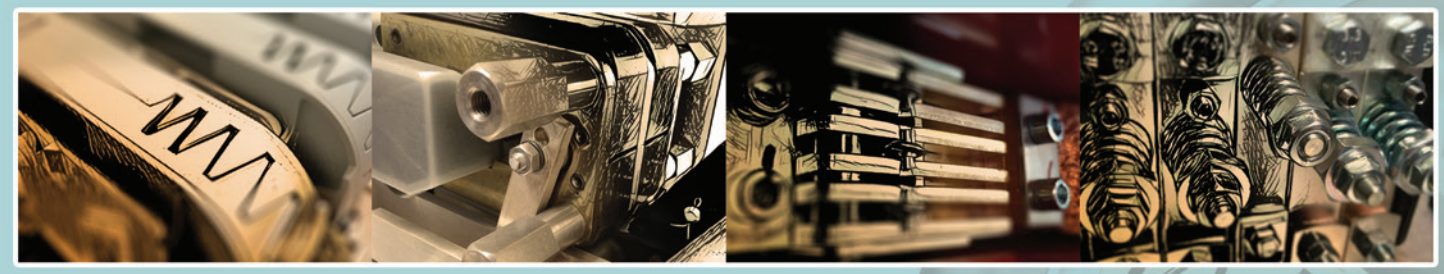
Switches Catalogue



BAR Contactors

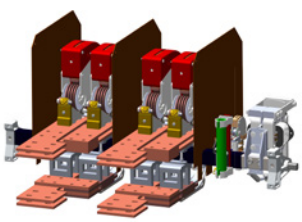
N
Contactos
W
Localização

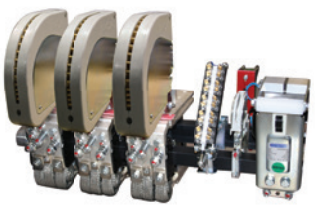
Microelettrica Scientifica

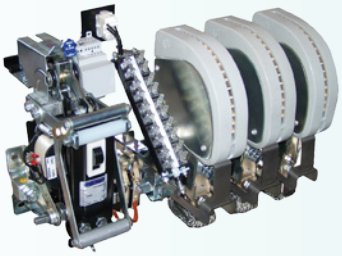
Index N Line

N Line

TADN Line







1. Components

Contactors

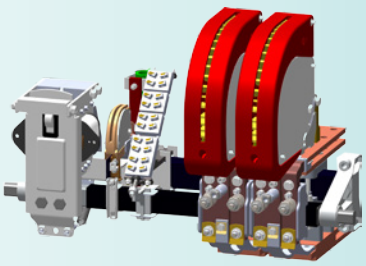
- LTHS Line
- LTC Line
- LTHH Line

DC High Speed Circuit Breakers

- IR 3000 Line
- IR 4000 Line
- IR 6000 Line

Disconnectors

- LTHM Line
- LTMP Line
- LTRM Line



BAR Contactors

- **N Line**
- **TADN Line**

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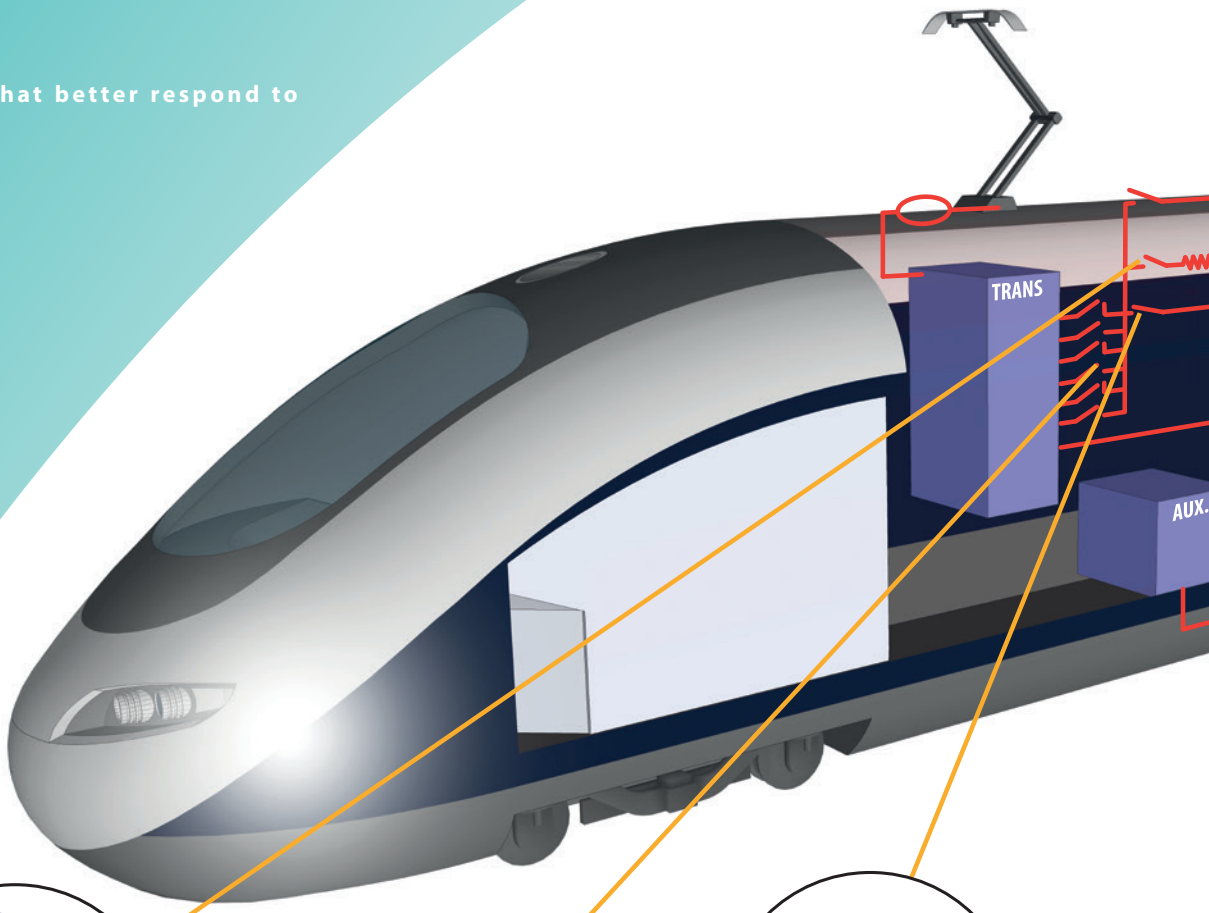
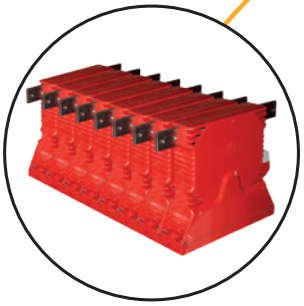
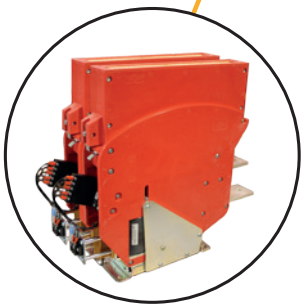


PRECHARGE CONTACTOR



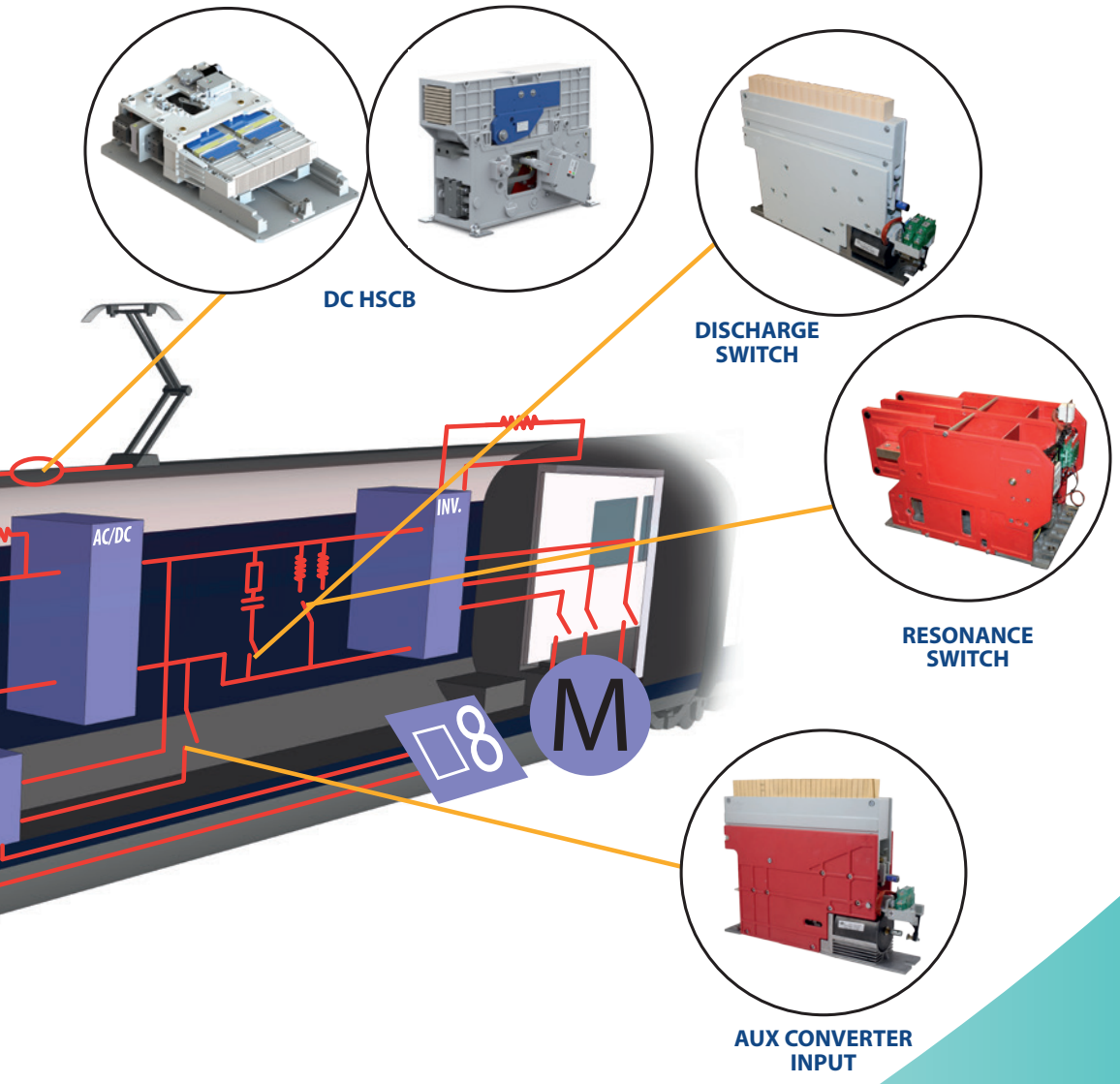
CONFIGURATION SWITCH



LINE SWITCH

2. Markets

traction component need



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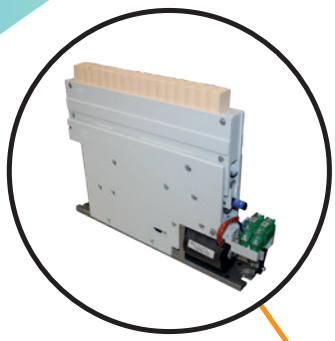
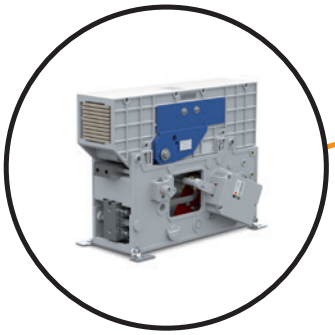


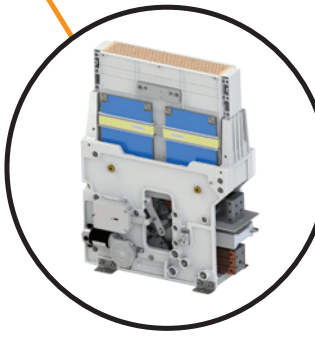
Precharge Contactor

Diaclad



IR 3000

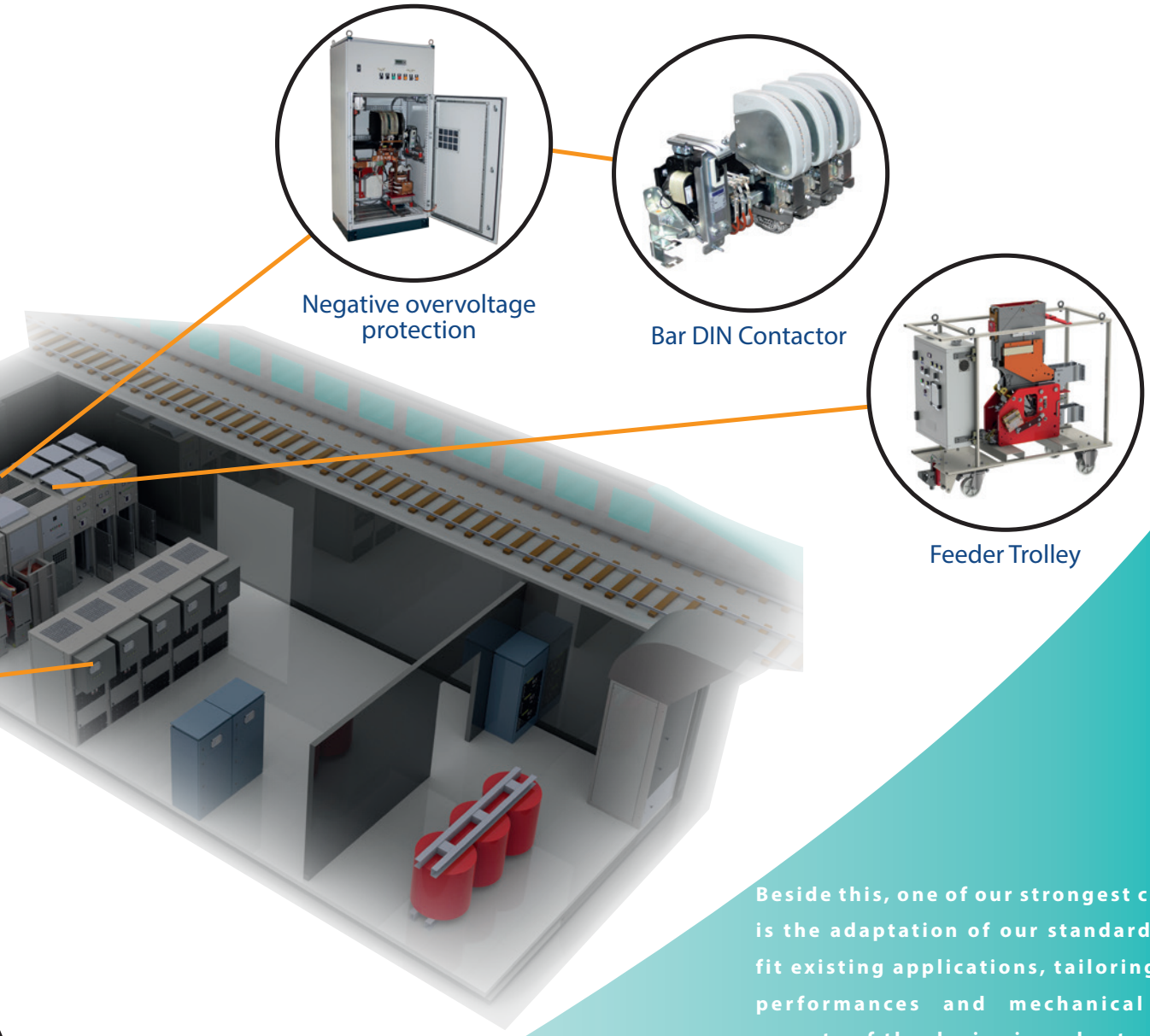
Feeder



IR 4000

2. Markets

substation component need



Negative overvoltage protection

Bar DIN Contactor

Feeder Trolley

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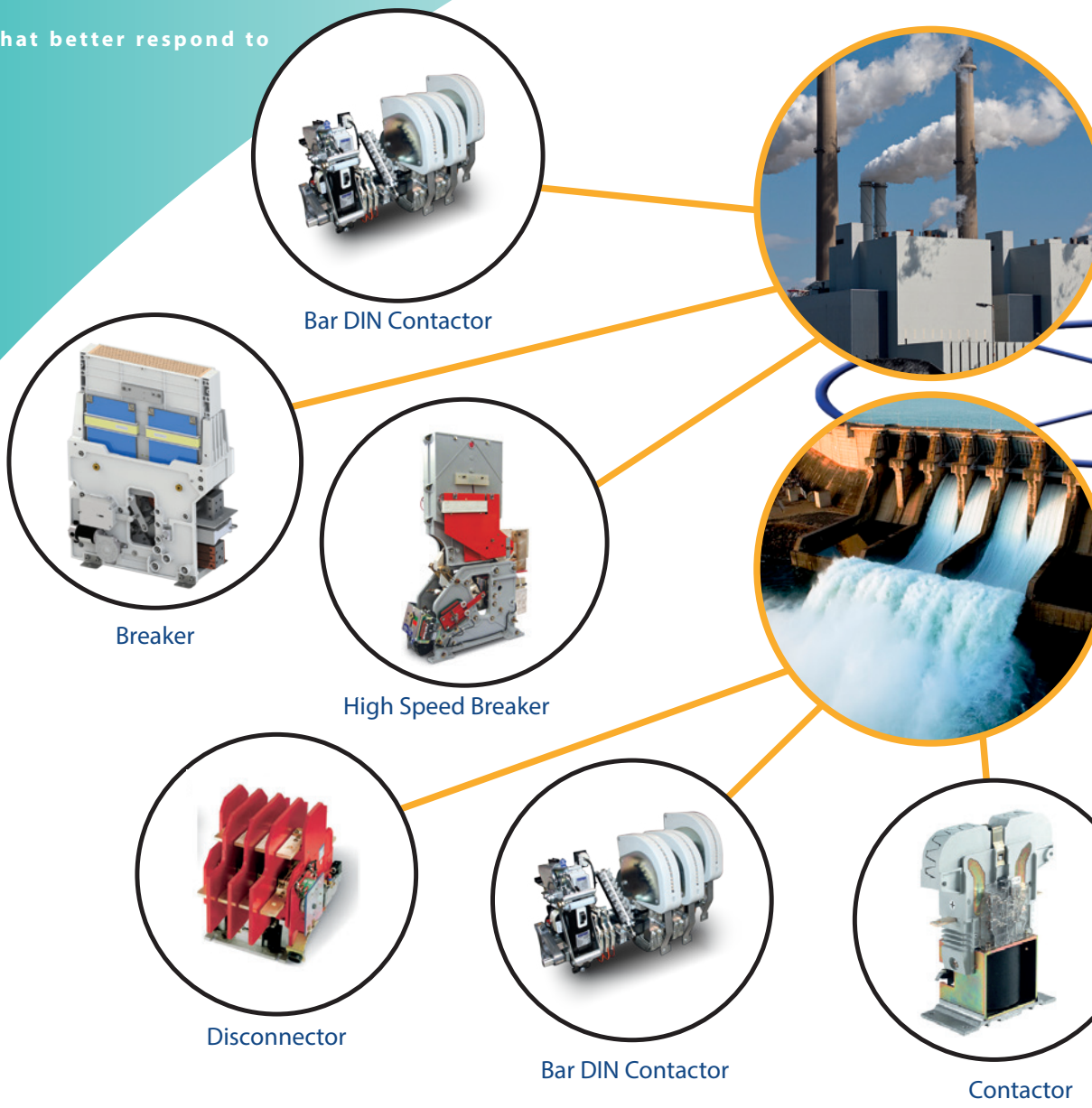
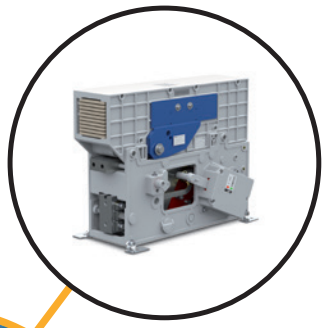
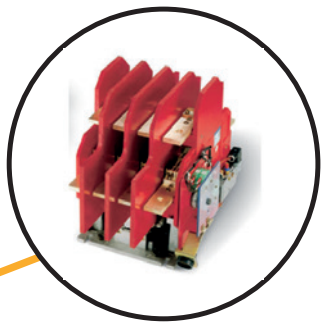


2. Markets

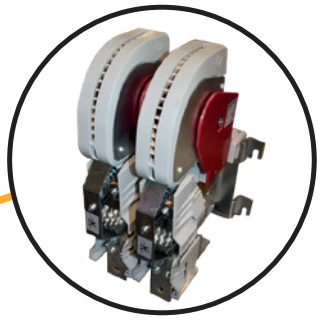
industry component need



Breaker



Disconnector



Inverter DC Contactor

AC Low Frequency Contactor

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BAR Contactors

N Line

TADN Line

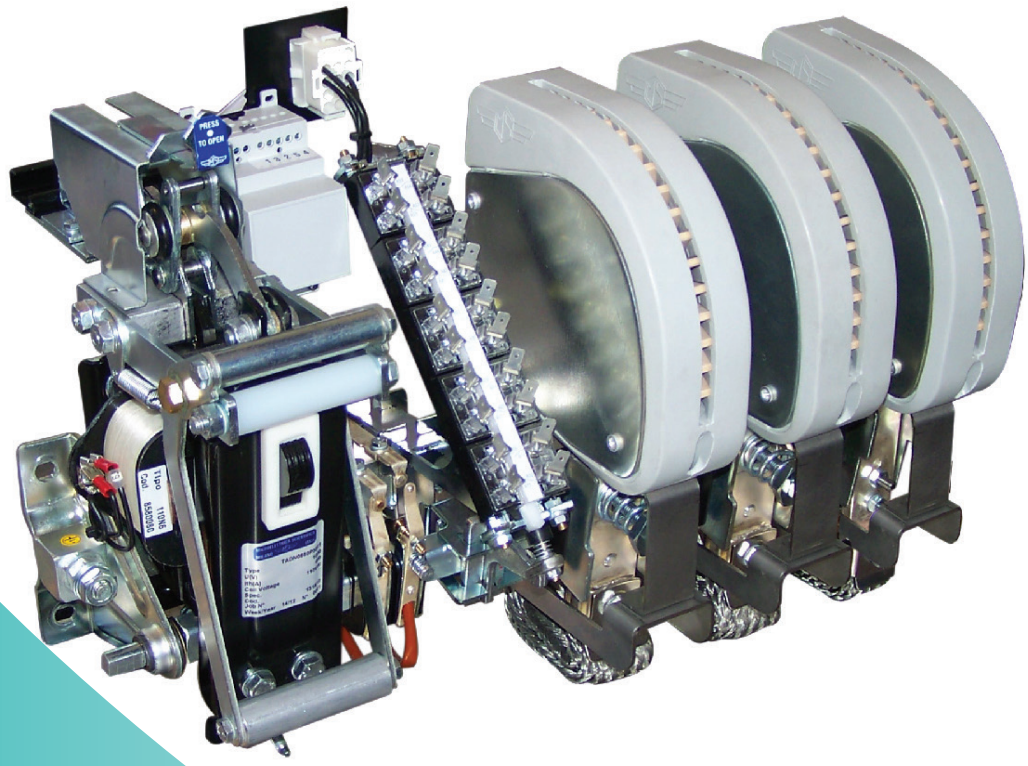
Bar Contactors

Microelettrica Scientifica bar mounted contactors, in spite of their 60 years old technical concept, are still state of the art for many industrial, low voltage, and heavy duty applications. These contactors are designed and tested according to the following standard:

- IEC 60947-4-1 for Low voltage industrial application;
- ANSI C37.18 for field excitation system in power plant;
- IEC 61992 for railway system fixed installation.

They provide excellent operational performances, making them the best choice for high power load connection, often covering the function of a fault clearing protection device.

The Bar mounted series contactors are characterised by a modular design so that their configuration can be tailored to the specific requirements of each application. In fact, the pole ratings cover a wide range, from 85A up to 3000A, and these poles can be mounted side by side regardless of their size and number on a customisable length shafts set. In this way MS offers a custom solution for a wide range of technical needs.



TADN line

The TADN Line is specifically designed in order to control the generator excitation circuit It's typically composed of 2NO poles for field supply and 1NC pole for field discharge.

In order to minimize power consumption is always equipped with a mechanical latch and shunt trip relay for double state function.

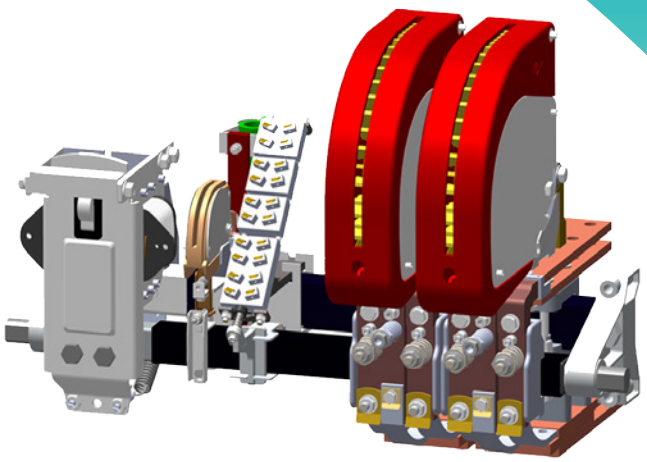
3. BAR Contactors Guideline

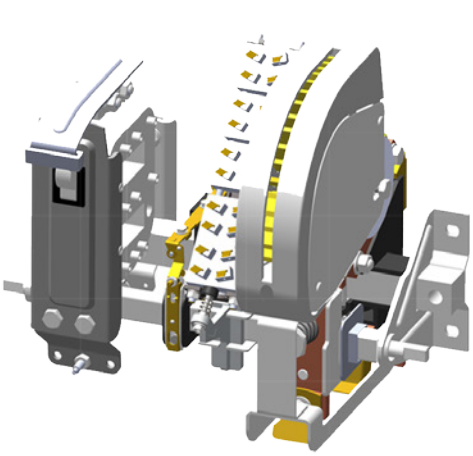
N Line

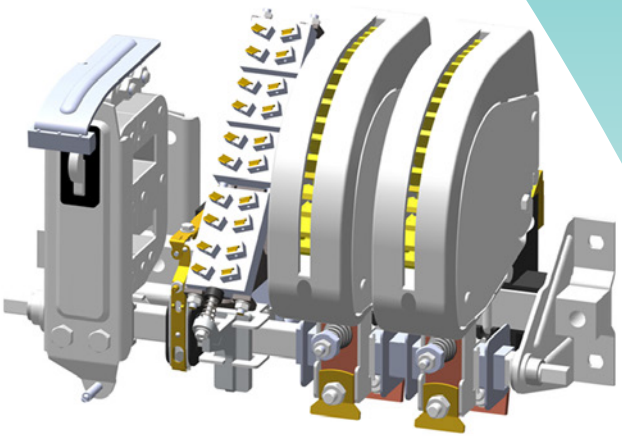
The N Line is a modular contactor with a single state function used for low voltage industrial application up to 1kV.

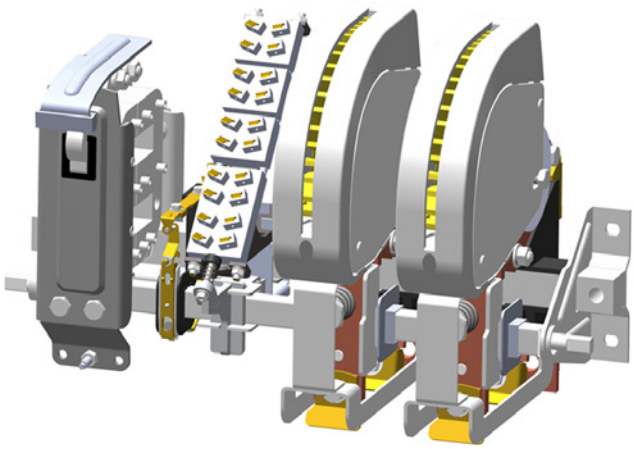
Number of poles and type of poles, normally open and normally close, are available configurations.

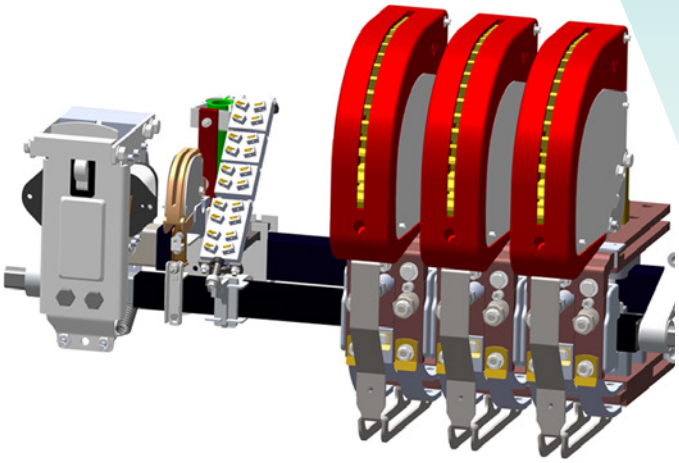
A typical application is the control of AC and DC motors.











General information

The BAR Contactors are particularly suitable for heavy duties and for all services where a high degree of reliability is required thanks to their strong construction and highly efficient performance. The bar assembling system allows a wide configuration in terms of number and type of main poles, anti-arc devices, auxiliary contacts and control voltages.
BAR contactors are designed in order to allow very easy inspection and servicing with immediate access to all component parts. This characteristic allows maintenance activities without removing the contactor from the electrical circuit considering the due safety procedure.
All metal parts, including bolts and springs, are oxidation proven and all insulating materials are made of anti-fungus synthetic fibers certified according to fire & smoke directives.
Products listed in this chapter have to be considered the base types produced by Microelettrica, all the possible configurations in terms of number and type of poles are available upon request.

Contactors characteristics

The contactor is defined by the international standard IEC 60947-1 as "a mechanical switching device having only one position of rest, operated otherwise than by hand, capable of making, carrying and breaking currents under normal circuit conditions including operating overload conditions".

Closing and opening operation are guaranteed by the movement of a moving contact towards a fixed contact. The breaking operation takes place in air and it is aided by a magnetic blow-out system. The electric arc is fully contained inside an arc-chute that is produced in polyester resin and ceramic or cement.

The contactor is electrically operated and can be produced with 2 control system:

Electromagnetic Contactor : "a contactor in which the force for closing the normally open main contacts or opening the normally closed main contacts is provided by an electromagnet". This contactor has only one rest position (Open for normally open contactor; closed for Normally closed contactor). Both N and TADN line are electromagnetic contactors.

Latched Contactor : "a contactor, the moving elements of which are prevented by means of a latching arrangement from returning to the position of rest when the operating means are de-energized". This contactor has two rest position (Open and closed). The force of closing and opening is provided by 2 independent electromagnet. TADN line is a latched contactor.

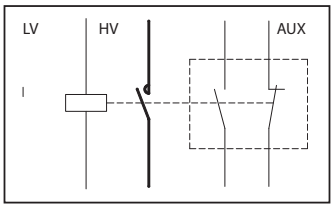
Technical details

MS manufactures electromagnetic, and mechanical latched contactors, designed for indoor installation with the following characteristics:
Rated operational Voltage per pole: 600V
Rated insulation Voltage: 1000V
Utilization category class: all AC classes and all DC classes;
Operational temperature range: -5°C ÷ +60°C;
Max. altitude without performance derating: 2000m.

The contactors are suitable for low voltage industrial installation certified according to IEC EN 60947-4-1.
The used insulating materials are low smoke emission, halogen free and in accordance with standards regarding fire and smoke directive for subways and railway installations.

All contactors are composed of the following elements (according to IEC 60947-1 standard):

1. Main circuit (High Voltage circuit): All the conductive parts of an assembly included in a circuit which is intended to transmit electrical energy. (IEV 441-13-02)
2. Control circuit: "all the conductive parts (other than the main circuit) of a switching device which are included in a circuit used for the closing operation or the opening operation, or both, of the device". It is intended to carry the power and/or the control signal to the actuating system that mechanically closes or opens the contacts. (Low Voltage circuit)
3. Auxiliary circuit: "all the conductive parts of a switching device which are intended to be included in a circuit other than the main circuit and the control circuits of the device". Normally most of the switching devices have an auxiliary circuit, whose purpose is mainly to signal if the main contacts are open or closed (AUX circuit)



Example of MS contactor electrical scheme

High Voltage Circuit (HV)

The aim of this chapter is to help the definition of the best contactor for every specific application through the widest contactors range on the market. Description and tables inside this chapter help choosing the right contactor according to the following parameters:

- **Conventional free air thermal current Ith**. This is the current that the contactor is able to carry continuously in an ambient with temperature up to 40°C.
- **Rated operational current Ie**. This is the current that the contactor is able to make and break during an electrical durability test at Ue (according to IEC 60947-4-1standard) or Un (according to MS standard procedure).
- **Rated Breaking capacity**. A value of breaking current that the contactor is capable of breaking at a stated voltage under prescribed conditions of use and behavior. (IEV 441-17-08)
- **Maximum breaking capacity**. The maximum value of breaking current that the contactor is capable of breaking a limited number of times.
- **Making capacity**. A value of making current that the contactor is capable of making at a stated voltage under prescribed conditions of use and behavior. (IEV 441-17-09)
- **Maximum making capacity**. The maximum value of making current that the contactor is capable of making a limited number of times.
- **Rated short-time withstand current Icw**. The current that the contactor in the closed position can carry during a specified short time under prescribed conditions of use and behavior. (IEV 441-17-17)
- **Rated breaking power Pe**. This is the power that the contactor is able to make and break during an electrical durability test.
- **Maximum breaking power PeMAX**. This is the maximum power that the contactor is able to make and break a limited number of times.
- **Nominal voltage Un**. A suitable voltage value used to design or identified a given supply system. (CEI EN 50124)
- **Rated operational voltage Ue**. This is a value of voltage which combined with rated operational current and rated operational frequency, determines the application of the equipment and which the relevant tests and the utilization categories are referred. (IEC 60947-4-1)
- **Maximum operational voltage UeMAX**. This is the maximum value of the voltage likely to be present on the circuit for maximum 5 minutes according to CEI EN 50163 standard.
- **Rated insulation voltage UNm**. An rms withstand voltage value characterizing the specified permanent withstand capability of its insulation. (CEI EN 50124)
- **Rated power frequency withstand voltage U50**. This is the rms value of the 50Hz sinusoidal voltage which does not cause an insulation failure under specified condition of test. (IEC 60947)

Main Pole Type:

The Bar contactor can be produced with normally open poles and normally closed poles assembled on the same shafts set. Among all possible configurations the standard ones are the followings:

- 1 normally open pole (1NO)
- 1 normally closed pole (1NC)
- 2 normally open poles (2NO)
- 3 normally open poles (3NO)
- 2 normally open poles combined with 1 normally closed pole (2NO+1NC)

A full range of main pole is available depending on the thermal current at an ambient temperature of 40 °C required from the system:

Main Pole	Thermal current [A]
N 125	125
N 190	190
N 350	350
N 650	650
N 800	800
N 1000	1000
N 1250	1250
N 1600	1600
N 2000	2000
N 3000	3000

Other thermal current ratings can be obtained through a combination of the above versions up to 12000 A.
The standard pole is named "FS" type and it's equipped with a magnetic blow-out coil, an arcing deflector and an arc chute.
The FS type is designed for switching under inductive load up to 20 times the rated current, and voltages above 660 V single pole. It's suitable for control of AC and DC motors and as line circuit breaker function.

Optionally, depending upon their use, BAR type contactors can be fitted with the following type of poles:

- "V" type, equipped without the magnetic blow-out coil, and without the arc chute. It's used for no-load switching and suitable, for example, for control of starting resistors and capacitors.
- "S" type, equipped with magnetic blow-out coil, arc chute, but without arcing deflector. It's used for switching under inductive load up to 10 times the rated current with voltage up to 660 V single pole. It's suitable, for example, for control of squirrel cage motors.
- "FSS" type, equipped with double switching system obtained through two series arcing contacts that grant a double speed switching and a double gap between open arcing contacts. This solution is available only for high thermal current size pole (3200 A, 4000 A and 6000 A obtained with 2 parallel poles type N1600, N2000 and N3000).

The poles of the BAR contactors have been carefully designed in order to achieve the following features:

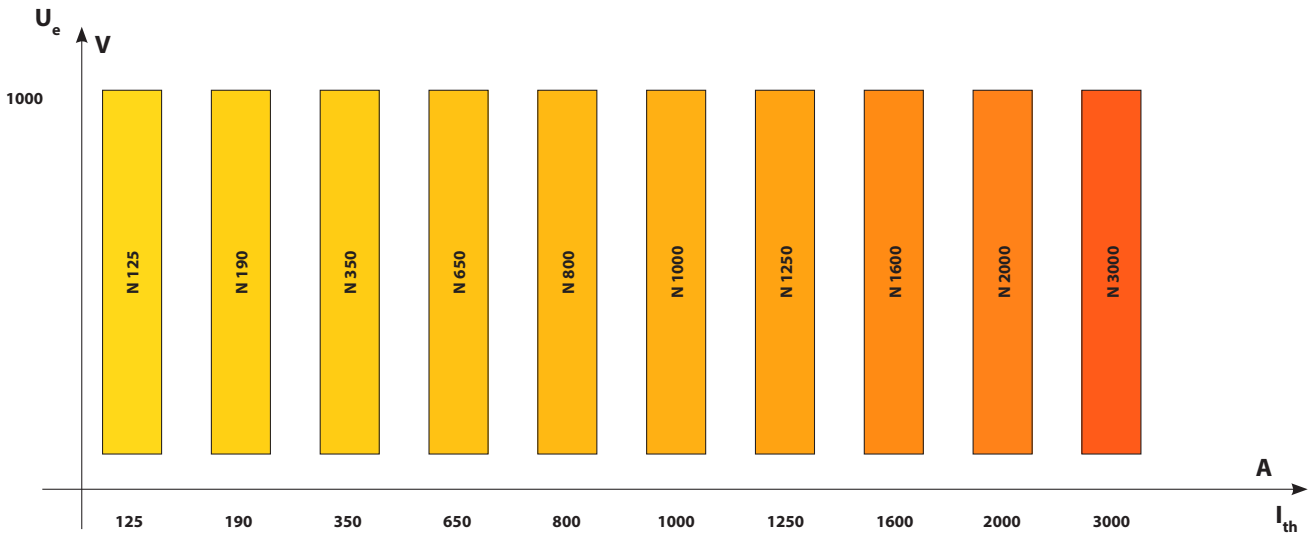
- Very low contact bounce;
- Relative brushing of the contact's surfaces with the resulting of self-cleaning effect;
- Low probability of arc re-priming, even with current, voltage and inductance particularly high;
- Regular wear of the main contacts.

The poles of the BAR contactors are normally fitted with sintered contacts in silver-tin oxide that guarantees the best ratio between electrical switching performances and thermal conductivities.

However, depending upon the application, the following materials are available according to the proper function required from the system:

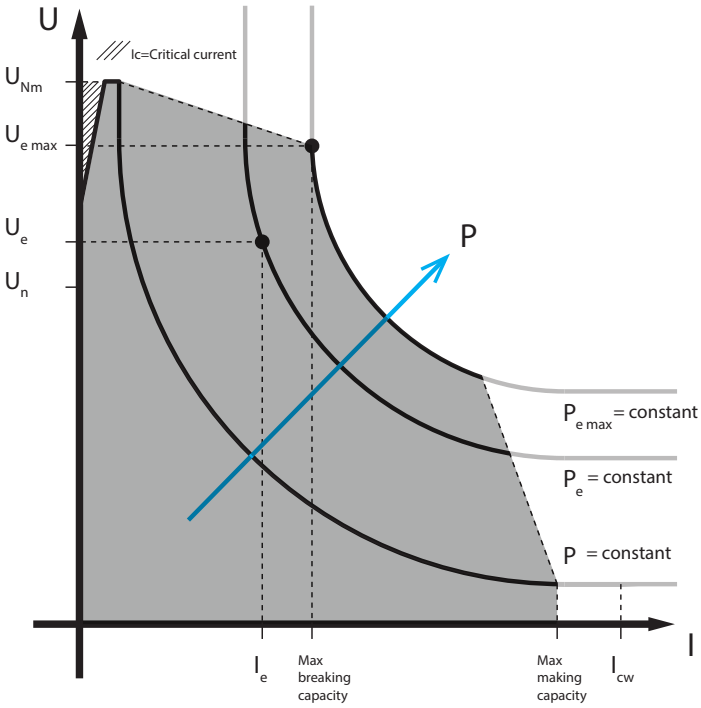
- S4, silver and tungsten alloy, that guarantees the best closing performances where a low contact resistance is not needed.
- CU, very hard solid copper, that guarantees the best price solution for light duty applications.

1. Conductive capabilities referred to CU and S6 contacts material type

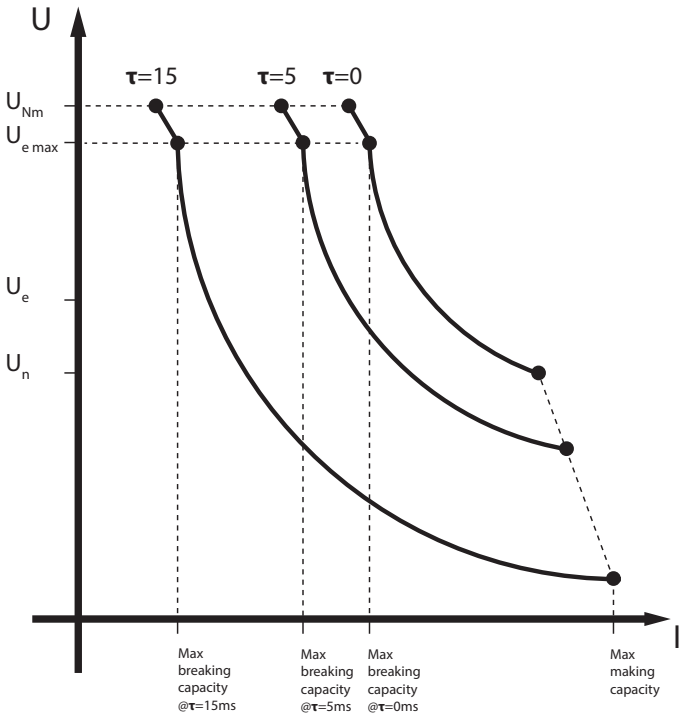


2. Switching capabilities

5.1 Breaking characteristic @ τ=Cost.



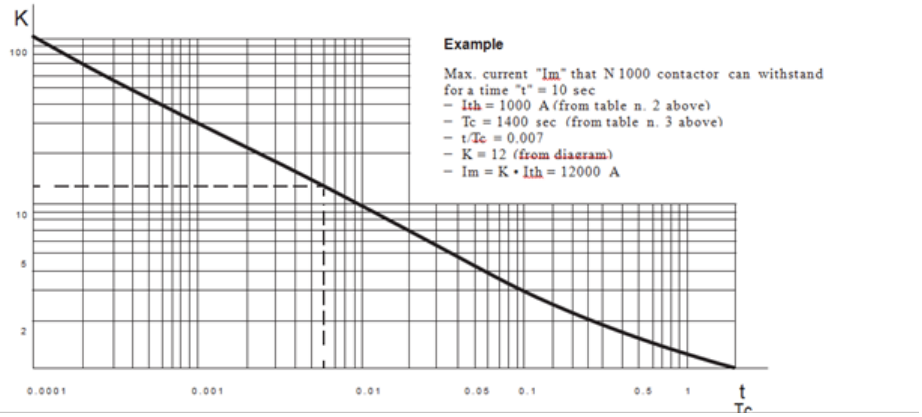
5.2 P_e max capabilities @ different τ



Overload capability of contactors

The contactors can withstand, for short time durations, currents much higher than the thermal current; in this instance two different phenomena must be considered: the thermal effect and the electrodynamic effect.
Dynamically the contactor can withstand current peaks to a limit where repulsion of the contacts may occur.
The current which causes the repulsion of the contacts could be higher than the making capacity of the contactors; it is considered that this phenomenon arises when the contactor is already closed.
Therefore, the electrodynamic stress in this case is not superimposed to the mechanical bounce effect that can arise during the closing operation which is the principal cause of the contacts melting.
Of course, the intensity of this dynamic current must also be thermally tolerable for the contactor and therefore, in the table below, the values "Id" of the maximum acceptable dynamic currents are given providing that their duration is no more than 100ms.
From the thermal point of view the intensity of the tolerable overload is inversely proportional to its duration and depends essentially upon the time constant Tc of the warning-up curve of the contactor when its rated current is applied. The diagram below gives the ratio t/Tc (where t is the duration of the overload) and the factor K which, when applied to the nominal current of the contactor, determines the intensity of the tolerable overload starting from the cold status.

Contactor Type N	125	190	350	650	800	1000	1250	1600	2000	3000
Id (Peak val.) KA	3.5	4.5	9	13	15	20	25	32	38	45
Tc sec.	1200	1500	1300	1500	1500	1400	1500	1800	2250	12150



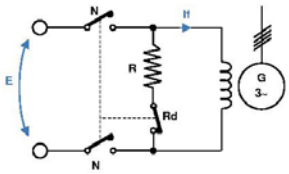
Typical Application:

1. Field discharge contactors: type TADN, 2NO + 1NC

The contactors for this application are intended for using in field circuit of apparatus such as generators, motors, synchronous condensers or exciters and embodying contacts for establishing field discharge circuits.
This contactor is composed of 2 normally open poles (NO) and 1 normally closed pole (NC) and are used for systems up to 1000Vdc. 2 NO poles charge the stator excitation field winding circuit while the 1 NC pole charge the discharge resistor responsible for stator de-fluxation. These three poles are operated at the same time through the common shaft and the operation sequence between NO and NC poles follows these rules:

a) Normally open contacts (Main contacts), opened when the contactor is open, are used to energize the field circuit of main apparatus.
b) Normally closed contacts (Discharge contact), closed when the contactor is open, are used to short-circuit, through a proper discharge resistor, the field circuit at the instant preceding the opening of the main contacts. Moreover, when the contactor is closed, the discharge contacts disconnect the field circuit from the discharge resistor, at the instant following the closing of the main contacts.
c) The closing system is a mechanical latch type in order to obtain a bi-stable device for power saving.

The most frequent type of connection, in the case of synchronous generators excited by static exciters, is the one shown in the figured diagram here below.



Characteristics of the field circuit

E = Rated nominal voltage of excitation circuit.
Ec = Exciter ceiling voltage (Ec = 140 % E)
If = Rated nominal current of excitation circuit.
Kdc x·If = Medium value of the field current under armature circuit fault conditions, at the instant of the contactor's opening.
Kc·x If = Peak value of the field current under armature circuit fault conditions at the instant of the contactor's opening.
Iccf = Field current under field circuit fault conditions with voltage = Ec.
Rd = Value of the discharge resistor in ohms.
N = Normally open Pole (NO)
R = Normally closed Pole (NC)

Characteristics of the contactor (See specific Datasheet)

1) Rated nominal voltage	Vn ≥ E
2) Rated continuous current of main contacts	In ≥ 1,1 x If
3) Rated short-time voltage of main contacts	V' ≥ Ec
4) Rated maximum interrupting voltage of main contacts	Vcc ≥ Kdc x If x Rd + E
5) Rated interrupting current of main contacts at V' (short-circuit in the field circuit)	I'cc ≥ Iccf
6) Rated interruption current of main contacts at Vcc (short-circuit in the armature circuit)	Icc ≥ Kdc x If + E / Rd
7) Rated 1/2 second short-time current of the main contacts	Icc0,5 ≥ Iccf
8) Rated interrupting current of the discharge contacts at V'	Iccd ≥ Ec / Rd
9) Rated making current of the discharge contacts (short-circuit in the armature circuit)	Ichd ≥ Kc x If + Ec /Rd
10) Rated 15 seconds short-time current of the discharge contacts	Id 15"

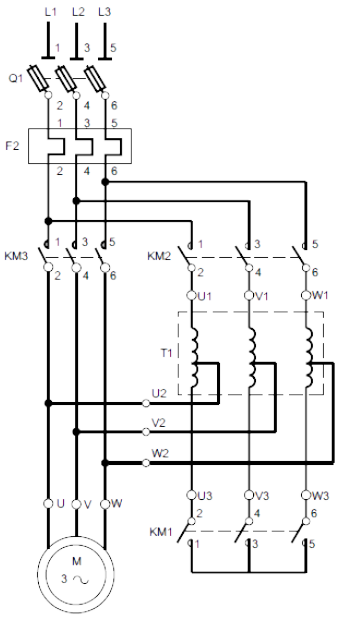
2. Three phase AC motor control: type n, 3NO

The contactor for this application is composed of 3 normally open poles (NO) for systems type 3P or 4 normally open poles (NO) for systems type 3P+N.
It can be used for systems at rated voltage up to 690Vac and motors with power up to 2 MW in the following cases:

- Slip-ring motor: starting and breaking.
  Utilization category according standard CEI EN 60947-4-1: AC2.
- Squirrel cage motor: starting, breaking, whilst motor running.
  Utilization category according standard CEI EN 60947-4-1: AC3.
- Squirrel cage motor: starting, reversing inching.
  Utilization category according standard CEI EN 60947-4-1: AC4.

The main parameters for contactor dimensioning are the following:

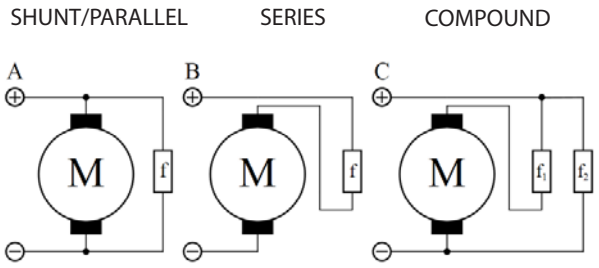
- Rated voltage Ue
- Rated current Ie
- Utilization category AC

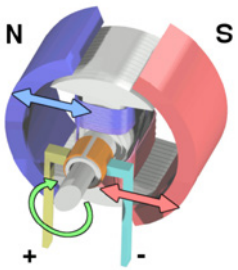


Typical application	Utilization category	Electrical durability (6000operations)						Occasional duty (50 operations)					
		Making			Breaking			Making			Breaking		
		I	U	cosϕ	I	U	cosϕ	I	U	cosϕ	I	U	cosϕ
Slip-ring motor: starting and breaking.	AC2	2 Ie	1.05Ue	0.65	2 Ie	1.05Ue	0.65	4Ie	1.05Ue	0.65	4Ie	1.05Ue	0.65
Squirrel cage motor: starting, breaking, whilst motor running.	AC3	2 Ie	1.05Ue	0.35	2 Ie	1.05Ue	0.35	8Ie	1.05Ue	0.65	8Ie	1.05Ue	0.65
Squirrel cage motor: starting, reversing inching.	AC4	6 Ie	1.05Ue	0.35	6 Ie	1.05Ue	0.35	10Ie	1.05Ue	0.65	10Ie	1.05Ue	0.65

3. Dc motor control: type N, 1 NO or 2 NO or 2 NO + 1 NC

DC motors differs, according to the stator type, in permanent magnet and wound stator type. For this last version, three different electrical connections between the stator and the rotor are feasible (series, shunt/parallel and compound) in order to achieve a unique speed/torque characteristics appropriate for different loading torque profiles.





The contactor for these applications can be used for systems at rated voltage up to 1000Vdc and motors with power up to 2,5 MW in the following cases:

- Permanent magnet DC motor and Wound stator DC Motors (Shunt connected): starting, plugging, inching. Dynamic breaking of DC Motor. Utilization category according standard CEI EN 60947-4-1: DC3.

- Wound stator DC Motors (Series or Compound connected): starting, plugging, inching. Dynamic breaking of DC Motor. Utilization category according standard CEI EN 60947-4-1: DC5.

The contactor for this application is composed of 1 or 2 normally open poles or 2 normally open+ 1 normally closed pole, according to the rated voltage and the working principle of the system:

- 1 normally open poles for DC motors with rated voltage up to 400 Vdc (DC3).
- 2 normally open poles (series connected) for DC motors with rated voltage up to 1000 Vdc (DC3) or 750 Vdc (DC5).
- 2 normally open poles (series connected) + 1 normally closed pole for DC motors, with rated voltage up to 1000 Vdc (DC3) or 750 Vdc (DC5), with braking resistor used to dissipate the energy produced by the motor during the braking phase. The NC pole is connected in series to the braking resistor. The three poles are operated at the same time through the common shaft.

Typical application	Utilization category	Electrical durability (6000operations)						Occasional duty (50 operations)					
		Making			Breaking			Making			Breaking		
		I	U	cosϕ	I	U	cosϕ	I	U	cosϕ	I	U	cosϕ
Permanent magnet DC motors & Shunt Motors: starting, reversing, inching	DC3	2.5Ie	1.05Ue	2	2.5Ie	1.05Ue	2	4Ie	1.05Ue	2.5	4Ie	1.05Ue	2.5
Series Motors: starting, reversing, inching	DC5	2.5Ie	1.05Ue	7.5	2.5Ie	1.05Ue	7.5	4Ie	1.05Ue	15	4Ie	1.05Ue	15

4. Insertion of resistive load for ac or dc systems: Type N, 1 NO or 2 NO or 1 NC

The contactor for this application is composed of 1 or 2 normally open poles (NO) or 1 normally closed pole (NC) according to the rated voltage or the working principle of the system:

- 1 normally open poles for rated voltage up to 600 V (DC1 and AC1).
- 1 normally closed poles for rated voltage up to 600 V (DC1 and AC1).
- 2 normally open poles (series connected) for rated voltage up to 1000 Vdc (DC1)

Typical application	Utilization category	Electrical durability (6000operations)						Occasional duty (50 operations)					
		Making			Breaking			Making			Breaking		
		I	U	L/R - cosϕ	I	U	L/R - cosϕ	I	U	L/R - cosϕ	I	U	L/R - cosϕ
Non Inductive load or slightly inductive load, resistance furnace	AC1	1Ie	1.05Ue	0.8	1Ie	1.05Ue	0.8	1.5Ie	1.05Ue	0.8	1.5Ie	1.05Ue	0.8
Non Inductive load or slightly inductive load, resistance furnace	DC1	1Ie	1.05Ue	1ms	1Ie	1.05Ue	1ms	1.5Ie	1.05Ue	1ms	1.5Ie	1.05Ue	1ms

5. DC lifting magnet: Type N 1 NO or 2NO or 1 NC

The contactor for this application is composed of 1 normally open poles (NO) or 1 normally closed pole (NC) according to the working principle of the system:

- 1 normally open poles for rated voltage up to 600 V (DC3).
- 1 normally closed poles for rated voltage up to 600 V (DC3).
- 2 normally open poles (series connected) for rated voltage up to 1000 V (DC3).

Typical application	Utilization category	Electrical durability (6000operations)						Occasional duty (50 operations)					
		Making			Breaking			Making			Breaking		
		I	U	L/R	I	U	L/R	I	U	L/R	I	U	L/R
DC Lifting magnet	DC3	2.5Ie	1.05Ue	2	2.5Ie	1.05Ue	2	4Ie	1.05Ue	2.5	4Ie	1.05Ue	2.5

6. Contactor for capacitors: Type CN

The switching of the usual three-phase power factor correction capacitors for motors or lines, is normally exploited by the standard type N contactors in the version with poles type V or S for voltage up to 1000 V. Special care must be taken for switching the capacitors (single-phase) used for power factor correction and current balancing of induction furnaces where high frequency of operation and remarkable presence of harmonics is expected. The CN contactors are properly designed to withstand the increased thermal stresses due to harmonics existing in the circuits feeding the capacitors, and to withstand for a great number of operations the highest overcurrent that may occur when connecting a capacitor. According to the figured diagram here below, for limiting the above mentioned transient current peaks, the contactor, where provided in the plant, connects the capacitor through a proper limiting resistor, which, after a very short delay, is by-passed by the main pole that connects the capacitor directly to the line. Moreover the contactor, when opening, can connect the capacitor across a discharge resistor by a proper contact. The above mentioned resistances, that on request can be supplied with the contactor, must be carefully designed according to the performances of the contactor itself and in function of the number of operations per hour required. For voltages up to 500 V the contactors are fitted with poles without magnetic blowers or arc-chutes. For voltages over 500 V the arcing poles are always of the magnetic blower type with arc-chutes. Moreover, for voltages over 1000 V, two or more arcing poles connected in series are provided.

T Y P E	RATED OPERATIONAL CURRENT [A]				Making current	Max. n° of oper./ hour
	50 Hz	100 Hz	150 Hz	250 Hz	[A]	
CN 125	100	90	85	60	3700	150
CN 190	150	135	125	95	4500	150
CN 350	250	225	210	175	9000	100
CN 650	460	410	390	325	13000	100
CN 800	560	500	480	400	16000	60
CN 1000	700	630	600	500	20000	60
CN 1250	900	800	750	650	30000	60

I = arcing pole
C = main pole
S = discharge resistance connecting contact
RI = limiting resistance
RS = discharge resistance

For reactive power higher than 0,5 KVAR, a discharge resistor must be always provided.

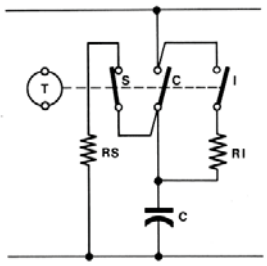


Fig. 1

Optional available

1. Mechanical interlock

All BAR contactors are mechanically interlockable two by two, between types of the same size and number of poles as well as between types of different size and number of poles. The mechanical interlock, normally provided for contactors mounted one above the other, works directly on the electromagnets for the contactors of the size N125. For bigger size contactors the mechanical interlock works by means of a rod connected to the movable shaft. This type of mechanical interlock is adjustable according to requested clearance as well as the distance between contactors. On request it is possible to interlock contactors mounted side by side or interlocks among more than two contactors.

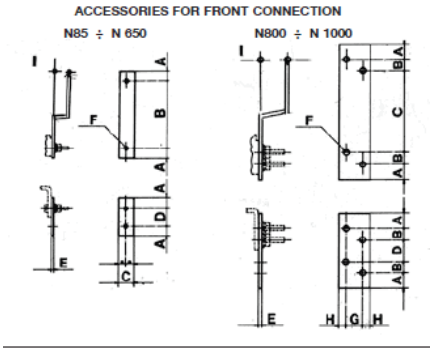
2. Draw-out execution

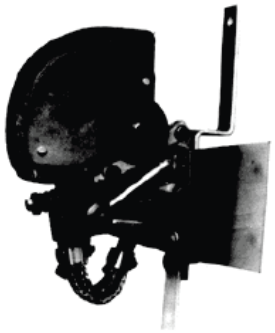
All BAR contactors can be supplied in a withdrawable execution. This execution allows the three positions «Service», «Test» and «Out of Service», with mechanical and electrical indication.
The connection of the main poles is made by spring clamps that take into account the thermal effects as well as the electrodynamics stresses conditions. The control circuit and the auxiliary contacts are connected through sliding contacts mechanically linked with the main poles.

3. Front connections accessories

All N series contactors can be equipped with front connections accessories that allows to elongate the main circuit connections in order to simplify cable/bars connections.

3. BAR Contactors Guideline

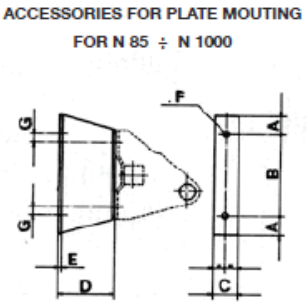




Type	Accessories for from connection								
	A	B	C	D	E	F	G	H	I
N125	10	100	20	40	4	8.5	-	-	32
N190	10	100	20	40	4	8.5	-	-	32
N350	15	140	25	50	5	8.5	-	-	35
N650	20	170	40	65	6	12	-	-	52
N800	15	18	180	64	8	11	25	12.5	55
N1000	15	18	180	64	8	11	25	12.5	55

4. Plate mounting accessories

All N series contactors can be equipped with plate mounting accessories that allows to shim their mechanical interface in order to simplify mechanical or electrical connections.



Type	Accessories for plate mounting						
	A	B	C	D	E	F	G
N125	12.5	100	30	65	3	9	20
N190	12.5	100	30	80	3	9	20
N350	15	120	30	80	3	9	20
N650	15	120	30	100	3	9	20
N800	20	140	30	107	4	9	20
N1000	20	140	30	107	4	9	20

5. Spark arresting sheet

All BAR contactors can be equipped with spark arresting sheet, for rated voltages higher than 1000 V, that allows to increase the insulating level between poles reducing the overall dimension of the complete contactor.

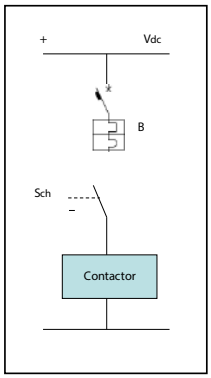
Low Voltage Circuit (LV)

The laminated magnetic circuit, in the movable as well as the fixed part, is made by three limbs in which the coil is housed.
The supply can be in AC (up to 350A rating) or DC with economy resistor, and the unique design provides very strong attraction with low coil consumption and very regular movement.
Special care has been applied in the design of the magnetic circuit to assure that the closing and opening of the contacts is performed in a single continuous movement, without vibration or bounce, even with relatively unstable voltages.

The coils of the control circuit can be provided at several voltages. Standard nominal voltages are 110Vac, 110Vdc, 220Vac and 220Vdc (range from -10% to +15%). Special voltages are also available on request for DC and AC circuits.

Electromagnetic contactors

Standard electromagnetic contactors control and protection scheme is represented here below.

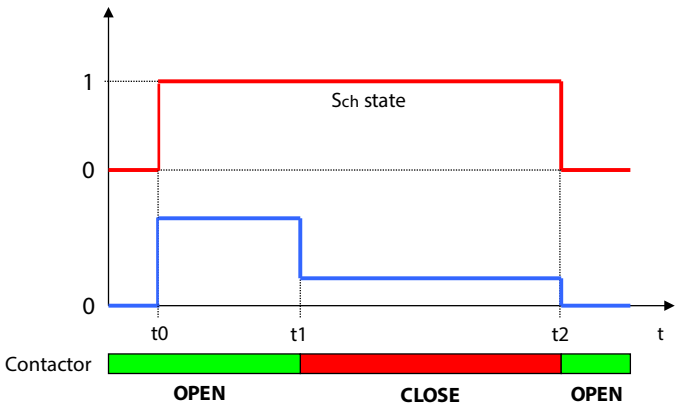


Legend:
B: safety thermal-magnetic breaker
Sch: Closing command

MS Scope of supply
Customer Scope

1. Single winding coil + saving resistor

Standard configuration for contactor, in which the contactor is operated by an impulse current coil with a and saving resistor switched by a dedicated aux delayed auxiliary contact.

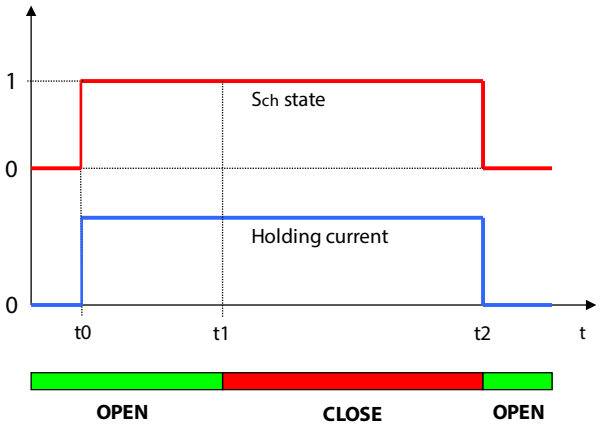


- **t0:** Sch changes its state from 0 to 1. This is the command for the contactor to close.
- **t0 -> t1**: Closing time. The movable arm of the contactor
- is closing. The saving resistor is short-circuited by the starter. The current in the holding coil is higher in order to guarantee a good closing operation. The contactor is open.
- **t1 -> t2:** Holding time. The starter switches off. Coil
- winding and saving resistor now are in series and both energized. The current in the holding coil is lower in closed. The contactor is closed.
- **t2:** Sch changes its state from 1 to 0. This is the command for the contactor to open.

2. Single winding coil for AC supply

Configuration for contactor, in which the contactor is operated and held closed by means of a single winding coil.
This control circuit is used only for AC coil of small contactor N125;N190 and N350.

Working principle

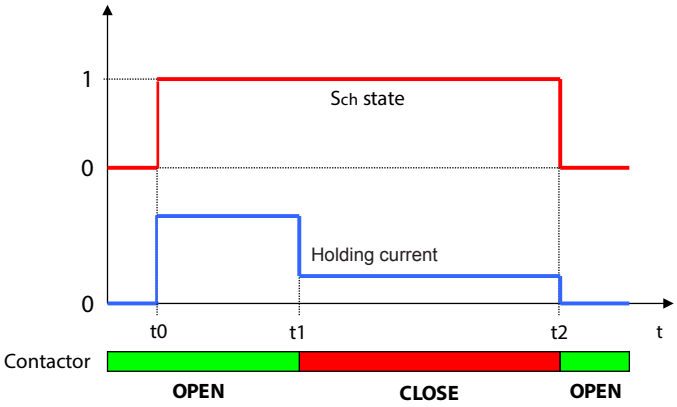


Legend:

- **t0:** Sch changes its state from 0 to 1. This is the command for the contactor to close.
- **t0->t1**: Closing time. The movable arm of the contactor is closing. The contactor is open.
- **t1 -> t2:** Holding time. The movable arm is closed. The contactor is closed.
- **t2:** Sch changes its state from 1 to 0. This is the command for the contactor to open.

3. Double winding coil

Some contactors are equipped with a double winding coil in association with a delayed NC auxiliary contact used for reducing power consumption.



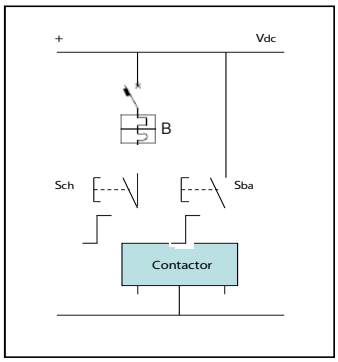
Legend:

- **t0:** Sch changes its state from 0 to 1. This is the command for the contactor to close.
- **t0 -> t1:** Closing time. The movable arm of the contactor is closing. Only one winding is powered (the second winding is short-circuited by the starter).The current in closing operation. The contactor is open.
- **t1 ->t2:** Holding time. The starter switches off. The two current in the holding coil is lower in order to reduce consumption. The movable arm is closed. The contactor is closed.
- **t2:** Sch changes its state from 1 to 0. This is the command for the contactor to open.

Mechanical Latched Contactors

All the contactors of the N series can be fitted with the mechanically latched control device type «TAN». By this device the contactor, when operated, remains mechanically latched and the closing electromagnet is automatically deenergized after a short delay which ensures a correct latching; the opening operation is made by a proper release electromagnet.
The «TAN» device mounted on the contactors of the sizes over 190 Amps, includes a low consumption auxiliary contactor which controls the main closing electromagnet, thus allow the operation by simple push buttons or auxiliary contacts.
The unit «TAN» is also complete with an antipumping device and with hand operation levers; moreover, on request, it can be fitted with under voltage release.
The «TAN» contactors, normally provided for D.C. supply, can also be fitted with a self-contained rectifier for A.C. supply.
The electrical characteristics and the overall dimensions of the «TAN» contactors are the same of the standard type «N» contactors of the corresponding size and number of poles with D.C. control and one more aux. contact besides those actually needed.

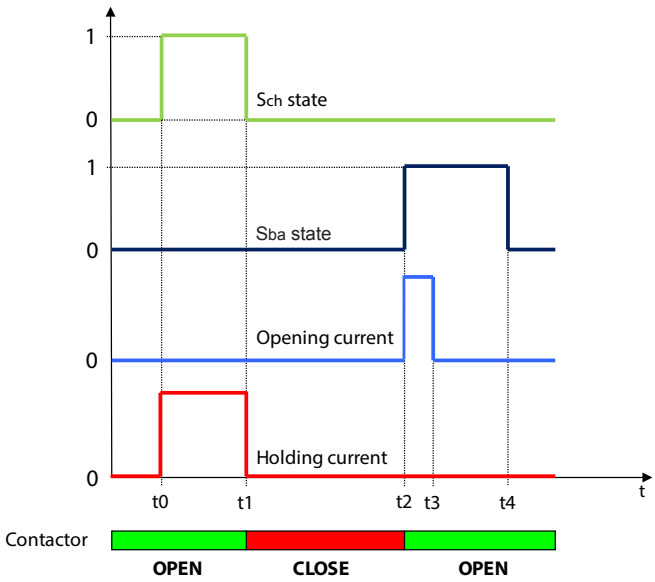
The TAN device is a standard solution for contactors TADN.



Legend:
B: safety thermal-magnetic breaker
Sch: Closing command
Sba: Opening command

MS Scope of supply
Customer Scope

Working principle



Legend:

- **t0:** Sch changes its state from 0 to 1. This is the command for the contactor to close
- **t0 -> t1:** Closing time. The movable arm of the contactor is closing. The contactor is open.
- **t1 -> t2:** Holding time. Sch could change its state from 1 to 0. The movable arm is closed. The contactor is closed
- **t2 -> t3:** Opening time. Sba changes its state from 0 to 1. This is the command for the contactor to open. The movable arm is opening. The contactor is close.
- **t4:** Both signals Sch and Sba have to change their state from 1 to 0 before closing again the contactor.

Auxiliary contacts (AUX)

Auxiliary contact: a contact included in an auxiliary circuit and mechanically operated by the switching device (IEV 441-15-10).

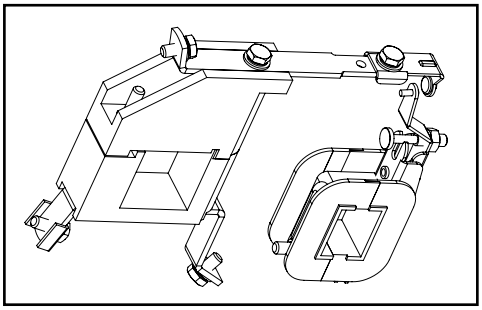
It can be:

Make contact or Normally open contact (NO): a control or auxiliary contact which is closed when the main contacts of the mechanical switching device are closed and open when they are open (IEV 811-31-03).

Break contact or Normally closed contact (NC): a control or auxiliary contact which is open when the main contacts of a mechanical switching device are closed and closed when they are open (IEV 811-31-04).

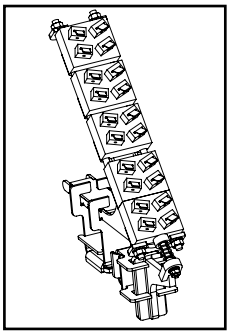
Change over contact (CO): a control or auxiliary contact which combination of two contact circuits with three contact members, one of which is common to the two contact circuits; such that when one of these contact circuits is open, the other is closed (IEV 447-04-12).

Like the main contacts, the auxiliary contacts can be easily varied to meet most requirements. Two types of auxiliary contacts are available:



Type P

- Type P - instantaneous single contact, mounted on the axles, with adjustable contact gap and pressure and with contact elements in silver; N/O (normally open), N/C (normally closed) and C/O (changeover) executions are available.



- Type B - set of 10 instantaneous contacts (5 N/O + 5 N/C), double interruption molded type, mounted together on a single frame and simultaneously controlled. Each set type B takes the same space as two type P contacts.

All the contactors of the sizes 270A and larger can be fitted with auxilliary poles rating 60A with or without magnetic blow outs and N/O or N/C type

Rating of aux contacts

Contactor Type	Aux. cont. Type	Rated curr. [A]	Breaking capacity in AC Cos ϕ = 0,5				Breaking capacity in DC L/R = 30ms		
		110V	220V	380V	500V	48V	110V	220V	100%
N190	P	10	20	15	10	2	5	3	2
	B	10	10	8	3	1,5	3	2	1
N350 ÷ N650	P	10	20	15	15	3	7	5	2
	B	10	10	8	3	1,5	3	2	1
N800 ÷ N3000	P	15	20	20	15	5	8	5	2
		10	10	8	3	1,5	3	2	1

N Line

The N Line has to be considered every time an high thermal current and high breaking current for systems up to 1 kV is required.
To accomplish most of the possible applications, all the N contactors can be manufactured in single or multipolar form. Versions with normally open or normally closed poles are manufactured.
The N Line displays a new arc chamber design with ceramic fins which withstand the highest current ratings in the harsh working conditions faced all around the world. The breaking phenomenon is completely bordered within the ceramic arc chute guaranteeing the smallest insulating distances from both plastic and metallic parts.
In order to work efficiently both with high and low currents, the N Line is equipped with blow out circuit.
This arc-extinguishing technology allows to work indifferently in alternative current (AC) as well as in direct current (DC) minimizing dimensions and weight.
The Silver alloy contacts solution allows a very long electrical durability guaranteeing always the best conductivity on the main contacts. As a result of this technology the working temperature of the components is stable during its entire lifetime preserving all insulation components of the circuit from accelerating ageing.
N Line is operated and hold closed by a single coil. The DC control coil operates with a power saving system in order to reduce power consumption within a wide working range.
The maintenance is simplified by direct accessibility to all parts due to open construction so that, in most cases, it is not necessary to remove the contactor from the cabinet.
In order to guide you through the widest contactors series on the market we selected for you the following special Selection that represent our standard solution.
Upon request, a very high degree of customization is available.

More than 2000 N contactors are delivered every year for the most demanding projects and applications worldwide. This huge fleet guarantee the biggest service proven reference on the market.

Applications
Transit and railway fixed systems
Excitation system in power plant
Control AC and DC high power motors
Heavy industries
Crane control
Magnet lifting control

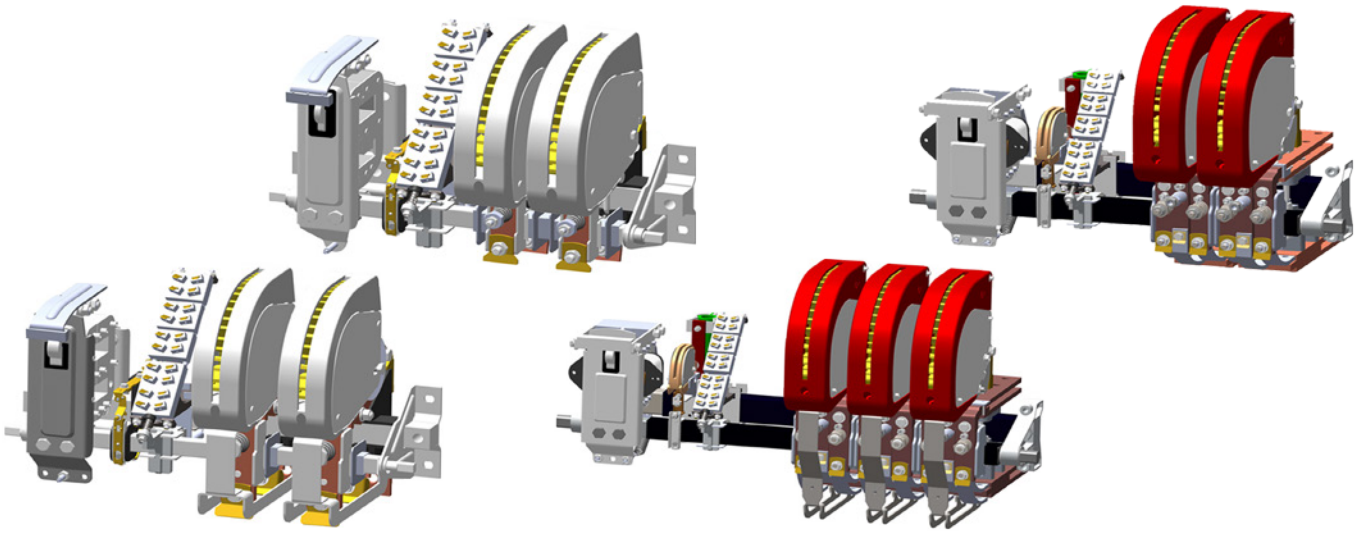
Customization Available

- Combination of different type and size assembled on the same rod
- Parallel connection of pole to reach up to 12000a rating
- Wide range of voltage supply (12v – 500v)
- Wide number and type of aux contacts assembled on the same rod
- Cupper contacts instead of silver alloy
- Poles type "v" without arc chute and blow out coil (no power switching)
- Mechanical latching
- Delayed nc pole
- Horizontal and vertical mechanical interlock
- Special fixing points
- Draw out solution
- Screw low voltage connections or any brand low voltage connectors
- Key lock
- Gold plated auxiliary contacts for extremely low currents on auxiliary circuit
- Increased isolation up to 3kv
- Stroke counter

4. N Line Highlights

Standard Characteristics

- The most experienced extra heavy duty line
- Designed for low voltage applications according to IEC 60947-4-1 and fixed application according to IEC61992
- Ratings up to 1000 VDC/AC and up to 3000 A/pole application
- Direct arc blow-out systems up to 1250A
- Idirect arc blow-out systems over to 1250A
- Multi-pole combination up to 3 NO or NC poles
- Voltage supply of 110Vac/dc or 220Vac/dc
- Aux contacts 5NO+5NC
- Low voltage connections with Fast-on terminal



Type	3 pole. A.C.motors control							
	Utilization category AC2 & AC3				Utilization category AC4			
	Maximum operational current lem [A]	Max. operational power [kw] (3 Phase)			Maximum operational current lem [A]	Max. operational power [kw] (3 Phase)		
		380 V	660 V	1000 V		380 V	660 V	1000 V
N 125	110	55	85	120	95	48	65	90
N 190	180	90	135	190	170	85	115	170
N 350	320	160	240	350	270	136	182	290
N 650	600	300	460	650	550	278	375	550
N 800	750	380	580	800	650	330	445	650
N 1000	900	450	680	950	800	405	545	800
N 1250	1100	550	850	1200	1000	510	680	1000
N 1600	1400	700	1050	1500	1250	630	850	1200
N 2000	1800	900	1350	1900	1600	810	1090	1600
N 3000	2500	1250	1900	2505	2250	1140	1530	2000

Type	1NO pole D.C. motors control		2NO pole D.C. motors control	
	Max. operation curr. lem [A]		Max. operation curr. lem [A]	
	CAT. DC1-DC3 440V	CAT. DC1-DC3 220V	CAT. DC5 1000V	CAT. DC5 750V
N 125	110	110	95	95
N 190	180	180	170	170
N 350	320	320	270	270
N 650	600	600	550	550
N 800	750	750	650	650
N 1000	900	900	800	800
N 1250	1100	1100	1000	1000
N 1600	1400	1400	1250	1250
N 2000	1800	1800	1600	1600
N 3000	2500	2500	2250	2250

TADN Line

TADN Line has to be considered every time an high thermal current and high breaking current for field control in the power plant generating systems up to 1 kV is required.
To accomplish the most requested configuration in this applications, the TADN contactors is manufactured with 2 normally open (NO) pole (for field supply) and 1 single normally close (NC) pole
The TADN Line displays a new arc chamber design with ceramic fins which withstand the highest current ratings in the harsh working conditions faced all around the world. The breaking phenomenon is completely bordered within the ceramic arc chute guaranteeing the smallest insulating distances from both plastic and metallic parts.
In order to work efficiently both with high and low currents, the N Line is equipped with blow out circuit.
The Silver alloy contacts solution allows a very long electrical durability guaranteeing always the best conductivity on the main contacts. As a result of this technology the working temperature of the components is stable during its entire lifetime preserving all insulation components of the circuit from accelerating ageing.
The TADN line has double state function (open and close) thanks to a mechanical latching device that also avoid power consumption during hold condition. TADN Line is operated by a single coil for closing operation and a shunt trip relay for opening operation. For safety reasons an overvoltage relay can be also provided as an option.
The maintenance is simplified by direct accessibility to all parts due to open construction so that, in most cases, it is not necessary to remove the contactor from the cabinet.
In order to guide you through the widest contactors series on the market we selected for you the following special Selection that represent our standard solution.
Upon request, a very high degree of customization is available.

Applications

Excitation system in power plant

More than 2000 N contactors are delivered every year for the most demanding projects and applications worldwide. This huge fleet guarantee the biggest service proven reference on the market.

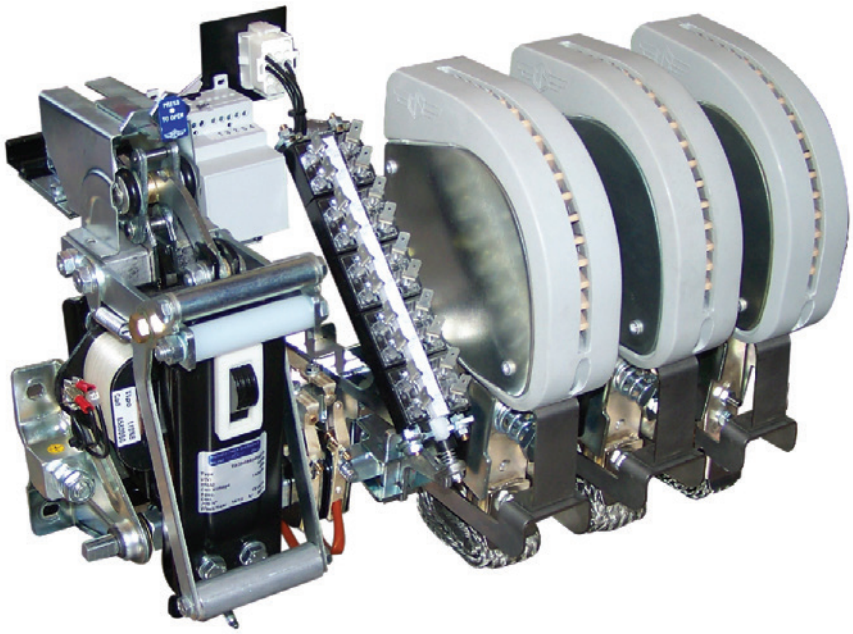
Customization Available

- Combination of different type and size assembled on the same rod
- Parallel connection of pole to reach up to 12000A rating, both for NO and NC poles
- Wide range of voltage supply (12V – 500V)
- Redundant shunt trip relay (available at any voltage)
- Undervoltage relay
- Wide number and type of aux contacts assembled on the same rod
- Horizontal and vertical mechanical interlock
- Special fixing points
- Draw out solution
- Screw low voltage connections or any brand low voltage connectors
- Key lock
- Gold plated auxiliary contacts for extremely low currents on auxiliary circuit
- Increased isolation up to 3kV
- Stroke counter

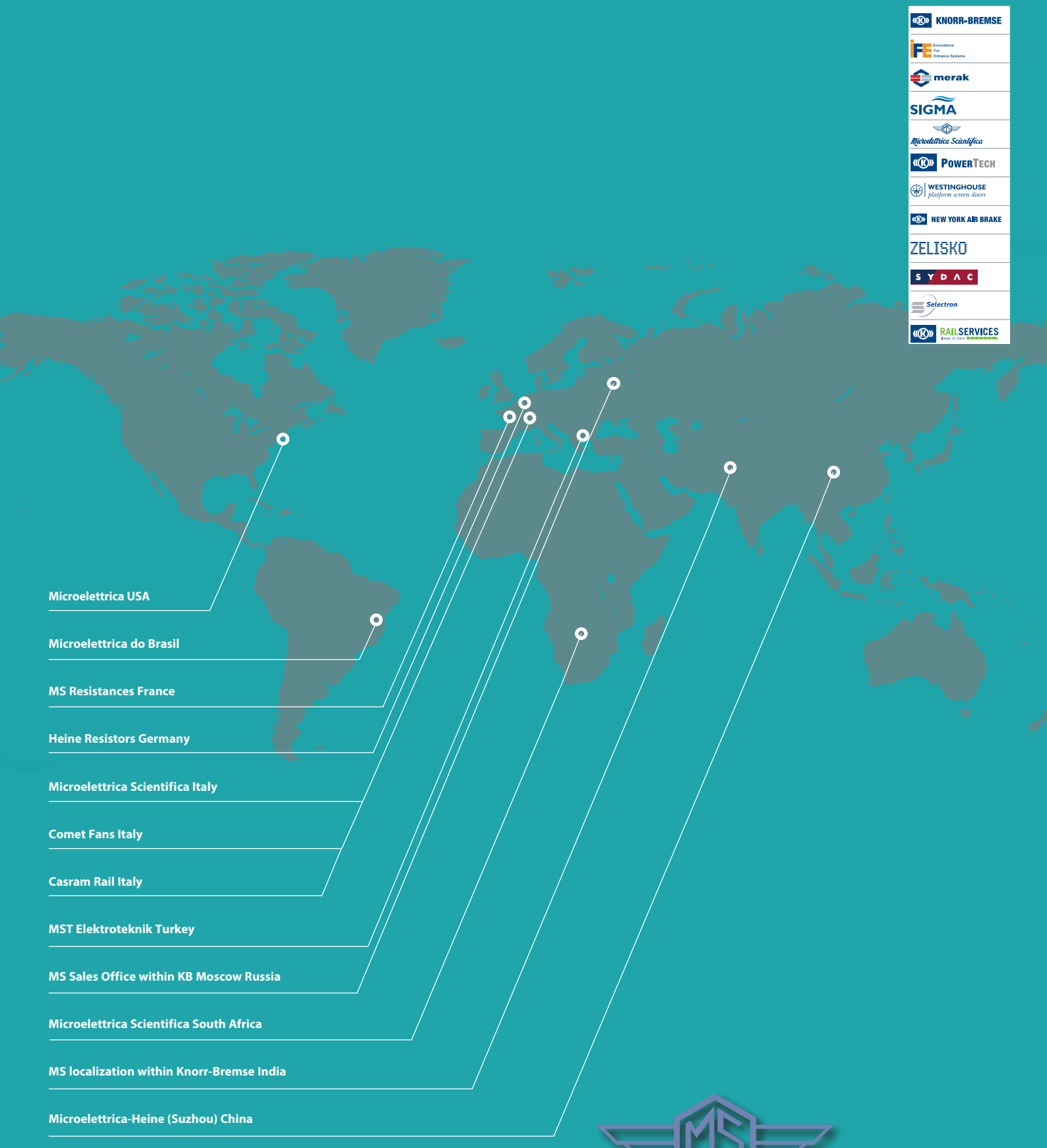
5. TADN Line Highlights

Standard Characteristics

- The most experienced extra heavy duty line
- Designed for field generation system according to ANSI IEEE C37.18
- Ratings up to 1000 VDC and up to 3000 A/pole application
- Direct arc blow-out systems up to 1250A
- Indirect arc blow-out systems over to 1250A
- Multi-pole combination up to 3 NO or NC poles
- Voltage supply of 110Vac/dc or 220Vac/dc
- Aux contacts 5NO+5NC
- Low voltage connections with Fast-on terminal for aux contacts
- Terminal board for contactor control



GENERAL CHARACTERI- STICS			CHARACTERISTICS OF THE MAIN CONTACTS (2 poles)					CHARACTERISTICS OF DISCARGE CONTACTS (1 pole)			
TADN Size	Vn [V]	V' [V]	In [A]	Vcc [V]	Icc [A]	I'cc [A]	Icc 0,5 [A]	Ind [A]	Iccd [A]	Ichd [A]	Id [A]
N 125	600	700	125	1000	1200	1000	5000	125	600	3000	1200
N 190	600	700	190	1000	2000	1500	8000	190	1000	4000	2000
N 350	750	700	350	1000	4000	3000	16000	350	3000	7000	3500
N 650	750	700	650	1000	7000	5000	20000	650	6000	10000	6500
N 800	1000	700	800	1000	8000	6000	25000	800	8000	12000	7000
N 1000	1000	700	1000	1000	10000	8500	25000	1000	10000	15000	8000
N 1250	1000	700	1250	1000	15000	10000	35000	1250	10000	15000	10000
N 1600	1000	700	1600	1000	20000	15000	50000	--	--	--	--
N 2000	1000	700	2000	1000	20000	15000	60000	--	--	--	--
N 3000	1000	700	3000	1000	20000	15000	80000	--	--	--	--



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