/60 Hz</td>
<td>3SV9911 - 2AA0</td>
</tr>
<tr>
<td>Solenoid</td>
<td></td>
<td>230/240 V AC, 50/60 Hz</td>
<td>3TY5741 - 0AG2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>110 V DC</td>
<td>3TY5741 - 0AL2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>120/125 V DC</td>
<td>3TY5741 - 0BF4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>220 V DC</td>
<td>3TY5741 - 0BG4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3TY5741 - 0BM4</td>
</tr>
<tr>
<td>Rectifier module</td>
<td></td>
<td></td>
<td>3AX1526 -1F</td>
</tr>
</tbody>
</table>

### Internal connection diagram

![Connection Diagram](image)

**Legend**

- **H**: Auxiliary switch
- **K1**: Vacuum contactor
- **K1E, K2E**: Contactor relay for pick-up coil
- **K3E**: Contactor relay for closing coil
- **K1M**: Solenoid-operated mechanism for vacuum contactor
- **V4**: Rectifier module
- **X0**: Plug for auxiliary conductor connection
### Dimensions and weights

**Weight** 80 kg

---

### Shipping

**Packaging**

The 3TL71 vacuum contactors are packed in accordance with the customer’s order specifications and shipped anywhere in the world in the mode determined by the customer.

If the customer has not specified the manner of packaging and mode of shipping, the most economic option is chosen depending on the size of the lot ordered.

<table>
<thead>
<tr>
<th>Package type</th>
<th>Destination</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Germany</td>
</tr>
<tr>
<td></td>
<td>Shipping by means of truck /</td>
</tr>
<tr>
<td></td>
<td>rail</td>
</tr>
<tr>
<td>Individual package</td>
<td>x / -</td>
</tr>
<tr>
<td>Lot-size package</td>
<td>- / x</td>
</tr>
<tr>
<td>Cardboard box with inner box to suit unit</td>
<td>x / x</td>
</tr>
<tr>
<td>Cardboard box with sealed packaging and inner box to suit unit</td>
<td>- / -</td>
</tr>
<tr>
<td>Skeleton container with cardboard boxes and inner box to suit unit</td>
<td>- / x</td>
</tr>
<tr>
<td>Plywood box + cardboard boxes with sealed packaging and inner box to suit unit</td>
<td>- / -</td>
</tr>
</tbody>
</table>

x = Preferred package type

Shipping dimensions and weights on request
Notes
If not stated otherwise on the individual pages on this catalog, we reserve the right to include modifications, especially regarding dimensions and weights.
Drawings are not binding.
All product designations used are trademarks or product names of Siemens AG or other suppliers.
If not stated otherwise, all dimensions in this catalog are given in mm.