

## DX<sup>3</sup> circuit-breakers use with direct current



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The DX3 Legrand modular offer includes a range of circuit breakers which are specifically designed for direct current applications, up to 500V.

Beyond this offer, for direct current, it's allowed to use DX3 Legrand circuit-breakers (1P/2P/3P/4P – Z, B and C curves) which are normally used at 230/400V~, taking in account the following recommendations and deratings.

### 1 – Magnetic tripping threshold (protection against short-circuit)

The maximum tripping threshold value is multiplied by 1.4.

For example, a C curve circuit-breaker tripping threshold which is set between 5 and 10 x  $I_n$  in an AC network, becomes 7 to 14 x  $I_n$  in a DC network.

### 2 – Thermal tripping threshold (protection against overload)

The thermal tripping curve, time / current, in AC and in DC network are identical.

### 3 – Electrical endurance

Endurance is 2000 operations under  $I_n$  for 1 module per pole DX<sup>3</sup> circuit-breakers.

Endurance is 1500 operations under  $I_n$  for 1.5 modules per pole DX<sup>3</sup> circuit-breakers.

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## 4 – Operating voltage

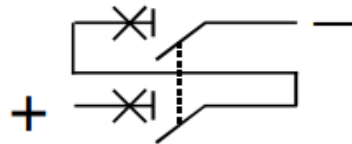
The minimum operating DC voltage is 12 V.

The maximum operating DC voltage is 60 V for 1 module single pole circuit-breakers, or 90 V for 1.5 modules single pole circuit-breakers.

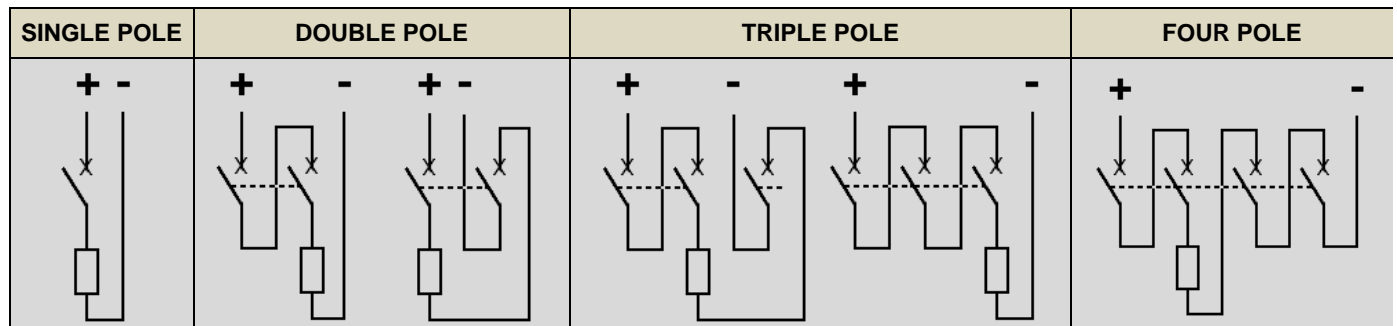
For higher voltages, several poles must be connected in series, in respect of the maximum operating voltages indicated in the following table.

Circuit breaker		SINGLE POLE	DOUBLE POLE	TRIPLE POLE	FOUR POLE
Max. operating voltage	1 mod. / pole	60 V	110 V	150 V	180 V
	1,5 mod. / pole	90 V	150 V	200 V	250 V

For example, for a 110 V DC voltage, a 2- pole circuit-breaker must be connected, the 2 poles in series.



## 5 – Connection mode



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### 6 – Breaking capacity

Breaking capacities are as follows :

DX <sup>3</sup> 4500/6 kA B,C curves ≤ 63 A		Voltage	SINGLE POLE	DOUBLE POLE	TRIPLE POLE	FOUR POLE
As per IEC60947.2	Icu	12 to 60 V	4.5 kA	4.5 kA	4.5 kA	4.5 kA
		110 V		4.5 kA	4.5 kA	4.5 kA
		150 V			4.5 kA	4.5 kA
		180 V				4.5 kA
	Ics (1)	12 to 60 V	100%	100%	100%	100%
		110 V		100%	100%	100%
		150 V			100%	100%
		180 V				100%

DX <sup>3</sup> 6000/10 kA B,C curves ≤ 63 A		Voltage	SINGLE POLE	DOUBLE POLE	TRIPLE POLE	FOUR POLE
As per IEC60947.2	Icu	12 to 60 V	6 kA	6 kA	6 kA	6 kA
		110 V		6 kA	6 kA	6 kA
		150 V			6 kA	6 kA
		180 V				6 kA
	Ics (1)	12 to 60 V	100%	100%	100%	100%
		110 V		100%	100%	100%
		150 V			100%	100%
		180 V				100%

DX <sup>3</sup> 10000/16 kA B,C curves ≤ 63 A		Voltage	SINGLE POLE	DOUBLE POLE	TRIPLE POLE	FOUR POLE
As per IEC60947.2	Icu	12 to 60 V	10 kA	10 kA	10 kA	10 kA
		110 V		10 kA	10 kA	10 kA
		150 V			10 kA	10 kA
		180 V				10 kA
	Ics (1)	12 to 60 V	100%	100%	100%	100%
		110 V		100%	100%	100%
		150 V			100%	100%
		180 V				100%

DX <sup>3</sup> 10000/16 kA B,C curves 80 A - 125 A		Voltage	SINGLE POLE	DOUBLE POLE	TRIPLE POLE	FOUR POLE
As per IEC60947.2	Icu	12 to 60 V	10 kA	10 kA	10 kA	10 kA
		110 V		10 kA	10 kA	10 kA
		150 V			10 kA	10 kA
		180 V				10 kA
	Ics (1)	12 to 60 V	100%	100%	100%	100%
		110 V		100%	100%	100%
		150 V			100%	100%
		180 V				100%

(1) : in % of Icu

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## 6 – Breaking capacity (continued):

DX <sup>3</sup> 25 kA B,C curves ≤ 25A		Voltage	SINGLE POLE	DOUBLE POLE	TRIPLE POLE	FOUR POLE
As per IEC60947.2	Icu	12 to 60 V	16 kA	16 kA	16 kA	16 kA
		110 V		16 kA	16 kA	16 kA
		150 V			16 kA	16 kA
		180 V				16 kA
	Ics (1)	12 to 60 V	100%	100%	100%	100%
		110 V		100%	100%	100%
		150 V			100%	100%
		180 V				100%

(2) Up to 32 A

DX <sup>3</sup> 25 kA B,C curves 32 A - 125 A		Voltage	SINGLE POLE	DOUBLE POLE	TRIPLE POLE	FOUR POLE
As per IEC60947.2	Icu	12 to 60 V	16 kA	16 kA	16 kA	16 kA
		110 V		16 kA	16 kA	16 kA
		150 V			16 kA	16 kA
		180 V				16 kA
	Ics (1)	12 to 60 V	100%	100%	100%	100%
		110 V		100%	100%	100%
		150 V			100%	100%
		180 V				100%

(3) Above 40 A

DX <sup>3</sup> 36kA C curve 10A-80A		Voltage	SINGLE POLE	DOUBLE POLE	TRIPLE POLE	FOUR POLE
As per IEC60947.2	Icu	12 to 60 V	25 kA	25 kA	25 kA	25 kA
		110 V		25 kA	25 kA	25 kA
		150 V			25 kA	25 kA
		180 V				25 kA
	Ics (1)	12 to 60 V	100%	100%	100%	100%
		110 V		100%	100%	100%
		150 V			100%	100%
		180 V				100%

DX <sup>3</sup> 50 kA B,C curve 10 A - 63 A		Voltage	SINGLE POLE	DOUBLE POLE	TRIPLE POLE	FOUR POLE
As per IEC60947.2	Icu	12 to 60 V	25 kA	25 kA	25 kA	25 kA
		110 V		25 kA	25 kA	25 kA
		150 V			25 kA	25 kA
		180 V				25 kA
	Ics (1)	12 to 60 V	100%	100%	100%	100%
		110 V		100%	100%	100%
		150 V			100%	100%
		180 V				100%

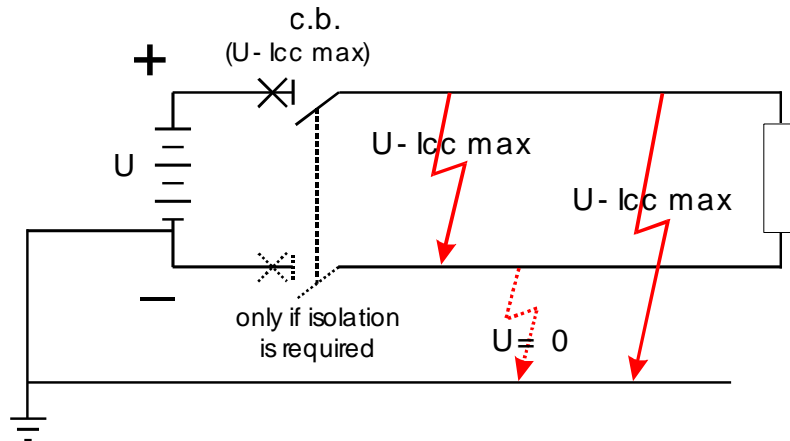
(1) : in % of Icu

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## 7 – Repartition of the breaking poles

It is necessary to know how the installation is connected to the earth in order to choose the proper circuit-breaker and to connect to each polarity the required poles, depending on the voltage and the short-circuit value.

- If the network is connected to the earth by one polarity, all the poles required for the short circuit interruption must be connected to the other polarity. To create isolation, one more pole must be connected to the polarity connected to the earth.



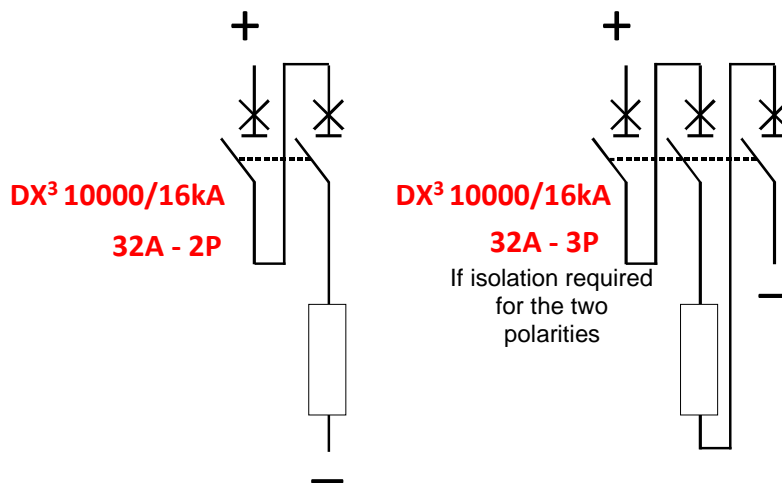
*Example : installation connected to the earth by the negative polarity /  $U = 110 \text{ V DC}$  /  $I_{cc} = 10 \text{ kA}$  /  $I_n = 32 \text{ A}$*

*The positive polarity must be protected with a circuit-breaker able to interrupt 10kA at 110 V DC.*

*A DX<sup>3</sup> 10000/16kA 2P 32 A circuit-breaker will be used with the 2 poles connected to the positive polarity.*

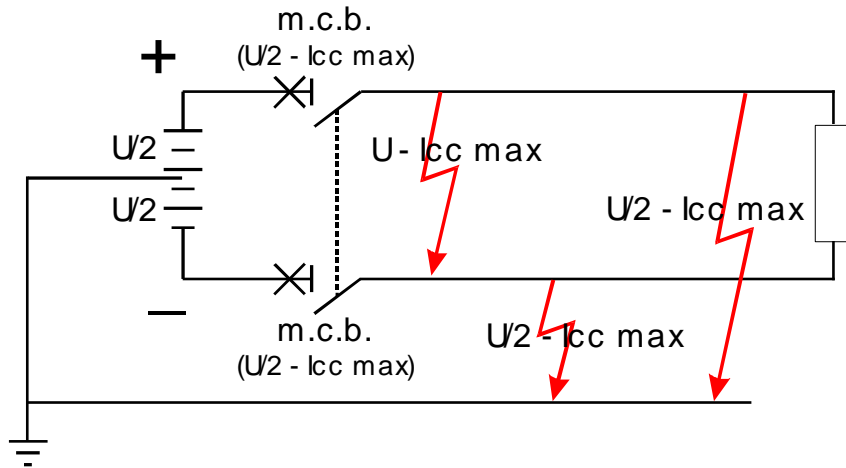
*To get isolation, use a DX<sup>3</sup> 10000/16kA 3P 32A circuit-breaker with 2 poles connected to the positive polarity and one pole connected to the negative polarity.*

DX <sup>3</sup> 10000/16 kA		Voltage	SINGLE POLE	DOUBLE POLE	TRIPLE POLE	FOUR POLE
As per IEC 60947.2	Icu	12 to 60 V	10 kA	10 kA	10 kA	10 kA
		<b>110 V</b>		<b>10 kA</b>	10 kA	10 kA
		150 V			10 kA	10 kA
		180 V				10 kA



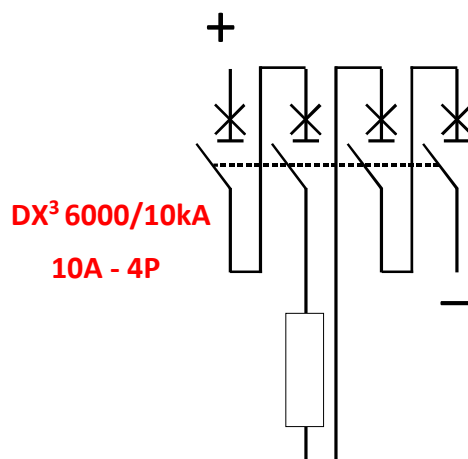
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If the network is equipped with a medium earth connection, for each polarity, it is necessary to have the number of poles capable of interrupting the max I<sub>cc</sub> with the voltage value divided by two.



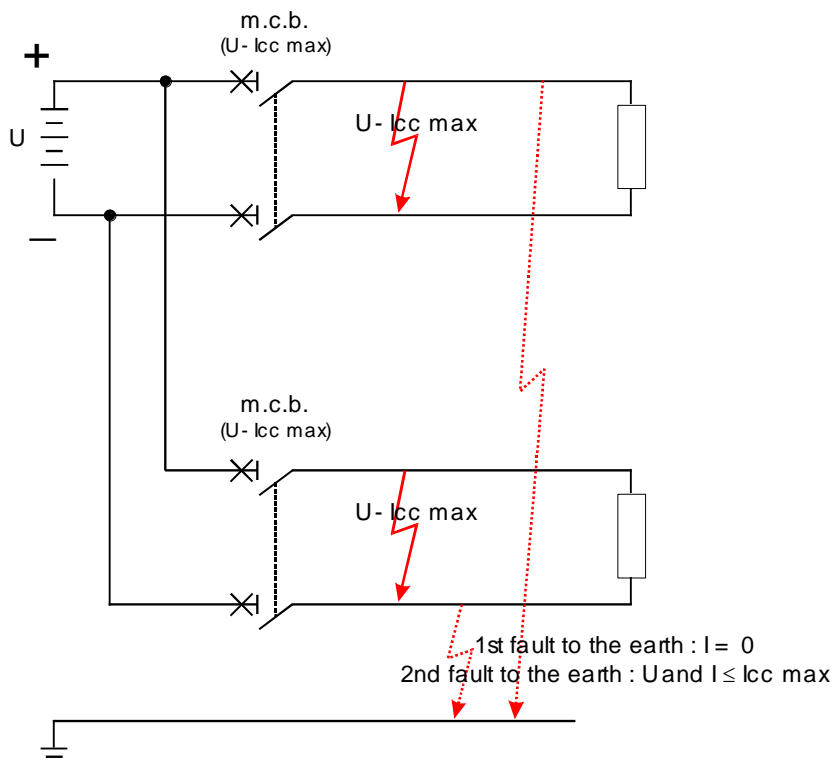
*Example : installation connected to the earth by the middle / U = 180 V DC / I<sub>cc</sub> = 6 kA / I<sub>n</sub> = 10 A*  
 Each polarity must be protected by a circuit-breaker able to interrupt 6 kA with half the voltage, in this example 90V. A DX<sup>3</sup> 6000/10kA 4P 10 A circuit-breaker will be used, with 2 poles connected to each polarity.

DX <sup>3</sup> 6000/10 kA		Voltage	SINGLE POLE	DOUBLE POLE	TRIPLE POLE	FOUR POLE
As per IEC 60947.2	I <sub>cu</sub>	12 to 60 V	6kA	6kA	6kA	6kA
		110 V		6kA	6kA	6kA
		150 V			6kA	6kA
		180 V				6kA



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- If the network is isolated from the earth, poles must be connected to both polarities in order to be properly protected even in case of a double fault to the earth (especially if several circuits are in parallel.).



Example : installation isolated from the earth /  $U = 48 \text{ V DC}$  /  $I_{cc} = 6 \text{ kA}$  /  $I_n = 40 \text{ A}$

A circuit-breaker able to interrupt 6 kA at 48 V must be used. Each polarity must be protected.

A DX<sup>3</sup> 6000/10kA 2P 40 A circuit-breaker will be used, with one pole connected to each polarity.

DX <sup>3</sup> 6000/10 kA		Voltage	SINGLE POLE	DOUBLE POLE	TRIPLE POLE	FOUR POLE
As per IEC 60947.2	I <sub>cu</sub>	12 to 60 V	6kA	6 kA	6 kA	6 kA
		110 V		6 kA	6 kA	6 kA
		150 V			6 kA	6 kA
		180 V				6 kA

