

CATALOG

SACE Tmax PV for photovoltaic applications

Flexibility for the changing renewable energy market



The SACE Tmax PV range of molded case circuit breakers and switch disconnectors for photovoltaic applications offers increasingly comprehensive technologies that anticipate market trends.

Table of contents

01-07 Introduction

08-25 IEC applications up to 1500V DC

26-41 UL applications up to 1500V DC

42-55 800V AC applications

56-62 Ordering codes



CHAPTER 1

Introduction

- 02-03 Keeping ahead of photovoltaic application trends**
- 04-05 Value proposition**
- 06-07 Examples of photovoltaic plants**

Keeping ahead of photovoltaic application trends

Quality, innovation, and advanced technologies to satisfy changing customer needs: these are the critical strengths of the **SACE Tmax PV** series of low-voltage molded case circuit breakers and switch disconnectors for photovoltaic applications.

This range of protection and connection devices for IEC and UL applications on both the DC and AC sides of a photovoltaic plant, expands on the adaptability and versatility of the SACE Tmax T series for every type of application. Created with internationalization in mind, the SACE Tmax PV range enables design engineers, panel builders and inverter manufacturers to rely on a single provider to meet specific requirements of photovoltaic systems installed anywhere in the world. It's a range that advances the trend in photovoltaic systems of using configurations based on string inverters with an increase in operating voltages.

The aim is to enhance energy efficiency and limit the rated currents involved, thereby reducing switchgear size, installation time and costs. By 2020, 93 percent of PV systems above one megawatt will function with a rated voltage of 1500V DC, especially in UL jurisdictions, compared to today's commonly used 1000V DC systems. This approach will help increase power density and significantly reduce the number of combiners, inverters and conductors required.



The SACE Tmax PV series includes molded case circuit breakers and switch disconnectors for PV applications up to 1500V DC that fully conform to UL and IEC Standards.

AC equipment in photovoltaic systems is evolving rapidly. Today's inverters are designed to operate in coordination with 600 or 690V AC distribution systems. Since they are connected to the grid by transformers, new installations are meant to operate with increased voltage values and reduced losses, producing increasingly efficient systems.

This is especially true of PV systems based on string-inverter configurations, which typically require extremely long cables.

The SACE Tmax PV range moves a step ahead of market requirements with a line of circuit breakers for alternating current with increased rated-voltage values up to 800V AC.



Value proposition

Step ahead to edge technologies



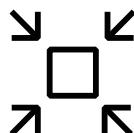
Energy efficiency

SACE Tmax PV technology boosts efficiency with higher voltages for AC and DC systems where, to reduce power losses, central inverters are standard for 1500V DC side and string inverters are preferred for 800V AC. In fact, the SACE Tmax PV series offers the first 800V AC molded case circuit breaker to comply with the UL 489 Standards.



Accelerated projects

Ensuring performances at 1500V DC and 800V AC, the SACE Tmax PV series enables quicker installation and lower wiring costs for the most advanced photovoltaic plant architectures, with significant time savings for utilities, engineers and panel builders.



Space savings

With higher voltages, a photovoltaic plant can operate with fewer components and simpler logistics. Furthermore, the SACE Tmax PV range is one of the most compact available. An integrated motorized version reduces sizes to unprecedented proportions.



Easy installation

The SACE Tmax PV range's expansive portfolio of shared accessories includes mandatory connection jumpers for UL versions. The jumper kits allow simple installation with maximum safety. The SACE Tmax PV range derives from the widely known SACE Tmax T series, with edge technology, top-level quality and no need to change installation practices. The SACE Tmax PV series is perfectly integrated into the wide range of electrical and mechanical accessories already available for SACE Tmax T.

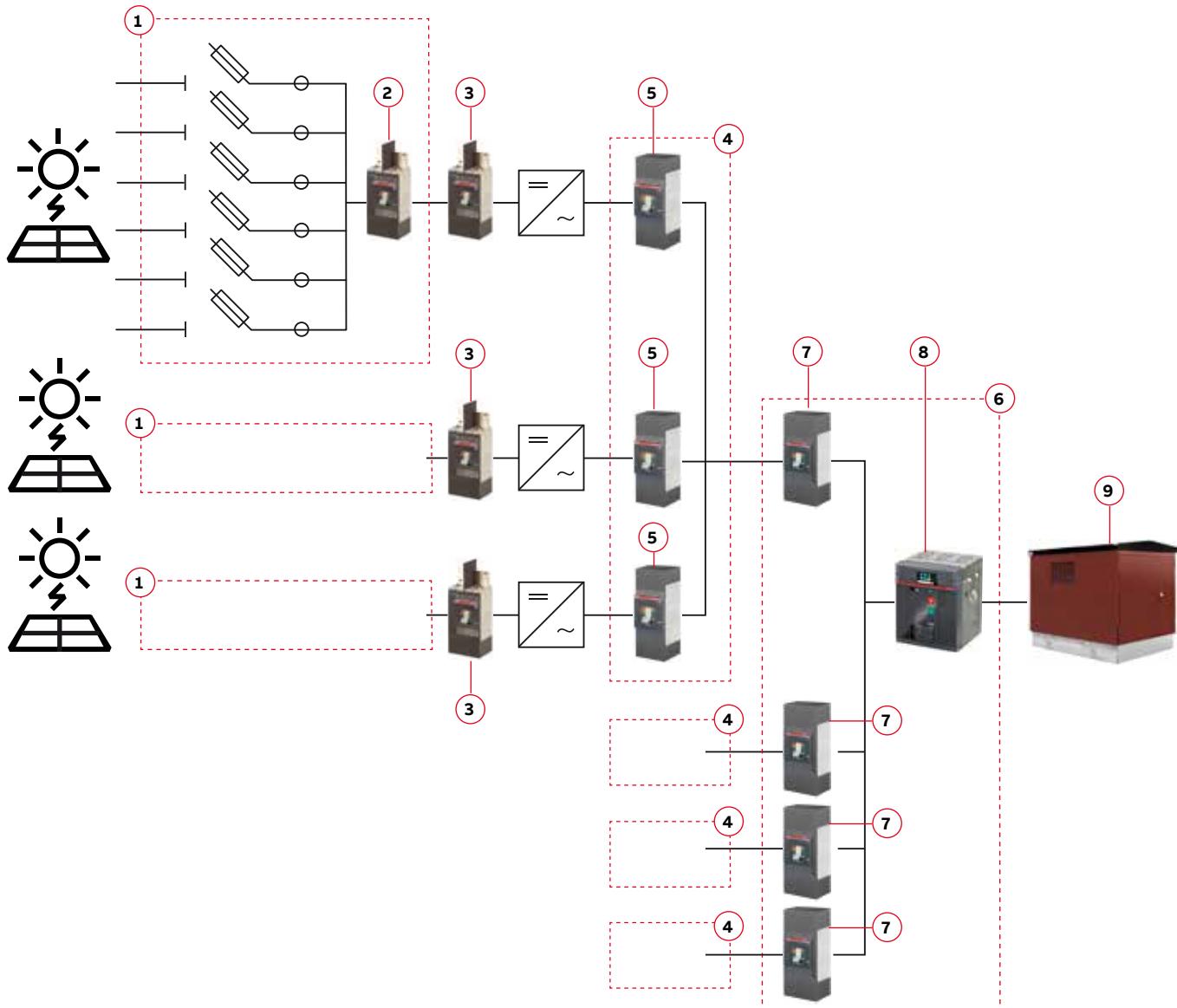


Global availability

SACE Tmax PV products meet all the major worldwide Standards: IEC, UL, CCC and GB. This means that engineers, panel builders, inverter manufacturers and OEMs can find the right solution for any solar plant, anywhere around the world.

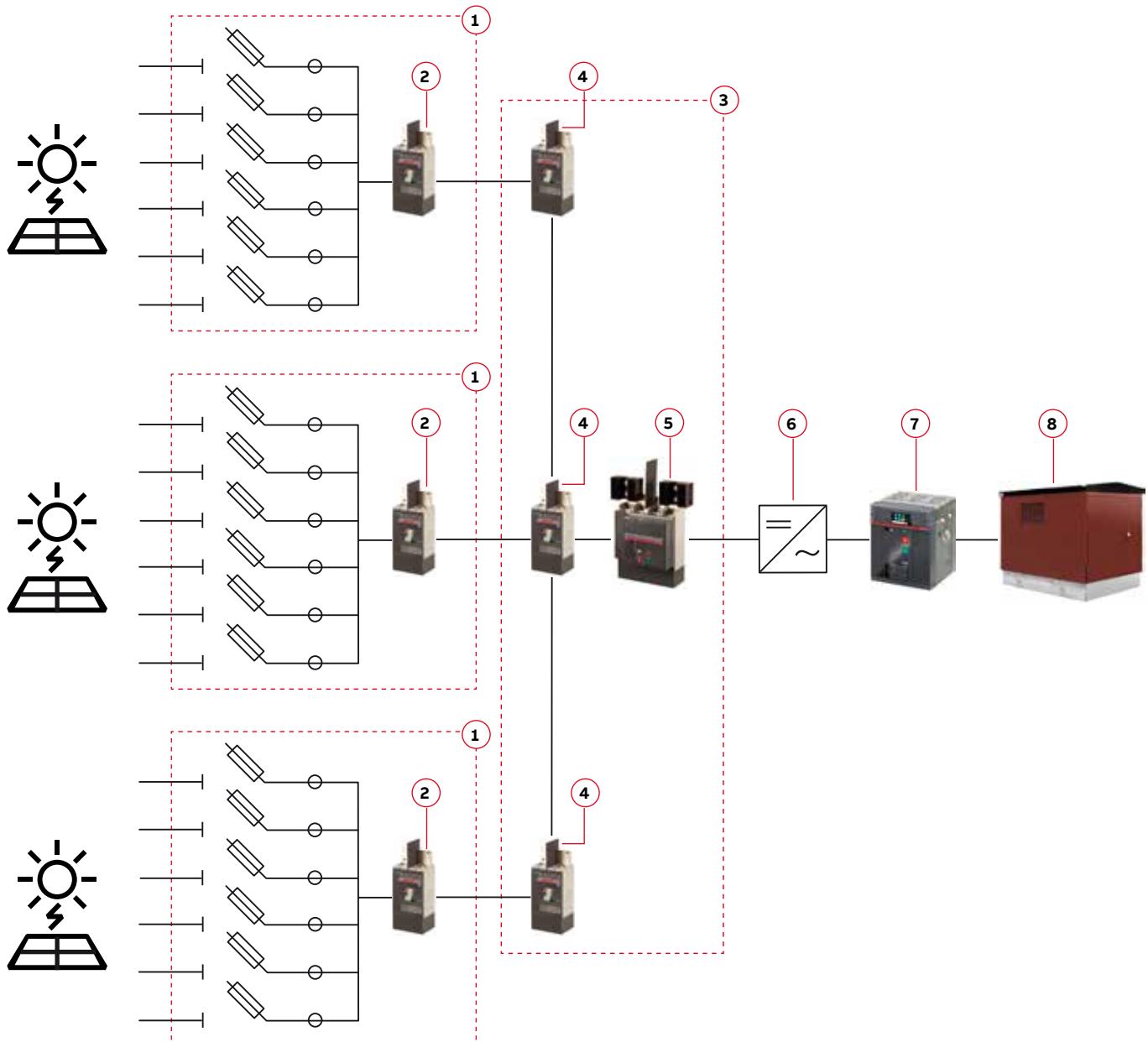
Examples of photovoltaic plants

String inverters architecture



1. String Combiner
2. Molded Case Switch Disconnector (e.g. T4D/PV-E)
3. Molded Case Circuit Breakers Tmax PV (e.g. T4N/PV-E)
4. AC Combiner
5. Molded Case Circuit Breakers for AC applications (e.g. T4V-HA)
6. Switchboard/AC Recombiner
7. Molded Case Circuit Breakers for AC applications (e.g. T5V-HA)
8. Emax 2 Air Circuit Breaker
9. MV/LV Transformer - Compact Secondary Substation

Central inverters architecture



1. String Combiner
2. Molded Case Switch Disconnector (e.g. T4D/PV-E)
3. Recombiner
4. Molded Case Circuit Breakers (e.g. T4N/PV-E)

5. Molded Case Switch Disconnector (e.g. T7D/PV-E)
6. Central inverter
7. Emax 2 Air Circuit Breaker
8. MV/LV Transformer - Compact Secondary Substation



CHAPTER 2

IEC applications

- 10-10 Flexibility guaranteed for new IEC-compliant requirements**
- 11-12 Ranges**
- 13-15 Characteristic curves**
- 16-19 Quick reference tables**
- 20-20 Temperature performances and wiring**
- 21-21 Power losses and insulation distances**
- 22-25 Dimensions**

Flexibility guaranteed for new IEC-compliant requirements

Meeting IEC 60947-3 and IEC 60947-2 specifications, the **SACE Tmax PV** range offers molded case circuit breakers and switch disconnectors for standard 1100V DC applications, with a choice of extended ratings up to 1500V DC for demanding solar applications. Connection jumpers are available for enhanced safety and installation ease.

The **SACE Tmax PV IEC** range provides protection up to 1500V DC. For applications up to 1500V DC with 100 to 250A rated current, the T4N/PV-E series of extremely compact molded case circuit breakers is an excellent solution for protection and isolation, mainly in PV systems with centralized inverters. In the 4-pole version, T4N/PV-E breakers can break short-circuit currents up to 25 kA (per IEC 60947-2 edition 5.0 Annex P) and up to 10 kA (per IEC60947-2 edition 4.2 and GB14048.2).

Dedicated jumper kits enable all the poles to be connected to a single polarity source with 4 poles in series or to a dual polarity source with 2 poles in series on the positive supply and two on the negative supply.

T4N/PV-E breakers can be fitted with a vast assortment of electrical and mechanical accessories already available for the SACE Tmax T range.

Ranges

Common data	
Operating temperature	[°C] -25 °C ... +70 °C
Storage temperature	[°C] -40 °C ... +70 °C
Numbers of poles	4
Version	fixed

Altitude derating		
Altitude [mt]	In [%]	Ue [%]
2000	100	100
3000	98	88
4000	95	78
5000	85	68

Molded case switch disconnectors up to 1100V DC in compliance with IEC 60947-3

Electrical characteristics

Tmax PV switch disconnectors in compliance with the IEC60947-3	T1D/PV	T3D/PV	T4D/PV	T5D/PV	T6D/PV	T7D/PV ¹⁾
Rated service current in category DC22 B, Ie	(A) 160	200	250	500	800	1250-1600
Number of poles	(No.) 4	4	4	4	4	4
Rated service voltage, Ue	1100V DC	1100V DC	1100V DC	1100V DC	1100V DC	1100V DC
Rated impulse withstand voltage, Uimp	(kV) 8	8	8	8	8	8
Rated insulation voltage, Ui	(V) 1150V DC	1150V DC	1150V DC	1150V DC	1150V DC	1150V DC
Test voltage at industrial frequency for 1 minute	(V) 3500	3500	3500	3500	3500	3500
Rated short-circuit-making capacity, switch disconnector only, Icm	(kA) 1.92	2.4	3	6	9.6	19.2
Rated short-time withstand current for 1s, Icw	(kA) 1.92	2.4	3	6	9.6	19.2
Versions	F	F	F	F	F	F
Standard terminals	FC Cu	F	F	F	F	F
Mechanical life	(No. Operations) 15000	15000	7500	7500	7500	20000
Electrical life (operations @ 1100V DC)	(No. Operations) 500	500	500*	500*	500*	500*
Basic dimensions	W (mm/in)	102/4.02	140/5.52	140/5.52	186/7.33	280/11.02
	D (mm/in)	70/2.76	70/2.76	103.5/4.07	103.5/4.07	103.5/4.07
	H (mm/in)	130/5.12	150/5.91	205/8.07	205/8.07	268/10.55
Weight (with standard terminals only)	(kg/lbs)	1.2/2.65	2/4.41	3.05/6.72	4.15/9.15	12/26.46
						12.5/27.56 (manual) 14/30.86 (motorized)

1) installation in vertical position only; * openings with SOR or UVR

Ranges

Molded case switch disconnectors up to 1500V DC in compliance with IEC 60947-3

Electrical characteristics

Tmax PV switch disconnectors in compliance with the IEC60947-3	T4D/PV-E	T5D/PV-E	T7D/PV-E ¹⁾
Rated service current in category DC22 A, Ie	(A) 250	500	1250-1600
Number of poles	(No.) 4	4	4
Rated service voltage, Ue	1500V DC	1500V DC	1500V DC
Rated impulse withstand voltage, Uimp	(kV) 8	8	8
Rated insulation voltage, Ui	(V) 1500V DC	1500V DC	1500V DC
Test voltage at industrial frequency for 1 minute	(V) 3500	3500	3500
Rated short-circuit-making capacity, switch disconnector only, Icm	(kA) 3	6	19.2
Rated short-time withstand current for 1s, Icw	(kA) 3	6	19.2
Versions	F	F	F
Standard terminals	F	F	F
Mechanical life	(No. Operations) 7500	7500	20000
Electrical life (operations @ 1500V DC)	(No. Operations) 1000*	1000*	500*
Basic dimensions			
	W (mm/in) 140/5.52	186/7.33	280/11.02
	D (mm/in) 103.5/4.07	103.5/4.07	178/7.01
	H (mm/in) 205/8.07	205/8.07	268/10.55
Weight (with standard terminals only)	(kg/lbs) 3.05/6.72	3.15/9.15	14/30.86

1) installation in vertical position only. Motorized version; * openings with SOR or UVR

Molded case circuit breakers up to 1500V DC in compliance with IEC 60947-2

Below is data on the IEC60947-2 automatic circuit breaker at 1500V DC. For circuit breakers at 1000V DC, see catalog Tmax T code 1SDC210015D0208.

Electrical characteristics

Tmax PV circuit breaker in compliance with IEC 60947-2	T4N-PV/E
Frame size	(A) 250
Rated service current	(A) 100-250
Number of poles	(No.) 4
Rated service voltage, Ue	(V) 1500
Rated impulse withstand voltage, Uimp	(kV) 8
Rated insulation voltage, Ui	(V) 1500
Rated ultimate short-circuit breaking capacity @ 1500V DC, Icu	(kA) 25 according to IEC 60947-2 Edition 5.0 Annex P ($\tau = 1$ ms) (kA) 10 according to IEC 60947-2 Edition 4.2 and GB 14048.2 ($\tau = 5$ ms)
Rated service short-circuit breaking capacity @ 1500V DC, Ics	(kA) 20 according to IEC 60947-2 Edition 5.0 Annex P ($\tau = 1$ ms) (kA) 7.5 according to IEC 60947-2 Edition 4.2 and GB 14048.2 ($\tau = 5$ ms)
Trip Unit	TMF
Versions	F
Standard terminals	FCCu
Connections*	Jumpers
Mechanical life	(No. Operations) 7500
Electrical life (operations @ 1500V DC)	(No. Operations) 1000**
Basic dimensions	
	W (mm/in) 140/5.52
	D (mm/in) 103.5/4.07
	H (mm/in) 205/8.07
Weight (with standard terminals only)	(kg/lbs) 3.05/6.72

* Selection of one of the jumper connection options is mandatory; ** Opening with SOR or UVR

Characteristic curves

The IEC circuit breaker T4 has an application range from 100A to 250A and breaking capacities up to 25kA at 1500V DC.

The circuit breakers are fitted with thermal magnetic trip units to protect direct current in solar networks.

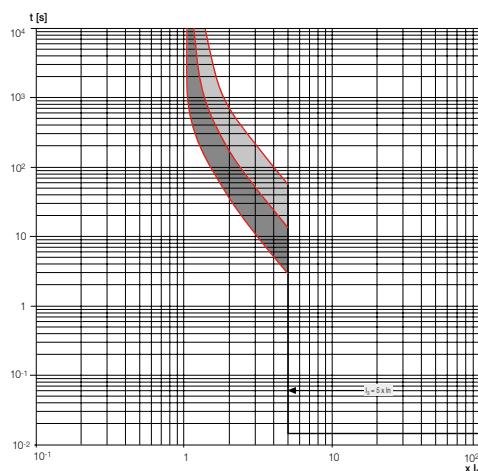
Protection against overload employs a bimetal thermal device, and protection against short-circuit uses a magnetic device.

T4 circuit breakers are equipped with thermomagnetic trip units with fixed thermal and magnetic thresholds (TMF) ($I_3 = 5 \times I_{N}$). The magnetic threshold has a 15% correction factor to adjust their original calibration for AC networks. The curves for the PV line are shown below.

Trip curves

T4N/PV-E TMF 250

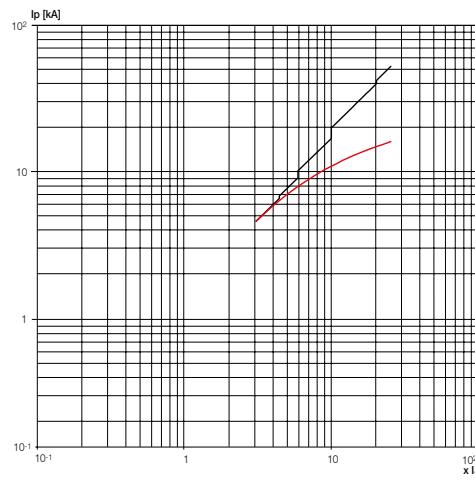
$I_N = 100 \dots 250\text{A}$



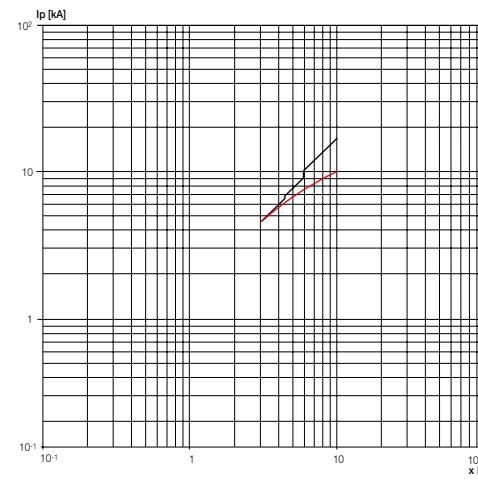
Characteristic curves

Limitation curves

T4N/PV-E
@ 1500V tau = 1ms

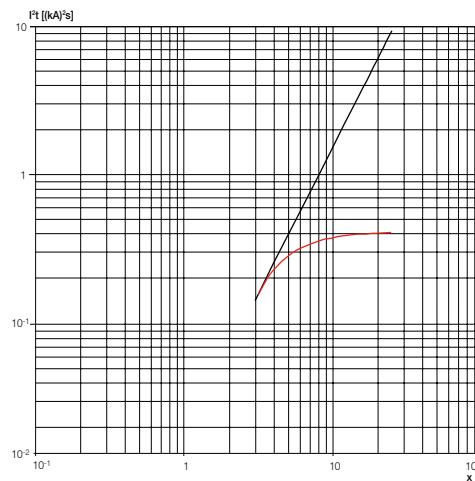


T4N/PV-E
@ 1500V tau = 5ms

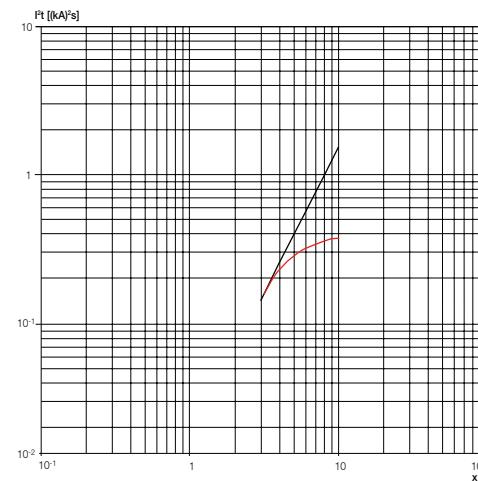


Specific let-through energy curves

T4N/PV-E
@ 1500V tau = 1ms



T4N/PV-E
@ 1500V tau = 5ms



—

ABB jumpers for pole-to-pole connection are a tested solution for a simplified, safe installation.

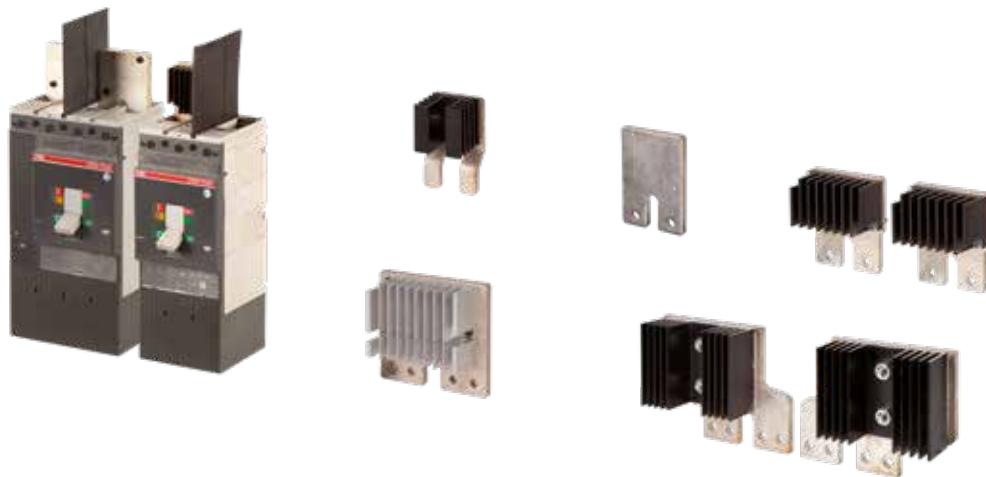
The innovative Tmax PV series of breakers and switch disconnectors can be accessorized with suitable jumpers. Tmax PV devices are 3- or 4-pole breakers. To break direct current, these poles must be configured in series on one or both of the polarities. Therefore,

jumpers between poles are necessary. For example, a 4PS (poles in series) jumper kit puts all 4 poles of a breaker in series on one polarity.

The jumpers are connected with or without heat sinks, depending on the breaker frame.

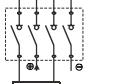
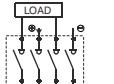
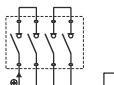
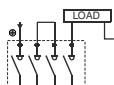
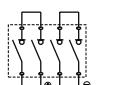
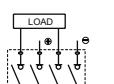
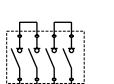
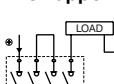
Jumper kits are available in two versions: one for cabling all the poles on one single polarity (4PS or 3PS) and one for dividing the poles on both polarities (2+2PS or 2+1PS).

Performances in the following tables are based on the use of ABB original jumpers.



Quick reference tables

Tmax PV switch disconnectors up to 1100V DC in compliance with IEC60947-3

Configuration & Supply	EF	FCCu	FCCuAl	HR	ES	F
						
Size						
T1D/PV						
2+2 - lower		●	●	●		
2+2 - upper		●	●	●		
4PS - lower		●	●	●		
4PS - upper		●	●	●		
T3D/PV						
2+2 - lower		●	●	●	●	
2+2 - upper		●	●	●	●	
4PS - lower		●	●	●		
4PS - upper		●	●	●		

Tmax PV switch disconnectors up to 1100V DC in compliance with IEC60947-3

Configuration & Supply	EF	FCCu	FCCuAI	HR	ES	F
Size						
T4D/PV						
2+2 - lower						
2+2 - upper						
4PS - lower						
4PS - upper						
T5D/PV						
2+2 - lower						
2+2 - upper						
4PS - lower						
4PS - upper						

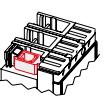
Quick reference tables

Tmax PV switch disconnectors up to 1100V DC in compliance with IEC60947-3

Configuration & Supply	EF	FCCu	FCCuAl	HR	ES	F
Size						
T6D/PV						
2+2 - lower		●		●		●
2+2 - upper			●			●
4PS - lower		●		●		●
4PS - upper			●			●
T7D/PV						
2+2 - lower		●		●	1)	●
2+2 - upper		●		●		●
4PS - lower		●		●		●
4PS - upper		●				●

1) Vertical (VR) terminals can be used too

Tmax PV switch disconnectors and circuit breakers up to 1500V DC in compliance with IEC60947-2 and IEC60947-3

Configuration & Supply	FCCu	FCCuAI	F ³⁾
			
Size			
T4D/PV-E	2+2 - lower  2)		
T4N/PV-E		2)	2)
	2+2 - upper  2)	2)	2)
	4PS - lower  2)	2)	2)
	4PS - upper  2)	2)	2)
T5D/PV-E	2+2 - upper  2)		2)
T7D/PV-E	2+2 - upper  2)	2)	2)
	2+2 - lower  1)	1)	1)
	4PS - lower  1)	1)	1)

1) Valid only when 1250 A jumpers are used; 2) Not valid for T4N/PV-E 250; 3) Not valid for T4N/PV-E

Temperature performances and wiring

Temperature performances of Tmax PV at temperatures other than 40 °C and for different altitudes are reported in the following table.

Temperature [°C] / In [A]	T1D/PV	T3D/PV	T4D/PV	T5D/PV	T6D/PV	T7D/PV 1250	T7D/PV 1600
40	160	200	250	500	800	1250	1600
45	160	200	250	500	771	1225	1600
50	160	200	250	500	741	1199	1600
55	160	200	250	500	709	1171	1542
60	153	200	250	500	676	1141	1481
65	145	190	237	474	641	1109	1418
70	138	179	224	447	605	1074	1352

Wire options Tmax PV - IEC

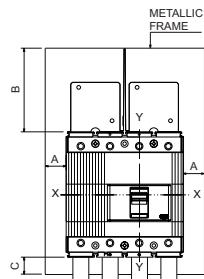
Ambient temp.	40°C	40°C
Cable type	Copper (FcCu lugs)	Aluminum (FcCuAL lugs)
In (A)	Required wires (number x section)	Required wires (number x section)
T1D/PV		
160	1 x 70mm ² **	Lug not available
T3D/PV		
200	1 x 95mm ²	1 x 150mm ² *
T4D/PV		
250	1 x 120mm ²	1 x 185mm ² *
T4D/PV-E		
250	1 x 120mm ²	1 x 185mm ² *
T4N/PV-E		
100	1 x 35mm ²	Lug not available
125	1 x 50mm ²	Lug not available
160	1 x 70mm ²	Lug not available
200	1 x 95mm ²	Lug not available
250	1 x 120mm ²	Lug not available
T5D/PV		
500	2 x 150mm ²	2 x 240mm ² *
T5D/PV-E		
500	2 x 150mm ²	2 x 240mm ² *
T6D/PV		
800	2 x 240mm ² *	Lug not available
T7D/PV		
1250	4 x 185mm ² *	Lug not available
1600	4 x 240mm ² *	Lug not available
T7D/PV-E		
1250	4 x 185mm ² *	Lug not available
1600	4 x 240mm ² *	Lug not available

*with FcCuAL; **Already installed

Power losses and insulation distances

When current passes through a molded case circuit breaker or switch disconnector, it dissipates heat which results in power loss. The Tmax PV series, however, causes very little power loss. The following table provides information about power losses in IEC versions of the devices.

Type	Version	In (A)	P (W/pole)
T1 MCS	IEC	160	15
T3 MCS	IEC	200	19
T4 MCS/MCCB	IEC	250	14
T5 MCS	IEC	500	30
T6 MCS	IEC	800	48
T7 MCS	IEC	1250	47
		1600	77



Insulation distances for installation in metallic cubicle

	A [mm]		B [mm]		C [mm]	
	With jumpers	No jumpers	With jumpers	No jumpers	With jumpers	No jumpers
T1D/PV	55	20	100	50	100	20
T3D/PV	25	25	100	100	20	20
T4D/PV - T4D/PV-E	50	50	120	120	120	120
T4N/PV-E $\tau = 1\text{ms}$	50	-	210	-	210	-
$\tau = 5\text{ms}$	150	-	210	-	210	-
T5D/PV	57	25	120	120	105	105
T5D/PV-E	57	57	122,5	122,5	122,5	122,5
T6D/PV	50	50	100	100	110	110
T7D/PV 1250 - T7D/PV-E 1250	100	100	200	200	200	200
T7D/PV 1600 - T7D/PV-E 1600	130	130	200	200	200	200

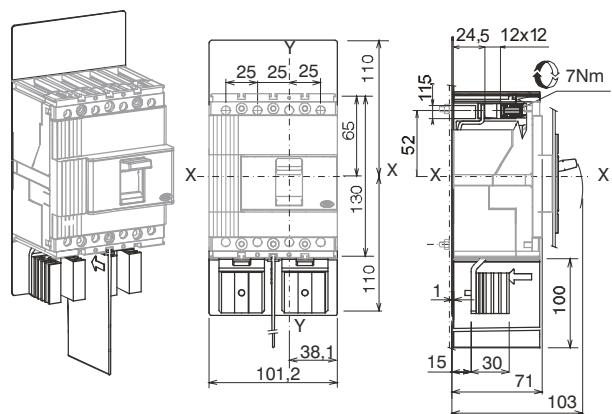
Insulation distances in air between two Tmax PV devices with jumpers put side by side*

	[mm]
T1	60
T3	50
T4	100
T4N/PV-E $\tau = 1\text{ms}$	100
$\tau = 5\text{ms}$	300
T5	100
T6	100
T7	200

* insulation distances can be reduced using suitable insulation barriers between breakers

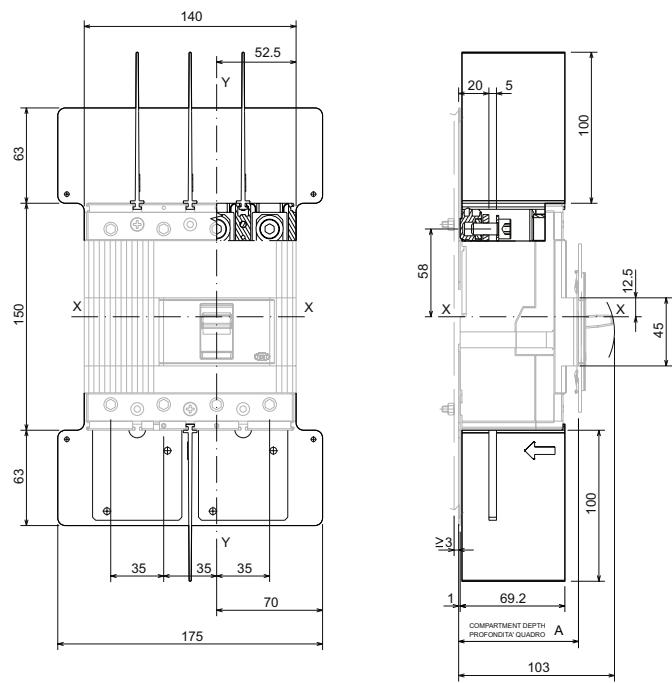
Dimensions

T1D/PV

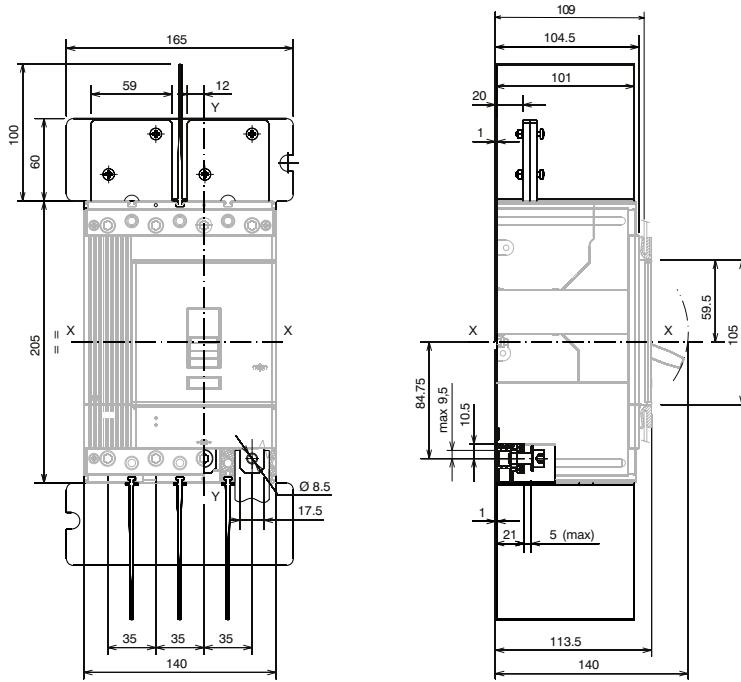


Installation instructions code 1SDH000777R0002 for other configurations and supply

T3D/PV



Installation instructions code 1SDH000778R0002 for other configurations and supply

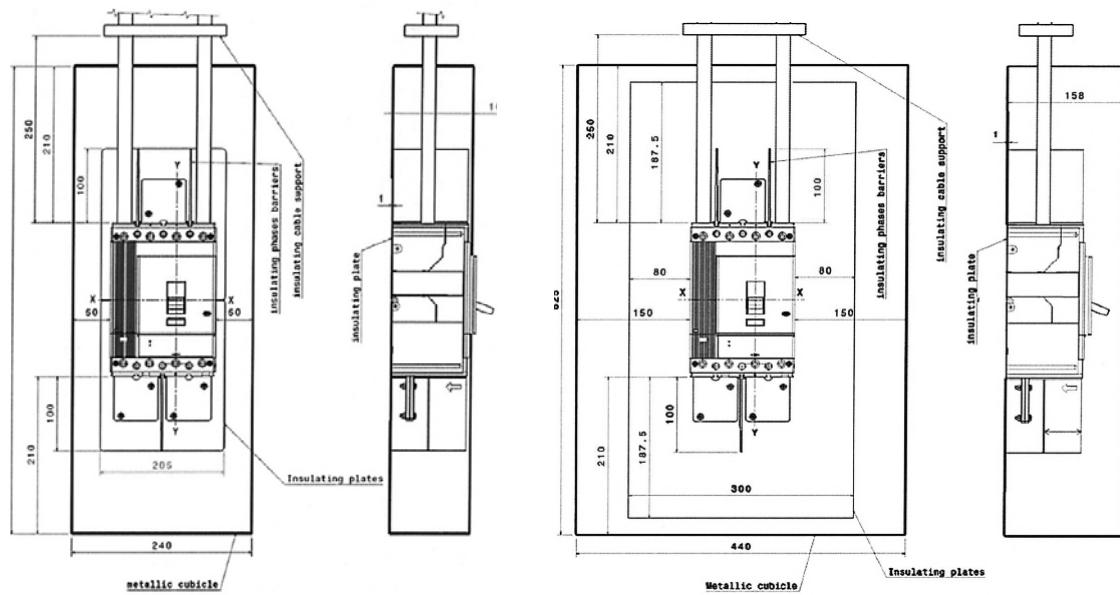
T4D/PV - T4D/PV-E

Installation instructions code 1SDH000779R0002 for other configurations and supply

T4N/PV-E

$\tau = 1\text{ms}$

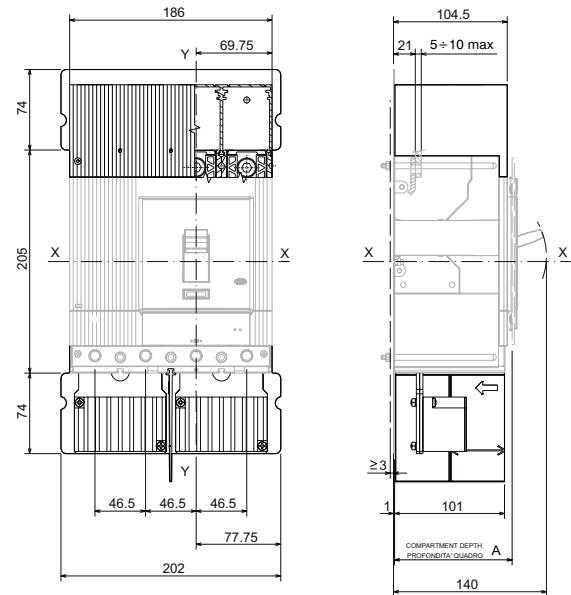
$\tau = 5\text{ms}$



Installation instructions code 1SDH000779R0004 for other configurations and supply

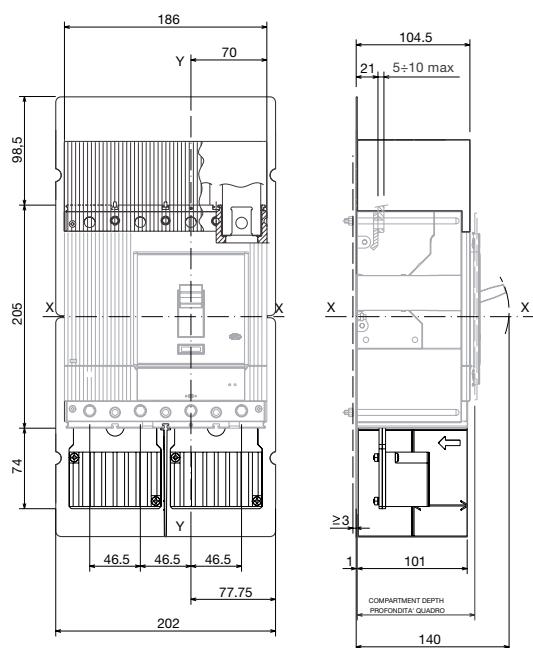
Dimensions

T5D/PV

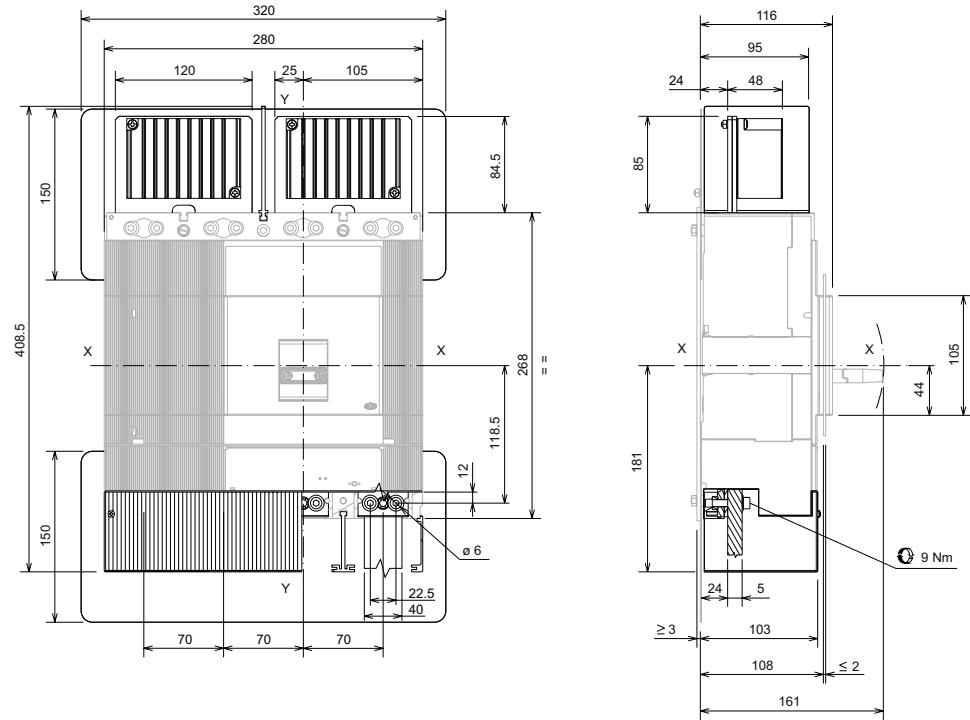


Installation instructions code 1SDH000780R0002 for other configurations and supply

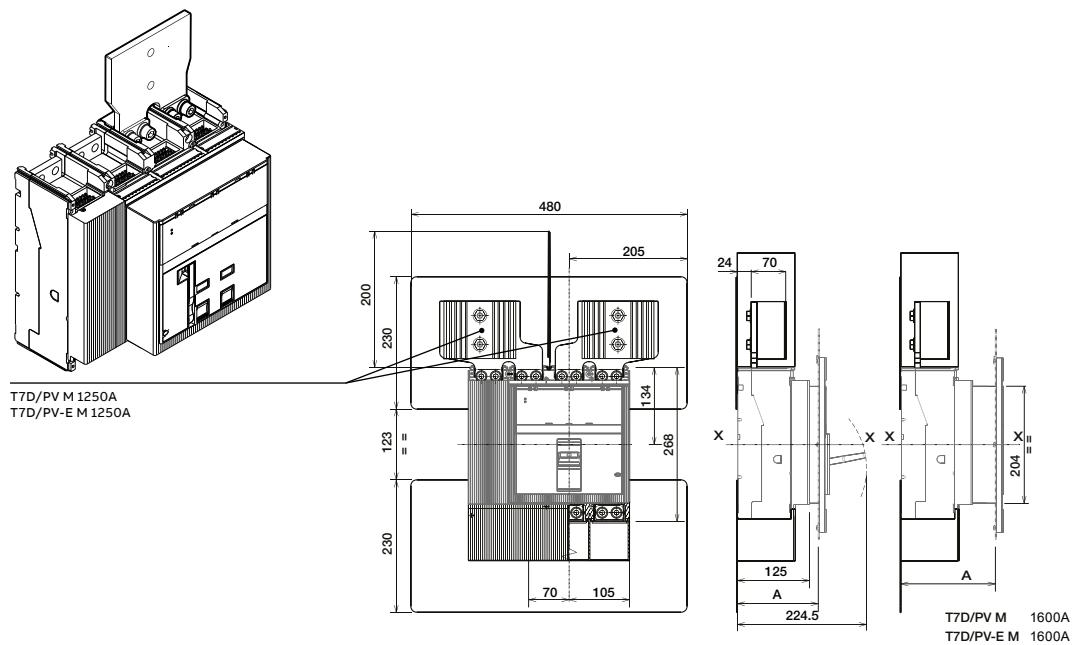
T5D/PV-E



Installation instructions code 1SDH000778R0002 for other configurations and supply

T6D/PV

Installation instructions code 1SDH000781R0002 for other configurations and supply

T7D - T7D/PV-E

Installation instructions code 1SDH000779R0004 for other configurations and supply



CHAPTER 3

UL applications

- 28-28 Dedicated solutions compliant with UL Standards**
- 29-29 Ranges**
- 30-31 Characteristic curves**
- 32-34 Quick reference tables**
- 35-35 Temperature performances**
- 36-36 Wiring**
- 37-37 Power losses**
- 38-38 Insulation distances**
- 39-41 Dimensions**

Dedicated solutions compliant with UL Standards

The **SACE Tmax PV** range of molded case circuit breakers and switch disconnectors includes a UL489B type-approved version designed for 1500V DC installations with rated current up to 1200A. Compact and versatile, these breakers and disconnectors compose an excellent DC solution for switchgear and inverters in all PV systems in all markets where North American regulations apply.

Employing the switch disconnector platform with T7N-D/PV-E integrated motor, the UL type-approved version provides optimized isolating performance over the entire current range.

Available in a 4-pole configuration, UL-compliant T7N-D/PV-E switch disconnectors include versions with an integrated motor operator and do not require external components. The resulting reductions in overall size, wiring materials and installation time lower installation costs.

All of these products can be equipped with the most common UL-listed mechanical and electrical accessories already available for the **SACE Tmax T UL** molded case circuit breaker series.

Ranges

Common data	
Operating temperature	[°C] -25 °C ... +70 °C
Storage temperature	[°C] -40 °C ... +70 °C
Numbers of poles	3 - 4
Version	fixed

Altitude derating		
Altitude [mt]	In [%]	Ue [%]
2000	100	100
3000	98	88
4000	95	78
5000	85	68

Molded case switch disconnectors up to 1500V DC in compliance with UL 489B

Electrical characteristics

Tmax PV UL switch disconnectors	T1N-D/PV	T4N-D/PV	T5N-D/PV	T6N-D/PV	T7N-D/PV ¹⁾	T7N-D/PV-E ¹⁾
Rated service current	(A) 100	200	400	600-800	1000	1000-1200
Number of poles	(No.) 4	3	3	4	4	4
Rated service voltage	(V) 1000V DC	1000V DC	1000V DC	1000V DC	1000V DC	1500V DC
Short-circuit current withstand	(kA) 1.2	3	5	10	18	18
Magnetic override	(kA) -	3	5	10	-	-
Versions	F	F	F	F	F	F
Connections*	Jumpers	Jumpers	Jumpers	Jumpers	Jumpers	Jumpers
Terminals provided with jumper kit	FCCu	FCCuAI	FCCu-ES	FCCuAI-EF	FCCuAI-F	1000A: F / FCCuAI 1200A: EF
Mechanical life	(No. Operations) 15000	7500	7500	7500	20000	20000
Electrical life (operations @ 1000V DC)	(No. Operations) 1000	1000**	500**	500**	500**	400**
Basic dimensions						
	W (mm/in) 102/4.02	105/4.13	140/5.52	280/11.02	280/11.02	280/11.02
	D (mm/in) 70/2.76	103.5/4.07	103.5/4.07	103.5/4.07	178/7.01	178/7.01
	H (mm/in) 130/5.12	205/8.07	205/8.07	268/10.55	268/10.55	268/10.55
Weight (with standard terminals only)	(kg/lbs) 1.2/2.65	2.35/5.18	3.25/7.17	12/26.46	14/30.86	14/30.86

1) installation in vertical position only * Selection of one of the jumper connection options is mandatory for Tmax PV UL ** openings with SOR or UVR

Molded case circuit breakers up to 1000V DC in compliance with UL 489B

Wherever short and overload protection are required (as in recombiner boxes), 1000V DC automatic Tmax PV circuit breakers are available. Below are the UL489B automatic circuit breaker offerings.

Electrical characteristics

Tmax PV circuit breaker in compliance with UL 489B	T4N/PV	T5N/PV	T6N/PV
Frame size	(A) 200	400	600-800
Rated service current	(A) 40-200	225-400	600-800
Number of poles	(No.) 3	3	4
Rated service voltage	(V) 1000V DC	1000V DC	1000V DC
Short-circuit interrupting rating @ 1000V DC	(kA) 7.5	5	10
Trip Unit	TMD/TMA	TMF/TMA	TMA
Versions	F	F	F
Standard terminals	F	F	F
Connections*	Jumpers	Jumpers	Jumpers
Terminals provided with jumper kit	FCCuAI	FCCuAI-FCCu-ES	FCCuAI-EF
Mechanical life	(No. Operations) 7500	7500	7500
Electrical life (operations @ 1000 VDC)	(No. Operations) 1000**	500**	500**
Basic dimensions			
	W (mm/in) 105/4.13	140/5.52	280/11.02
	D (mm/in) 103.5/4.07	103.5/4.07	103.5/4.07
	H (mm/in) 205/8.07	205/8.07	268/10.55
Weight (with standard terminals only)	(kg/lbs) 2.35/5.18	3.25/7.17	12/26.46

* Selection of one of the jumper connection options is mandatory for Tmax PV UL ** openings with SOR or UVR

Characteristic curves

The UL circuit breaker range is divided into three frames - T4, T5 and T6 - with an application range from 40A to 800A and breaking capacities up to 10kA at 1000V DC.

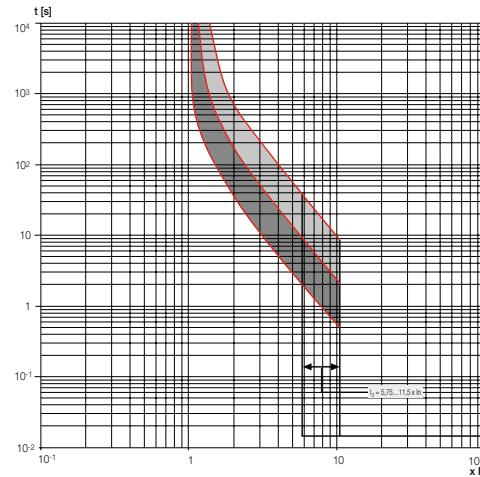
The circuit breakers are fitted with thermal magnetic trip units for protection of direct current in solar networks. They protect against overload with a bimetal thermal device and protect against short-circuit with a magnetic device.

The range of breakers for photovoltaic applications includes the following:

- T4 (up to 50A) circuit breakers equipped with TMD thermal magnetic trip units with adjustable thermal threshold ($I_1 = 0.7 \dots 1 \times I_n$) and fixed magnetic threshold ($I_3 = 10 \times I_n$).

T4N/PV UL 200

$I_n = 40 \dots 200\text{A}$



- T4, T5 and T6 circuit breakers equipped with TMA thermal magnetic trip units with adjustable thermal threshold ($I_1 = 0.7 \dots 1 \times I_n$) and adjustable magnetic threshold ($I_3 = 5 \dots 10 \times I_n$). The T5 225, 250 and 300 A use a special TMF trip unit with a fixed thermal threshold and adjustable magnetic threshold as indicated in the dedicated table ($I_3=1500 \dots 3000\text{ A}$).

The magnetic threshold for Tmax T4, T5 and T6 has a corrective factor of 15 percent because the TMD and TMA releases were originally calibrated for use in AC networks.

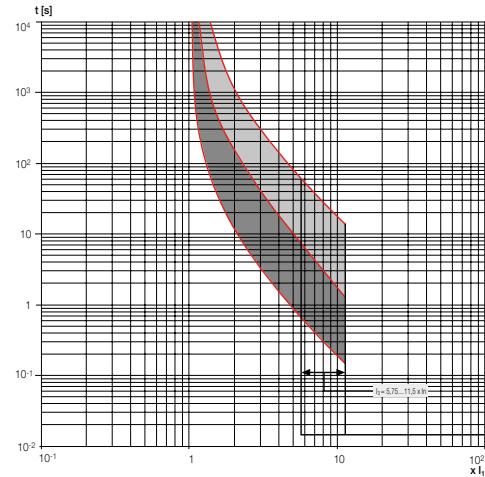
The curves for the PV line are shown below.

T5N/PV UL - Magnetic Threshold

I_n	I_3
225	7.5 ... 15x I_n
250	7 ... 14x I_n
300	5.75 ... 11.5x I_n
400	5.75 ... 11.5x I_n

T5N/PV UL 400

$I_n = 225, 250, 300, 400\text{A}$



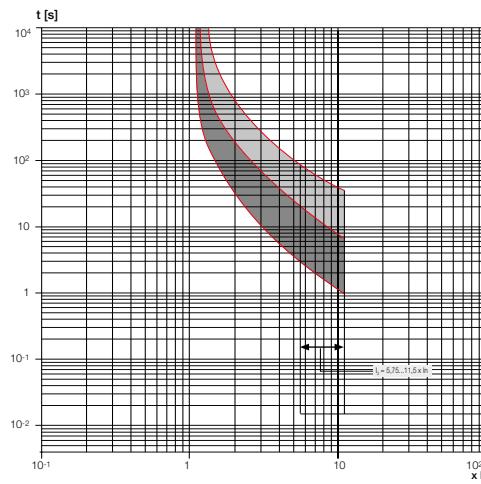
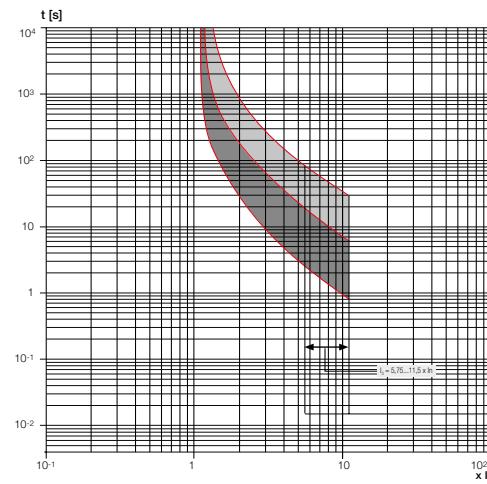
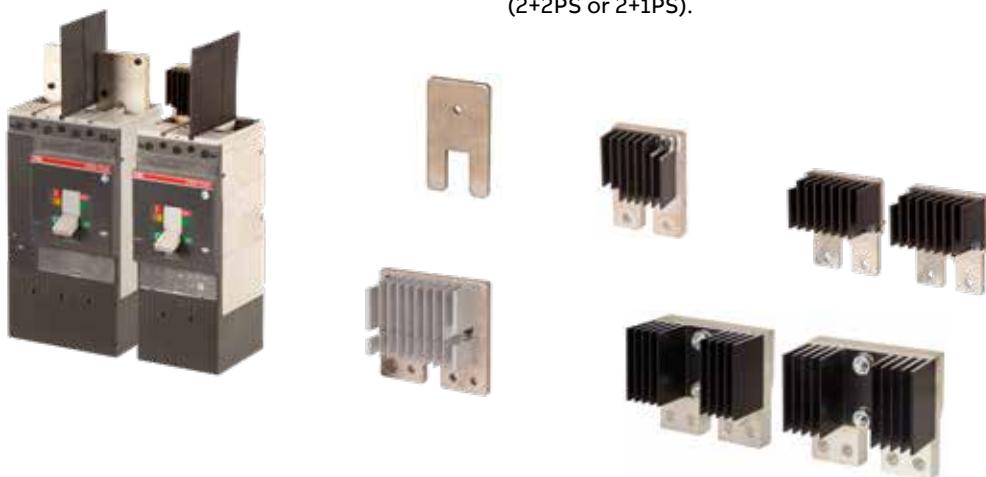
T6N/PV UL 600 $I_{n} = 600A$ **T6N/PV UL 800** $I_{n} = 800A$ 

ABB jumpers for pole-to-pole connection are the tested solution for a simplified, safe installation.

The innovative Tmax PV series of circuit breakers and switch disconnectors can be accessorized with suitable jumpers. Tmax PV breakers are 3 or 4 pole designs.



To break direct current, these poles must be placed in series on one or both polarities which renders jumpers unnecessary. For example a 4PS (poles in series) jumper kit puts all 4 poles of a breaker in series on one polarity. One jumper kit ordering code includes 1, 2 or 3 jumpers plus any required lugs and accessories.

The jumpers are connected with or without heat sinks, depending on the breaker frame.

Jumper kits are available in two versions: one for cabling all the poles on one polarity (4PS or 3PS) and one for dividing the poles on both polarities (2+2PS or 2+1PS).

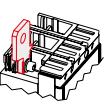
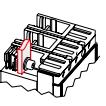
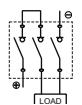
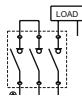
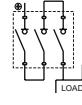
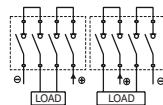
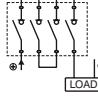
Quick reference tables

Tmax PV switch disconnectors and automatic circuit breakers up to 1000V DC in compliance with UL 489B

Configuration & Supply	EF	FCCu	FCCuAI	ES	F
Size					
T1N-D/PV	2+2 - lower 				
	2+2 - upper 				
	4PS - lower 				
	4PS - upper 				
T4N-D/PV - T4N/PV	2+1 - lower 				
	3PS - lower 				
	3PS - upper 				

1) Included with jumpers kit

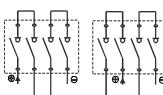
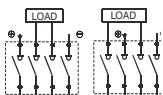
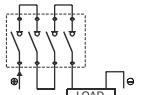
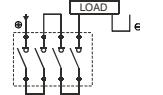
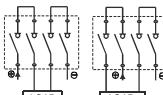
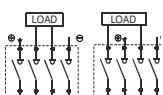
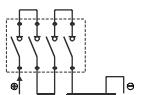
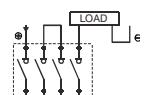
Tmax PV switch disconnectors and automatic circuit breakers up to 1000V DC in compliance with UL 489B

Configuration & Supply	EF	FCCu	FCCuAI	ES	F
					
Size					
T5N-D/PV - 2+1 - lower	 	1) 3)	2) 3)	4)	
3PS - lower		1) 3)	2) 3)	4)	
3PS - upper		1) 3)	2) 3)	4)	
T6N-D/PV - 2+2 - lower	 	4)	3)		
4PS - lower		4)	3)		

1) T5 300-400A only; 2) T5 225-250A only; 3) Included with jumper kit "cable type"; 4) Included with jumper kit "busbar type"

Quick reference tables

Tmax PV switch-disconnectors up to 1500V DC in compliance with UL 489B

Configuration & Supply	EF	FCCu	FCCuAl	ES	F
					
Size					
T7N-D/PV	<p>2+2 - lower</p>  <p>3)</p>			<p>3)</p>	<p>4)</p>
	<p>2+2 - upper</p>  <p>3)</p>			<p>3)</p>	<p>4)</p>
	<p>4PS - lower</p>  <p>3)</p>			<p>3)</p>	<p>4)</p>
	<p>4PS - upper</p>  <p>3)</p>			<p>3)</p>	<p>4)</p>
T7N-D/PV-E	<p>2+2 - lower</p>  <p>1) 5)</p>		<p>2) 3)</p>		<p>2) 4)</p>
	<p>2+2 - upper</p>  <p>1) 5)</p>		<p>2) 3)</p>		<p>2) 4)</p>
	<p>4PS - lower</p>  <p>1) 5)</p>		<p>2) 3)</p>		<p>2) 4)</p>
	<p>4PS - upper</p>  <p>1) 5)</p>		<p>2) 3)</p>		<p>2) 4)</p>

1) Mandatory for T7 1200A; 2) T7 1000A only; 3) Included with jumper kit "cable type"; 4) Included with jumper kit "busbar type"; 5) Included with jumper kit

Temperature performances

T1 MCS PV UL	
With 40 °C Cables	
40	100
50	100
60	87
70	71

T4 MCS PV UL	
With 40 °C Cables	
40	200
50	200
60	184
70	167

T5 MCS PV UL	
With 40 °C Cables	
40	400
50	400
60	386
70	372

T6 MCS PV UL	
With 40 °C Cables	
40	800
50	800
60	700
70	600

T7 MCS PV UL	
1000A version	
With 40 °C Cables	
40	1000
50	1000
55	935
60	866
65	791
70	707

T7 MCS PV UL	
1200A version	
With 40 °C Cables	
40	1200
50	1054
55	981
60	912
65	835
70	751

T4 PV UL range (MCCB)

With 40 °C Cables		With 50 °C Cables	
refer to page 38 for cable dimensions		refer to page 38 for cable dimensions	
40	200	40	200
50	180	50	200
60	166	60	181
70	150	70	160

T5 PV UL (MCCB), 225A version

With 40 °C Cables		With 50 °C Cables	
refer to page 38 for cable dimensions		refer to page 38 for cable dimensions	
40	225	40	225
50	200	50	225
60	175	60	200
70	160	70	175

T5 PV UL (MCCB), 250A version

With 40 °C Cables		With 50 °C Cables	
refer to page 38 for cable dimensions		refer to page 38 for cable dimensions	
40	250	40	250
50	225	50	250
60	195	60	220
70	165	70	190

T5 PV UL (MCCB), 300A version

With 40 °C Cables		With 50 °C Cables	
refer to page 38 for cable dimensions		refer to page 38 for cable dimensions	
40	300	40	300
50	270	50	300
60	240	60	265
70	210	70	230

T5 PV UL (MCCB), 400A version

With 40 °C Cables		With 50 °C Cables	
refer to page 38 for cable dimensions		refer to page 38 for cable dimensions	
40	400	40	400
50	387	50	400
60	373	60	380
70	300	70	360

T6 PV UL (MCCB), 600A version

With 40 °C Cables		With 50 °C Cables	
refer to page 38 for cable dimensions		refer to page 38 for cable dimensions	
40	600	40	600
50	600	50	600
60	525	60	525
70	450	70	450

T6 PV UL (MCCB), 800A version

With 40 °C Cables	
refer to page 38 for cable dimensions	
40	800
50	800
60	700
70	600

Test performed by busbars

Wiring

UL MCCBs have two deratings, in accordance with UL489B: one for 40°C cables and one for 50°C cables. Cables dimensions are specified by UL489B.

Wire options for Tmax PV - UL

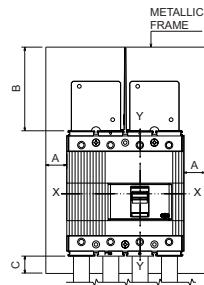
Ambient temp.	40°C	50°C		
Cable type	Copper	Aluminum	Copper	Aluminum
In (A)	required wires (number x section)		required wires (number x section)	
T1N-D/PV				
100	1 x 3 AWG	Lug not available	1 x 1/0 AWG	Lug not available
T4N-D/PV				
200	1 x 3/0 AWG	1 x 250kcmil	1 x 300kcmil	Lug not available
T4N/PV				
40	1 x 8 AWG	1 x 8 AWG	1 x 6 AWG	1 x 4 AWG
50	1 x 8 AWG	1 x 6 AWG	1 x 4 AWG	1 x 3 AWG
80	1 x 4 AWG	1 x 2 AWG	1 x 2 AWG	1 x 1/0 AWG
100	1 x 3 AWG	1 x 1 AWG	1 x 1/0 AWG	Lug not available
125	1 x 1 AWG	1 x 2/0 AWG	1 x 2/0 AWG	1 x 4/0 AWG
150	1 x 1/0 AWG	1 x 3/0 AWG	1 x 3/0 AWG	1 x 250kcmil
200	1 x 3/0 AWG	1 x 250kcmil	1 x 300kcmil	Lug not available
T5N-D/PV				
400	2 x 3/0 AWG	Lug not available	2 x 300kcmil	Lug not available
T5N/PV				
225	1 x 4/0 AWG	1 x 300kcmil	1 x 350kcmil	2 x 3/0 AWG
250	1 x 250kcmil	1 x 350kcmil	1 x 400kcmil	Lug not available
300	1 x 350kcmil	Lug not available	2 x 3/0 AWG	Lug not available
400	2 x 3/0 AWG	Lug not available	2 x 300kcmil	Lug not available
T6N-D/PV				
600	2 x 350kcmil	2 x 500kcmil	3 x 300kcmil	3 x 400kcmil
T6N/PV				
600	2 x 350kcmil	2 x 500kcmil	3 x 300kcmil	3 x 400kcmil
T7N-D/PV-E				
1000	3 x 400kcmil	4 x 350kcmil	4 x 400kcmil	Lug not available
1000	3 x 400kcmil	4 x 350kcmil	4 x 400kcmil	Lug not available

Power Losses

When current passes through a molded case circuit breaker or switch disconnector, it dissipates heat which results in power loss. The Tmax T series, however, is well-known for having very little power loss. The table below offers data on power losses in UL versions.

Type	Trip Unit	Version	I _n (A)	P (W/pole)
T1	MCS	UL	100	7,5
T4	MCS	UL	200	8,9
	TMD	UL	40	3,8
			50	3,9
	TMA	UL	80	6,4
			100	7,6
			125	7,9
			150	8
			200	10
T5	MCS	UL	400	19
	TMA	UL	400	29
T6	MCS	UL	600	31
			800	48
	TMA	UL	600	33
			800	50
T7	MCS	UL	1000	30
			1200	47

Insulation distances



UL489 Insulation distances for installation in metallic cubicle

	A [mm]	B [mm]	C [mm]
T1N-D/PV	55	100	100
T4N-D/PV - T4N/PV	50	200	200
T5N-D/PV - T5N/PV	57	200	200
T6N-D/PV* - T6N/PV	70	220	110
T7N-D/PV - T7N-D/PV-E	165	230	200

Insulation distances in air between two Tmax PV with jumpers put side by side*

	[mm]
T1	55
T3	-
T4	100
T5	100
T6	265
T7	330

* insulation distances can be reduced using suitable insulation barriers between breakers

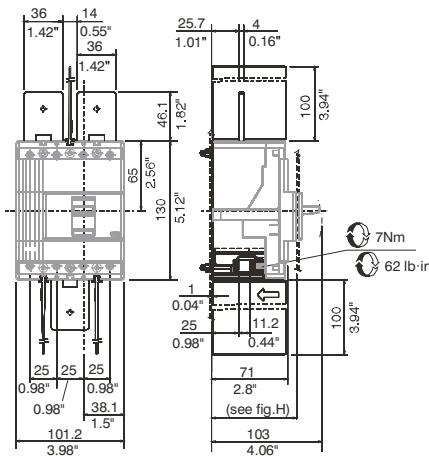
UL489B cubicle dimensions for Tmax PV

	H [mm]	W [mm]	D [mm]
T1/PV UL	370	245	72
T4/PV UL	520	420	200
T5/PV UL	710	550	175
T6/PV UL	704	540	173
T7/PV UL	704	610	173

Dimensions

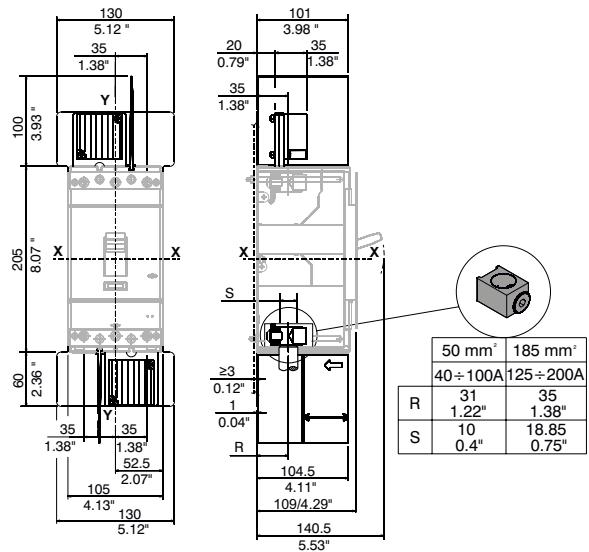
T1N-D/PV

4PS solution, lower supply



Installation instructions code 1SDH000777R0003 for other configurations and supply

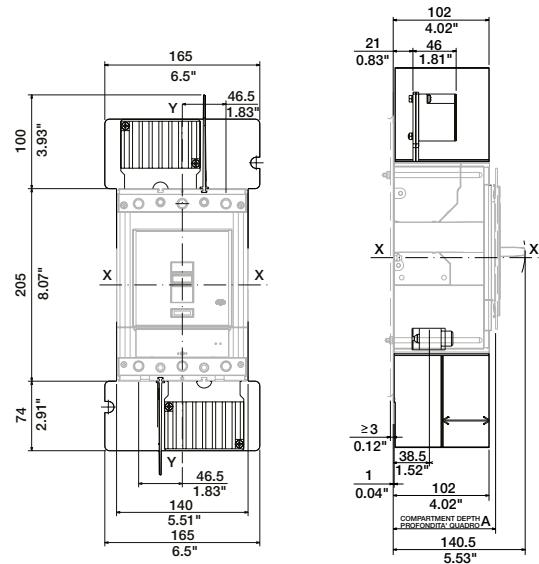
T4N-D/PV - T4N/PV



Installation instructions code 1SDH000779R0003 for other configurations and supply

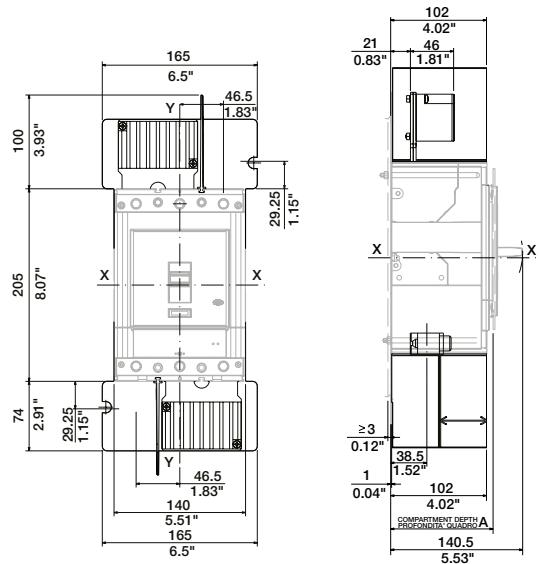
Dimensions

T5N-D/PV - T5V/PV

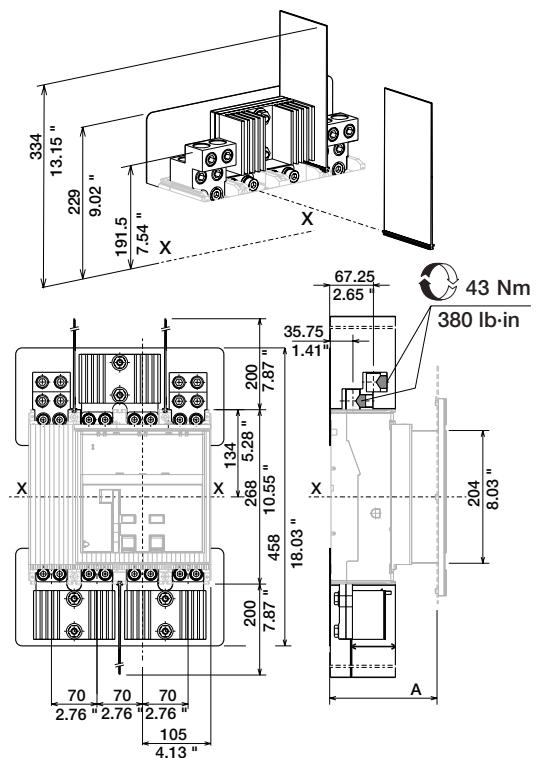


Installation instructions code 1SDH000780R0003 for other configurations and supply

T6N-D/PV - T6N/PV



Installation instructions code 1SDH000781R0003 for other configurations and supply

T7N-D/PV - T7N-D/PV-E

Installation instructions code 1SDH000789R0003 for other configurations and supply



CHAPTER 4

800V AC applications

- 44-44 Full protection for string inverters with 800V AC output**
- 45-45 Ranges**
- 46-47 Characteristic curves**
- 48-48 Temperature performances**
- 49-49 Wiring**
- 50-50 Power losses**
- 51-51 Insulation distances**
- 52-55 Dimensions**

Full protection for string inverters with 800V AC output

ABB continues to meet market demand with a series of AC products designed to address two critical trends in state-of-the-art facility design: the growth of PV systems using string inverters and an increase in rated voltages.

SACE Tmax PV T4V-HA and T5V-HA circuit breakers for AC applications are available in UL type-approved versions and versions that conform to IEC 60947-2 and GB14048.2 Standards. ABB supplies the T4V-HA version, bearing the three UL, IEC and CCC marks, and the T5V-HA, bearing both the IEC and UL marks.

Size T4 controls currents up to 250A and can break short-circuit current up to 25kA, while size T5 controls currents up to 630A and breaks short-circuit current up to 32kA.

The T4V-HA UL up to 150A and the T5V-HA UL are 100% rated. Ideal for protecting AC switchgear and string inverters, these breakers can be integrated with the entire range of electrical and mechanical accessories already available for the SACE Tmax T molded case circuit breaker series.

Ranges

IEC

	T4V-HA	T5V-HA			
Rated uninterrupted current [A]	80, 100, 125, 160, 200, 250	320	400	500	630
Rated service voltage [V]	800	800			
Rated impulse withstand voltage, Uimp [kV]	8	8			
Rated insulation voltage, Ui [V]	1000	1000			
Distribution System	IT, TN	IT, TN			
Rated breaking capacity, Icu [kA]	25	32			
Rated service breaking capacity, Ics [kA]	12	16			
Category of use (IEC 60947-2)	A	A			
Isolation behaviour	Yes	Yes			
Reference Standards	IEC60947-2/GB14048.2	IEC60947-2/GB14048.2			
Product Certification	IEC - CCC	IEC - CCC			
Trip unit type	TMA	TMA	PR221		
Poles	3P/4P	3P/4P			
Class of pollution	III	III			
Derating on uninterrupted current @ 4000m	93%	93%			
Working Temperature [°C]	-25 + 70	-25 + 70			
Electrical life [No. Operations]	2000	1000			
Mechanical life [No. Operations]	20000	20000			
Version	F	F			
Terminals (cables, busbars)	Front, FcCuAl (1x185), FcCu (1x185)	Front, FcCuAl (1x240), FcCu (1x240)	Front		

UL

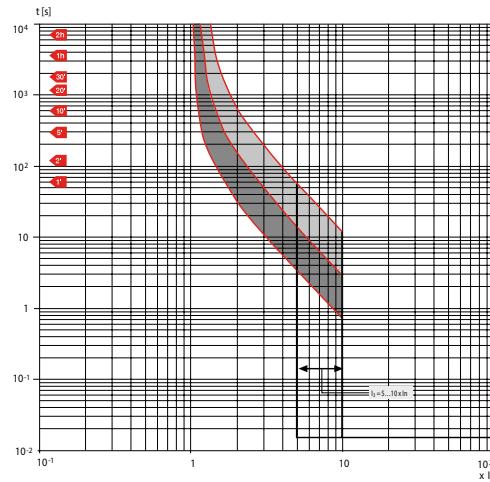
	T4V-HA	T5V-HA	
Rated uninterrupted current [A]	80, 100, 125, 150, 200	300	
Rated	100% up to 150A, 80% at 200A	100%	
Rated service voltage [V]	800	800	
Rated impulse withstand voltage, Uimp [kV]	8	8	
Rated insulation voltage, Ui [V]	1000	1000	
Distribution System	Δ	Δ	
Short circuit interrupting rating [kA]	25	25	
Isolation behaviour	Yes	Yes	
Reference Standards	UL489	UL489	
Product Certification	UL - IEC - CCC	UL - IEC	
Trip unit type	TMA	TMA, PR221	
Poles	3P/4P	3P/4P	
Class of pollution	III	III	
Derating on uninterrupted current @ 4000m	93%	93%	
Working Temperature [°C]	-25 + 70	-25 + 70	
Electrical life [No. Operations]	4000	1000	
Mechanical life [No. Operations]	20000	20000	
Version	F	F	
Terminals	FcCuAl (1x350kcmil)	FcCuAl (1x500kcmil)	

Characteristic curves

Circuit breakers with thermomagnetic trip units – IEC

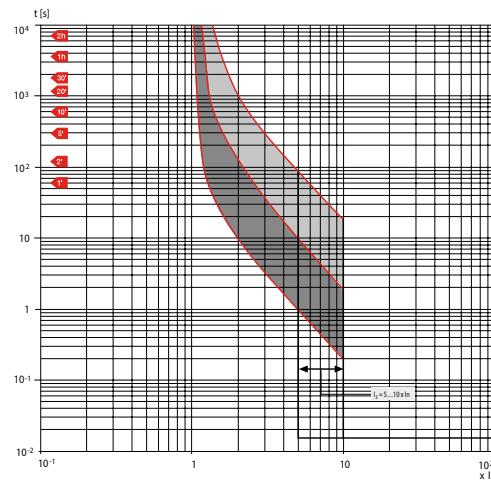
T4 TMA

$I_{n} = 80 \dots 250\text{A}$



T5 TMA

$I_{n} = 320 \dots 500\text{A}$



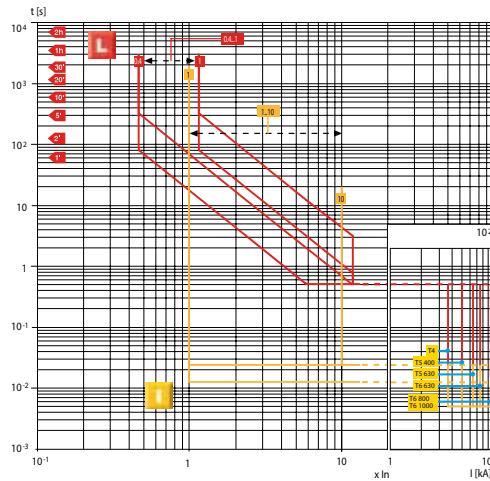
Circuit breakers with electronic trip units – IEC

T5 PR221

L-I Funcions

$I_{n} = 630\text{A}$

$I_{3 \max} = 9.5 \times I_{n}$

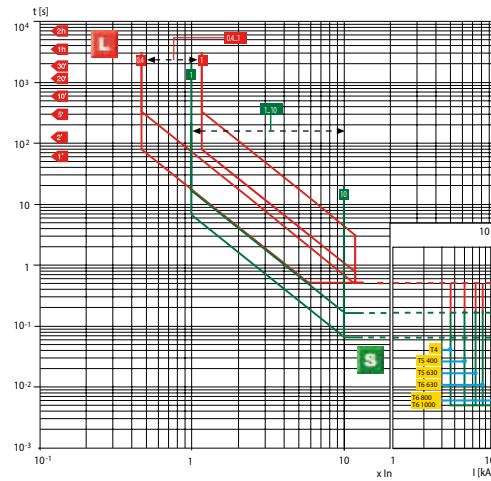


T5 PR221

L-S Funcions

$I_{n} = 630\text{A}$

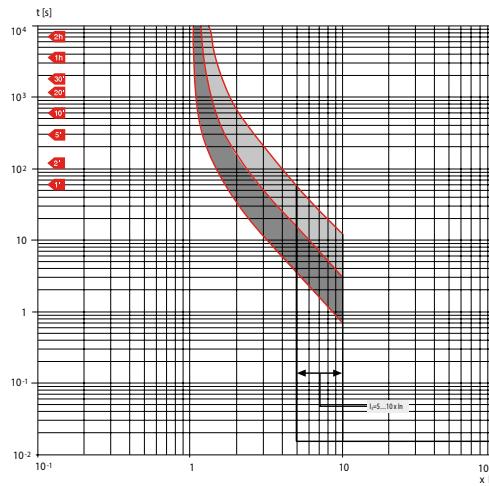
$I_{2 \max} = 9.5 \times I_{n}$



Circuit breakers with thermomagnetic trip units – UL

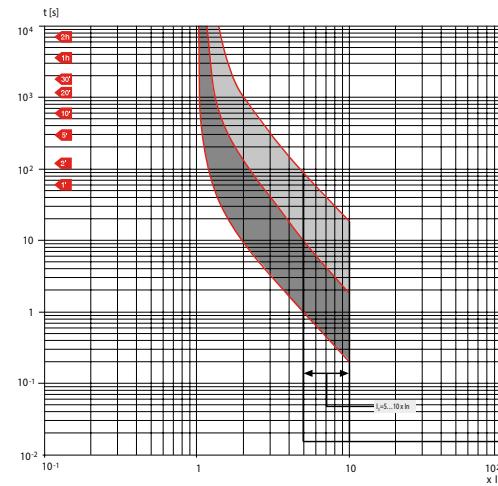
T4 TMA

$I_n = 80\ldots200A$



T5 TMA

$I_n = 300A$

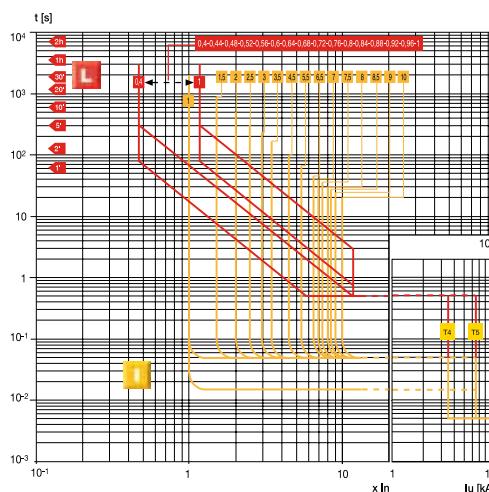


Circuit breakers with electronic trip units – UL

T5 PR221

L-I Funcions

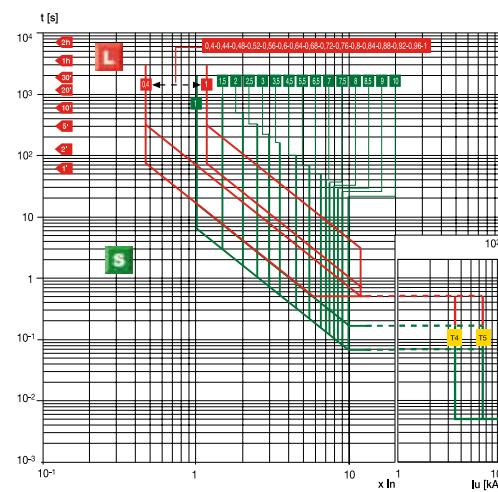
$I_n = 300A$



T5 PR221

L-S Funcions

$I_n = 300A$



Temperature performances

IEC

Circuit breaker with electronic trip unit									
	up to 40°C		50°C		60°C		70°C		
	I _{max} [A]	I ₁							
Tmax T5 630									
	630	1	580	0.92	529	0.84	479	0.76	

Circuit breaker with thermomagnetic trip units															
	10°C		20°C		30°C		40°C		50°C		60°C		70°C		
In [A]	MIN	MAX													
Tmax T4															
80	69	98	64	96	60	86	56	80	52	74	46	66	41	58	
100	83	118	79	113	74	106	70	100	66	95	59	85	52	75	
125	101	145	98	140	94	134	88	125	80	115	73	105	66	95	
160	130	185	123	176	118	168	112	160	105	150	98	140	91	130	
200	161	230	154	220	147	210	140	200	133	190	122	175	112	160	
250	200	285	193	275	183	262	175	250	168	240	161	230	154	220	
Tmax T5															
320	258	368	245	350	234	335	224	320	213	305	200	285	184	263	
400	325	465	309	442	294	420	280	400	266	380	248	355	227	325	
500	434	620	406	580	378	540	350	500	315	450	280	400	241	345	

UL

Circuit breaker with electronic trip unit							
	up to 140°F/40°C		122°F/50°C		140°F/60°C		158°F/70°C
	I _{max} [A]	I ₁	I _{max} [A]	I ₁	I _{max} [A]	I ₁	I _{max} [A]
Tmax T5 300							
	300	1	264	0.88	228	0.76	189*
							0.63

* To grant 288A, a cable size of 500kmcil with lug 1x240mm² must be used.

Circuit breaker with thermomagnetic trip units							
In [A]	50°F/10°C	68°F/20°C	86°F/30°C	104°F/40°C	122°F/50°C	140°F/60°C	158°F/70°C
Tmax T4							
80	94	90	85	80	75	68	62
100	118	112	106	100	95	85	77
125	148	140	133	125	119	106	100
150	177	168	159	150	143	127	114
200	236	224	212	200	190	170	167
Tmax T5							
300	241...345	230...328	220...314	210...300	200...286	187...267	178...254

Wiring

IEC

Wire options Tmax T4V-HA IEC and T5V-HA

Ambient temp.	40°C	
Cable type	Copper	Aluminum
In (A)	Required wires (number x section)	
T4V-HA		
80	1 x 25mm ²	1 x 35mm ² *
100	1 x 35mm ²	1 x 50mm ² *
125	1 x 50mm ²	1 x 70mm ² *
160	1 x 70mm ²	1 x 120mm ² *
200	1 x 95mm ²	1 x 150mm ² *
250	1 x 150mm ²	1 x 185mm ² *
T5V-HA		
320	1 x 185mm ²	2 x 120mm ² *
400	1 x 240mm ²	2 x 150mm ² *
500	2 x 150mm ² *	2 x 240mm ² *
630	2 x 185mm ² *	Lug not available

*with FcCuAL

UL

Wire options Tmax T4V-HA UL and T5V-HA

Ambient temp.	40°C	
Cable type	Copper	Aluminum
In (A)	Required wires (number x section)	
T4V-HA		
80	1 x 4 AWG	1 x 2 AWG
100	1 x 3 AWG	1 x 1 AWG
125	1 x 1 AWG	1 x 2/0 AWG
150	1 x 1/0 AWG	1 x 3/0 AWG
200	1 x 3/0 AWG	1 x 250kcmil
T5V-HA		
300	1 x 350kcmil	1 x 500kcmil

Power losses

IEC

Type	Trip Unit	In [A]	P [w/pole]
T4	TMA	80	4,6
		100	5,2
		125	6,2
		160	7,4
		200	9,9
		250	13,7
T5	TMA	320	13,6
		400	19,5
		500	28,8
	ELT	630	41,0

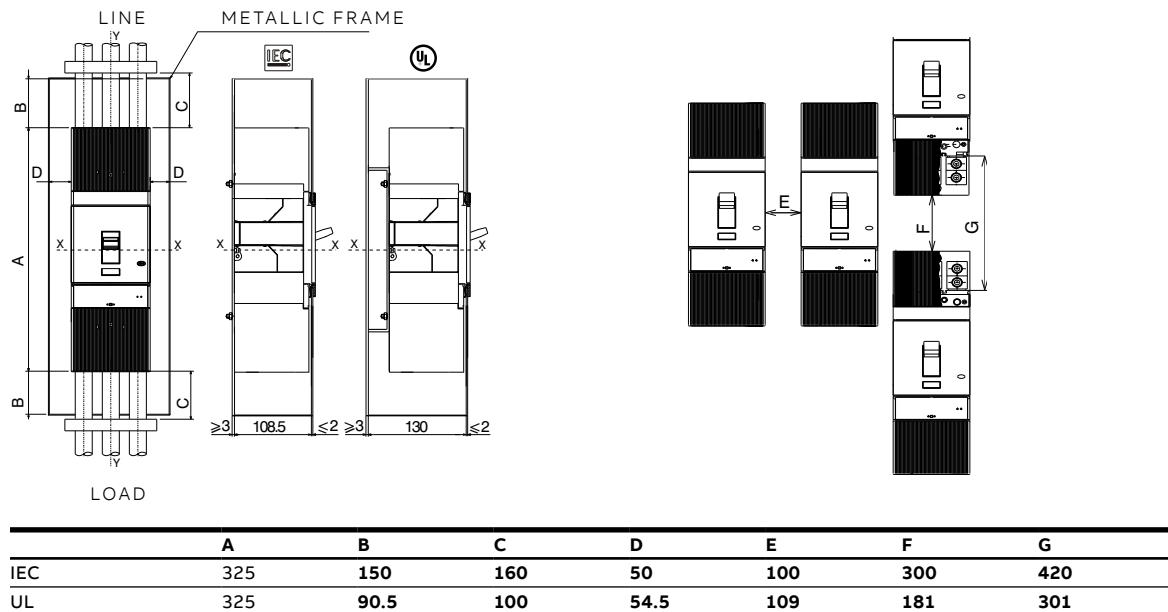
UL

Type	Trip Unit	In [A]	P [w/pole]
T4	TMA	80	4,6
		100	5,2
		125	5,7
		150	6,9
		200	9,9
	ELT	300	12,3
T5	TMA	300	9,3
		300	

Insulation distances

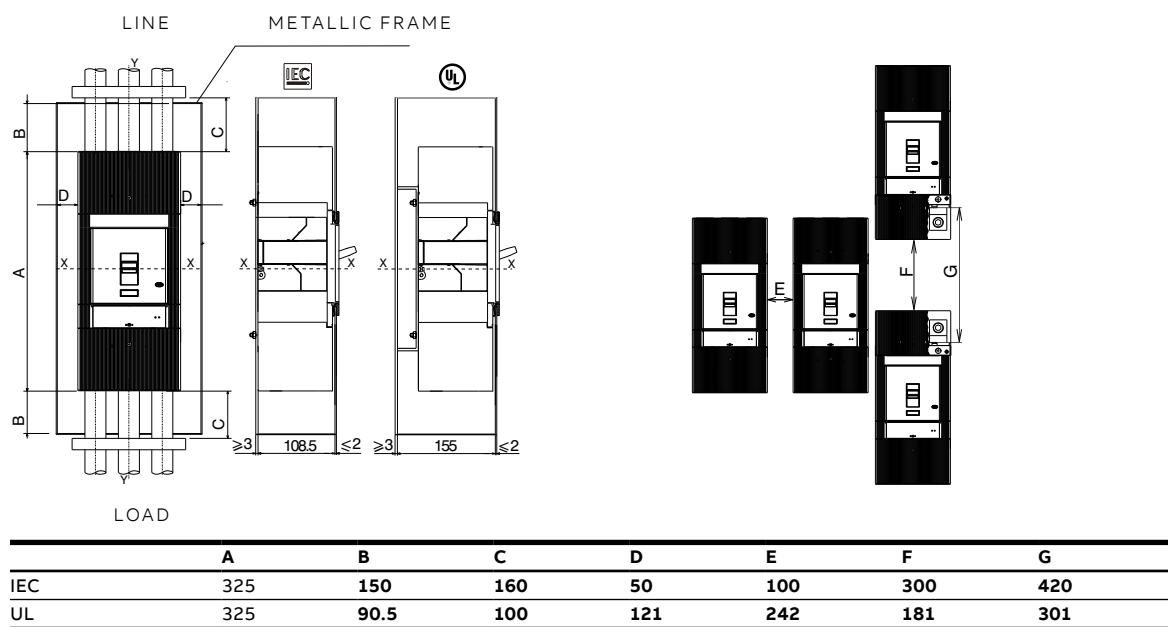
T4V-HA

$U_n \leq 800V AC$



T5V-HA

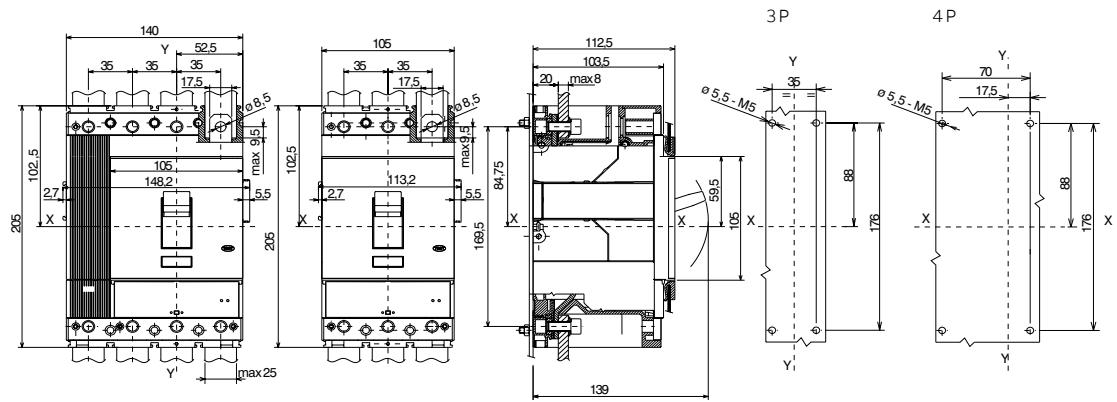
$U_n \leq 800V AC$



Dimensions

T4V-HA IEC/UL

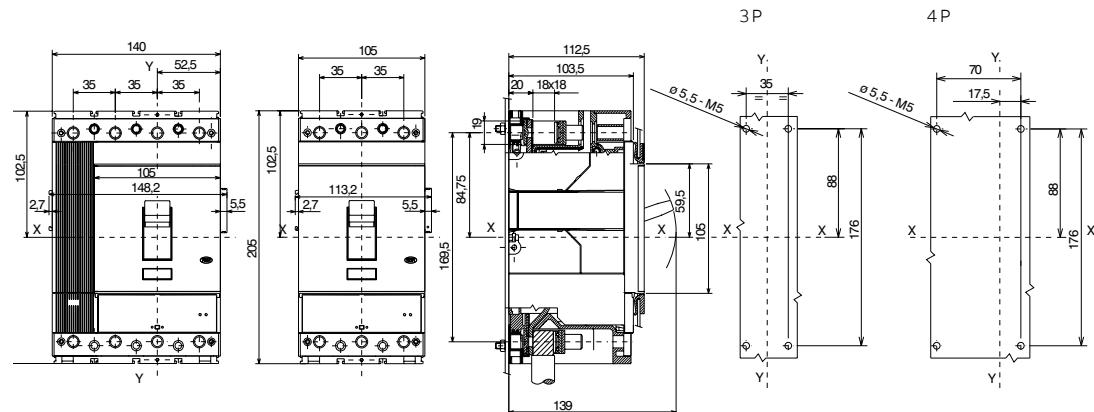
F



Installation instructions code 1SDH001607R0001 for other configurations and supply

T4V-HA IEC/UL

FC Cu

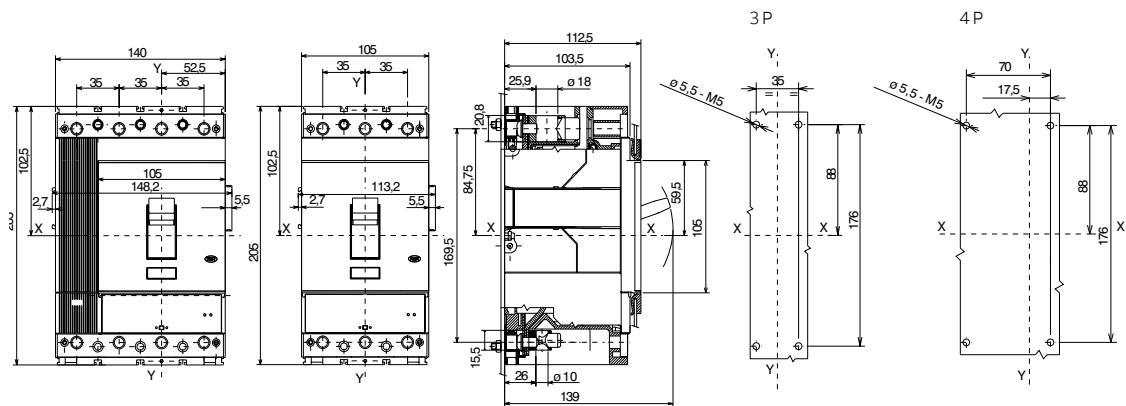


Installation instructions code 1SDH001608R0001 for other configurations and supply.

NOTE: High terminal covers are mandatory for top and bottom and are already included in the circuit breakers' ordering codes.

T4V-HA IEC/UL

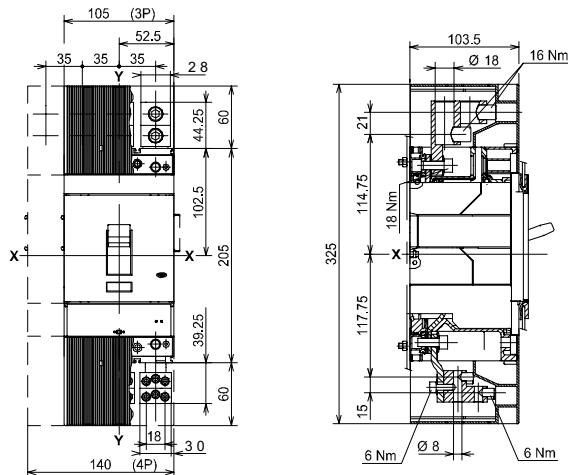
FC Cu Al



Installation instructions code 1SDH001607R0001 for other configurations and supply

T4V-HA IEC/UL

HIGH TERMINAL COVERS



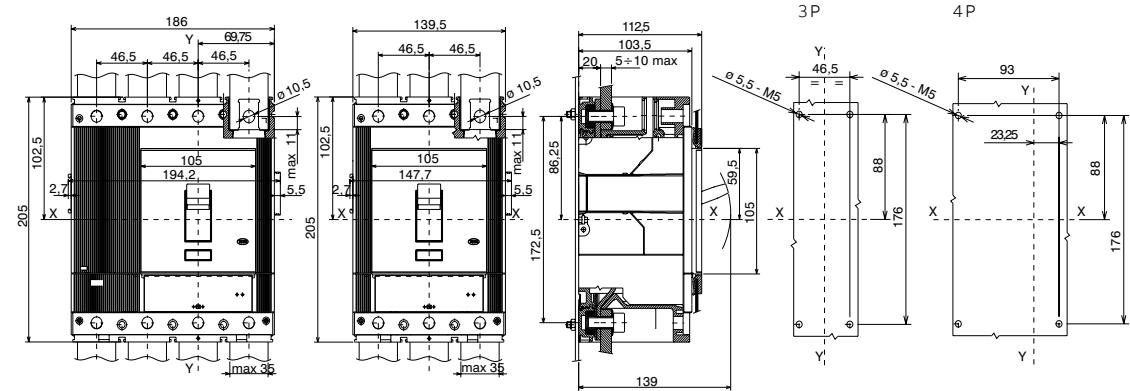
Installation instructions code 1SDH001607R0001 for other configurations and supply.

NOTE: High terminal covers are mandatory for top and bottom and are already included in the circuit breakers' ordering codes

Dimensions

T5V-HA IEC/UL

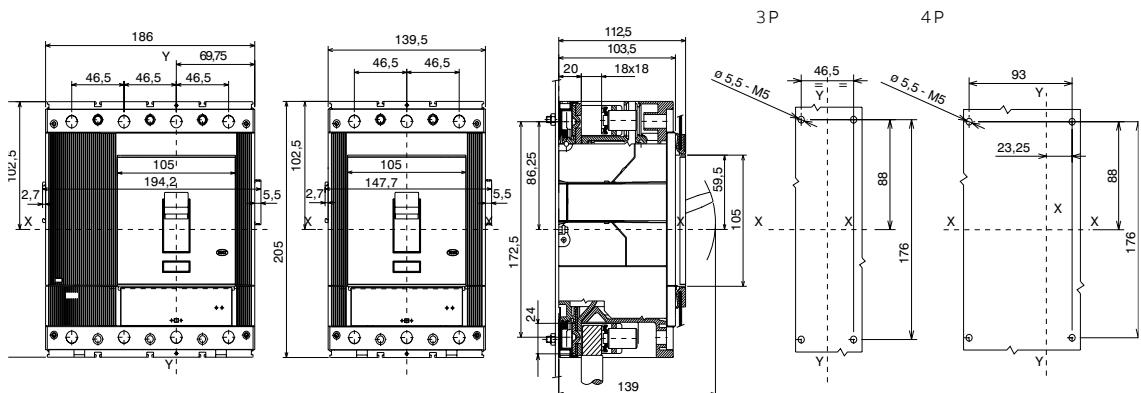
F



Installation instructions code 1SDH001607R0001 for other configurations and supply

T5V-HA IEC/UL

FC Cu

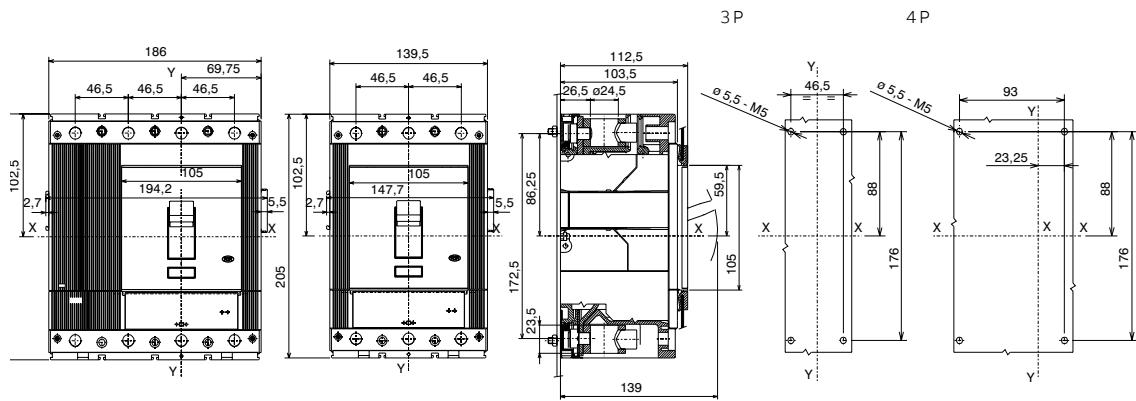


Installation instructions code 1SDH001608R0001 for other configurations and supply.

NOTE: High terminal covers are mandatory for top and bottom and are already included in the circuit breakers' ordering codes.

T5V-HA IEC/UL

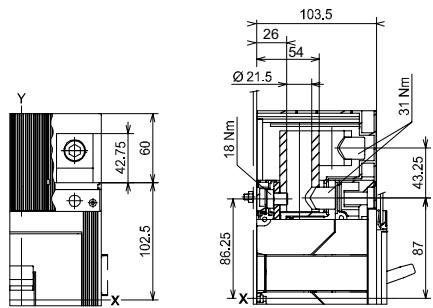
FC Cu Al



Installation instructions code 1SDH001607R0001 for other configurations and supply

T5V-HA IEC/UL

HIGH TERMINAL COVERS



Installation instructions code 1SDH001608R0001 for other configurations and supply.

NOTE: High terminal covers are mandatory for top and bottom and are already included in the circuit breakers' ordering codes.



CHAPTER 5

Ordering codes

- 58-59 UL range ordering codes**
- 60-61 800V AC IEC and UL ranges ordering codes**
- 62-62 U.S. to global ordering code cross reference**

UL range ordering codes

Thermal magnetic adjustable molded case circuit breakers, 1000 V DC

Frame size	Voltage	Current rating	Lugs	Jumper configuration	Ordering code
T4	1000 V DC	40A	Yes	2 + 1	T4PB040TL
T4	1000 V DC	40A	Yes	3	T4PA040TL
T4	1000 V DC	50A	Yes	2 + 1	T4PB050TL
T4	1000 V DC	50A	Yes	3	T4PA050TL
T4	1000 V DC	80A	Yes	2 + 1	T4PB080TL
T4	1000 V DC	80A	Yes	3	T4PA080TL
T4	1000 V DC	100A	Yes	2 + 1	T4PB100TL
T4	1000 V DC	100A	Yes	3	T4PA100TL
T4	1000 V DC	125A	Yes	2 + 1	T4PB125TL
T4	1000 V DC	125A	Yes	3	T4PA125TL
T4	1000 V DC	150A	Yes	2 + 1	T4PB150TL
T4	1000 V DC	150A	Yes	3	T4PA150TL
T4	1000 V DC	200A	Yes	2 + 1	T4PB200TL
T4	1000 V DC	200A	Yes	3	T4PA200TL
T5	1000 V DC	225A	Yes	2 + 1	T5PB225TL
T5	1000 V DC	225A	Yes	3	T5PA225TL
T5	1000 V DC	250A	Yes	2 + 1	T5PB250TL
T5	1000 V DC	250A	Yes	3	T5PA250TL
T5	1000 V DC	300A	Yes	2 + 1	T5PB300TL ¹
T5	1000 V DC	300A	Yes	3	T5PA300TL ¹
T5	1000 V DC	400A	Yes	2 + 1	T5PB400TL
T5	1000 V DC	400A	Yes	3	T5PA400TL
T5	1000 V DC	400A	No	3	T5PB400TW
T5	1000 V DC	400A	No	3	T5PA400TW
T6	1000 V DC	600A	Yes	2 + 2	T6PB600TL-4
T6	1000 V DC	600A	Yes	4	T6PA600TL-4
T6	1000 V DC	800A	No	2 + 2	T6PB800TW-4
T6	1000 V DC	800A	No	4	T6PA800TW-4

NOTE: All poles in series is for use in grounded systems, 2+1 or 2+2 configurations are for ungrounded systems.

¹ Consult factory for availability

Molded case switch (MCS), 1000 V DC

Frame size	Voltage	Current rating	Lugs	Jumper configuration	Ordering code
T1	1000 V DC	100A	Yes	2 + 2	T1PB100DL-4
T1	1000 V DC	100A	Yes	4	T1PA100DL-4
T4	1000 V DC	200A	Yes	2 + 1	T4PB200DL
T4	1000 V DC	200A	Yes	3	T4PA200DL
T5	1000 V DC	400A	Yes	2 + 1	T5PB400DL
T5	1000 V DC	400A	Yes	3	T5PA400DL
T5	1000 V DC	400A	No	2 + 1	T5PB400DW
T5	1000 V DC	400A	No	3	T5PA400DW
T6	1000 V DC	600A	Yes	2 + 2	T6PB600DL-4
T6	1000 V DC	600A	Yes	4	T6PA600DL-4
T6	1000 V DC	800A	No	2 + 2	T6PB800DW-4
T6	1000 V DC	800A	No	4	T6PA800DW-4
T7M	1000 V DC	1000A	Yes	2 + 2	T7MPB1000DL-4
T7M	1000 V DC	1000A	Yes	4	T7MPA1000DL-4

Molded case switch (MCS), 1500 V DC

Frame size	Voltage	Current rating	Lugs	Jumper configuration	Ordering code
T7M	1000 V DC	1000 A	Yes	4	T7MPA1000DL-4
T7M	1000 V DC	1000 A	Yes	2 + 2	T7MPB1000DL-4
T7M	1000 V DC	1000 A	No	4	T7MPA1000DW-4
T7M	1000 V DC	1000 A	No	2 + 2	T7MPB1000DW-4
T7M	1500 V DC	1000 A	Yes	4	T7MPVA1000DL-4
T7M	1500 V DC	1000 A	Yes	2 + 2	T7MPVB1000DL-4
T7M	1500 V DC	1000 A	No	4	T7MPVA1000DW-4
T7M	1500 V DC	1000 A	No	2 + 2	T7MPVB1000DW-4
T7M	1500 V DC	1200 A	Yes	4	T7MPVA1200DL-4
T7M	1500 V DC	1200 A	Yes	2 + 2	T7MPVB1200DL-4

800V AC IEC and UL ranges ordering codes

IEC range ordering codes

Frame size	Voltage	Current rating	Current range	Poles	Lugs	Trip type	Rated	Ordering code
T4	800 V AC	250 A	80 - 800 A	4 P	No	TMA	80%	T4P8VE080TW-4
T4	800 V AC	250 A	100 - 1000 A	4 P	No	TMA	80%	T4P8VE100TW-4
T4	800 V AC	250 A	125 - 1250 A	4 P	No	TMA	100%	T4P8VE125TW-4
T4	800 V AC	250 A	160 - 1600 A	4 P	No	TMA	100%	T4P8VE160TW-4
T4	800 V AC	250 A	200 - 2000 A	4 P	No	TMA	100%	T4P8VE200TW-4
T4	800 V AC	250 A	250 - 2500 A	4 P	No	TMA	100%	T4P8VE250TW-4
T5	800 V AC	400 A	320 - 3200 A	4 P	No	TMA	100%	T5P8VE320TW-4
T5	800 V AC	400 A	400 - 4000 A	4 P	No	TMA	100%	T5P8VE400TW-4
T5	800 V AC	630 A	500 - 5000 A	4 P	No	TMA	100%	T5P8VE500TW-4
T4	800 V AC	250 A	80 - 800 A	3 P	No	TMA	0,8	T4P8VE080TW
T4	800 V AC	250 A	100 - 1000 A	3 P	No	TMA	0,8	T4P8VE100TW
T4	800 V AC	250 A	125 - 1250 A	3 P	No	TMA	0,8	T4P8VE125TW
T4	800 V AC	250 A	160 - 1600 A	3 P	No	TMA	0,8	T4P8VE160TW
T4	800 V AC	250 A	200 - 2000 A	3 P	No	TMA	0,8	T4P8VE200TW
T4	800 V AC	250 A	250 - 2500 A	3 P	No	TMA	0,8	T4P8VE250TW
T5	800 V AC	400 A	320 - 3200 A	3 P	No	TMA	0,8	T5P8VE320TW
T5	800 V AC	400 A	400 - 4000 A	3 P	No	TMA	0,8	T5P8VE400TW
T5	800 V AC	630 A	500 - 5000 A	3 P	No	TMA	0,8	T5P8VE500TW
T5	800 V AC	630 A	630 A	3 P	No	PR221DS-LS/I 0,8		T5P8VE630BW
T5	800 V AC	630 A	630 A	4 P	No	PR221DS-LS/I 0,8		T5P8VE630BW-4

NOTE: High Terminal Covers are mandatory for top and bottom and already included in the circuit breakers ordering codes

UL range ordering codes

Frame size	Voltage	Current rating	Current range	Poles	Lugs	Trip type	Rated	Ordering code
T4	800 V AC	250 A	80 - 800 A	4 P	No	TMA	100%	T4P8VQ080TW-4
T4	800 V AC	250 A	100 - 1000 A	4 P	No	TMA	100%	T4P8VQ100TW-4
T4	800 V AC	250 A	125 - 1250 A	4 P	No	TMA	100%	T4P8VQ125TW-4
T4	800 V AC	250 A	150 - 1500 A	4 P	No	TMA	100%	T4P8VQ150TW-4
T4	800 V AC	250 A	200 - 2000 A	4 P	No	TMA	80%	T4P8VU200TW-4
T4	800 V AC	250 A	80 - 800 A	3 P	No	TMA	100%	T4P8VQ080TW
T4	800 V AC	250 A	100 - 1000 A	3 P	No	TMA	100%	T4P8VQ100TW
T4	800 V AC	250 A	125 - 1250 A	3 P	No	TMA	100%	T4P8VQ125TW
T4	800 V AC	250 A	150 - 1500 A	3 P	No	TMA	100%	T4P8VQ150TW
T4	800 V AC	250 A	200 - 2000 A	3 P	No	TMA	80%	T4P8VU200TW
T5	800 V AC	400 A	300 - 3000 A	3 P	No	TMA	100%	T5P8VQ300TW
T5	800 V AC	400 A	300 - 3000 A	4 P	No	TMA	100%	T5P8VQ300TW-4
T5	800 V AC	400 A	300 A	3 P	No	PR221DS-LS/I 100%		T5P8VQ300BW
T5	800 V AC	400 A	300 A	4 P	No	PR221DS-LS/I 100%		T5P8VQ300BW-4

NOTE: High Terminal Covers are mandatory for top and bottom and already included in the circuit breakers ordering codes

Terminal kits options Tmax PV - IEC/UL

Frame size	Cable material	Cable size	Pieces	
T4	FcCuAL	1 x 350 kcmil	3	KT4250-3
T4	FcCuAL	1 x 350 kcmil	4	KT4250-4
T5	FcCuAL	1 x 500 kcmil	3	KT5300-3
T5	FcCuAL	1 x 500 kcmil	4	KT5300-4
T4	FcCu	1 x 185 mm ²	3	KT4250S-3
T4	FcCu	1 x 185 mm ²	4	KT4250S-4
T4	FcCuAL	1 x 185 mm ²	3	KT4250-3
T4	FcCuAL	1 x 240 mm ²	4	KT4250-4
T5	FcCu	1 x 240 mm ²	3	KT5300S-3
T5	FcCu	1 x 240 mm ²	4	KT5300S-4
T5	FcCuAL	1 x 240 mm ²	3	KT5300-3
T5	FcCuAL	1 x 240 mm ²	4	KT5300-4

All Tmax PV devices can be accessorized with Tmax T series accessories, except for the following:

Frame size	Exception
T1D PV	Interlocks, KLC, PLL
T3D PV	Interlocks, KLC, PLL
T4D PV	Interlocks
T5D PV	Interlocks
T6D PV	Interlocks
T7D PV	Interlocks
T7D PV M	Interlocks

Accessories part number, wirings and data can be found in the Tmax T UL489 1SDC210023D0201 technical catalog.

U.S. to global ordering code cross reference

US Ordering Code	Global breaker code	Breaker description	Global jumper code	Jumper description
T4PB040TL	1SDA070461R1	T4N/PV 200 UL TMD 40 3p FF 1000V DC	1SDA070483R1	Kit 1 jumper 2+1PS T4N/PV-B 100A UL 3p
T4PA040TL	1SDA070461R1	T4N/PV 200 UL TMD 40 3p FF 1000V DC	1SDA070485R1	Kit 2 jumper 3PS T4N/PV-A 100A UL 3p
T4PB050TL	1SDA070462R1	T4N/PV 200 UL TMD 50 3p FF 1000V DC	1SDA070483R1	Kit 1 jumper 2+1PS T4N/PV-B 100A UL 3p
T4PA050TL	1SDA070462R1	T4N/PV 200 UL TMD 50 3p FF 1000V DC	1SDA070485R1	Kit 2 jumper 3PS T4N/PV-A 100A UL 3p
T4PB080TL	1SDA070463R1	T4N/PV 200 UL TMA 80-800 3p FF 1000V DC	1SDA070483R1	Kit 1 jumper 2+1PS T4N/PV-B 100A UL 3p
T4PA080TL	1SDA070463R1	T4N/PV 200 UL TMA 80-800 3p FF 1000V DC	1SDA070485R1	Kit 2 jumper 3PS T4N/PV-A 100A UL 3p
T4PB100TL	1SDA070467R1	T4N/PV 200 UL TMA 100-1000 3p FF 1000V DC	1SDA070483R1	Kit 1 jumper 2+1PS T4N/PV-B 100A UL 3p
T4PA100TL	1SDA070467R1	T4N/PV 200 UL TMA 100-1000 3p FF 1000V DC	1SDA070485R1	Kit 2 jumper 3PS T4N/PV-A 100A UL 3p
T4PB125TL	1SDA070468R1	T4N/PV 200 UL TMA 125-1250 3p FF 1000V DC	1SDA070484R1	Kit 1 jumper 2+1PS T4 PV-B 200A UL 3p
T4PA125TL	1SDA070468R1	T4N/PV 200 UL TMA 125-1250 3p FF 1000V DC	1SDA070486R1	Kit 2 jumper 3PS T4 PV-A 200A UL 3p
T4PB150TL	1SDA070469R1	T4N/PV 200 UL TMA 150-1500 3p FF 1000V DC	1SDA070484R1	Kit 1 jumper 2+1PS T4 PV-B 200A UL 3p
T4PA150TL	1SDA070469R1	T4N/PV 200 UL TMA 150-1500 3p FF 1000V DC	1SDA070486R1	Kit 2 jumper 3PS T4 PV-A 200A UL 3p
T4PB200TL	1SDA070470R1	T4N/PV 200 UL TMA 200-2000 3p FF 1000V DC	1SDA070484R1	Kit 1 jumper 2+1PS T4 PV-B 200A UL 3p
T4PA200TL	1SDA070470R1	T4N/PV 200 UL TMA 200-2000 3p FF 1000V DC	1SDA070486R1	Kit 2 jumper 3PS T4 PV-A 200A UL 3p
T5PB400TL	1SDA070472R1	T5N/PV 400 UL TMA 400-4000 3p FF 1000V DC	1SDA070487R1	Kit 1 jumper 2+1PS T5 PV-B 400 UL 3p cables
T5PA400TL	1SDA070472R1	T5N/PV 400 UL TMA 400-4000 3p FF 1000V DC	1SDA070488R1	Kit 2 jumper 3PS T5 PV-A 400 UL 3p cables
T5PB400TW	1SDA070472R1	T5N/PV 400 UL TMA 400-4000 3p FF 1000V DC	1SDA074504R1	Kit 1 jumper 2+1PS T5 PV-B 400 UL 3p busbars
T5PA400TW	1SDA070472R1	T5N/PV 400 UL TMA 400-4000 3p FF 1000V DC	1SDA074505R1	Kit 2 jumper 3PS T5 PV-A 400 UL 3p busbars
T6PB600TL-4	1SDA070495R1	T6N/PV 800 UL TMA 600-6000 4p FF 1000V DC	1SDA070499R1	Kit 2 jumper 2+2PS T6 PV-B 600 UL 4p
T6PA600TL-4	1SDA070495R1	T6N/PV 800 UL TMA 600-6000 4p FF 1000V DC	1SDA070500R1	Kit 3 jumper 4PS T6 PV-A 600 UL 4p
T6PB800TW-4	1SDA070496R1	T6N/PV 800 UL TMA 800-8000 4p FF 1000V DC	1SDA070501R1	Kit 2 jumper 2+2PS T6 PV-B 800 UL 4p
T6PA800TW-4	1SDA070496R1	T6N/PV 800 UL TMA 800-8000 4p FF 1000V DC	1SDA070502R1	Kit 3 jumper 4PS T6 PV-A 800 UL 4p

Breaker codes	Description
1SDA070448R1	T7N-D/PV 1000 MCS UL 4p F F M 1000V DC
1SDA082657R1	T7N-D/PV-E 1000 MCS UL 4p F F M 1500V DC
1SDA082915R1	T7N-D/PV-E 1200 MCS UL 4p F F M 1500V DC

Jumper kits	Description	Jumper Configuration	Amperage	Lug
1SDA070452R1	KIT 3JUMPER U 4PS T7N-D/PV UL FCCuAI	4 poles in series	1000	4 X 500kcmil CUAL
1SDA070451R1	KIT 2JUMPER 2+2PS T7N-D/PV UL FCCuAI	2 poles plus 2 poles	1000	4 X 500kcmil CUAL
1SDA081763R1	KIT 3JUMPER U 4PS T7N-D/PV1000 UL Term.F	4 poles in series	1000	Front terminal only
1SDA081762R1	KIT 2JUMPER 2+2PS T7N-D/PV1000 UL Term.F	2 poles plus 2 poles	1000	Front terminal only
1SDA083039R1	KIT 3JUMPER U 4PS T7N-D/PV1200 UL Term.F	4 poles in series	1200	Extended Front Terminal
1SDA083038R1	KIT 2JUMPER 2+2PS T7N-D/PV1200 UL Term.F	2 poles plus 2 poles	1200	Extended Front Terminal

Combined code	Description	Global ordering code	Jumper global ordering code
T7MPA1000DL-4	T7PV 1000 MCS UL 4p M 1000VDC 4PS	1SDA070448R1	1SDA070452R1
T7MPB1000DL-4	T7PV 1000 MCS UL 4p M 1000VDC 2+2	1SDA070448R1	1SDA070451R1
T7MPA1000DW-4	T7PV 1000 MCS UL 4p M 1000VDC 4PS	1SDA070448R1	1SDA081763R1
T7MPB1000DW-4	T7PV 1000 MCS UL 4p M 1000VDC 2+2	1SDA070448R1	1SDA081762R1
T7MPVA1000DL-4	T7MPVE 1000 MCS UL 4p 1500VDC 4PS	1SDA082657R1	1SDA070452R1
T7MPVB1000DL-4	T7MPVE 1000 MCS UL 4P 1500VDC 2+2	1SDA082657R1	1SDA070451R1
T7MPVA1000DW-4	T7MPVE 1000 MCS UL 4p 1500VDC 4PS	1SDA082657R1	1SDA081763R1
T7MPVB1000DW-4	T7MPVE 1000 MCS UL 4P 1500VDC 2+2	1SDA082657R1	1SDA081762R1
T7MPVA1200DL-4	T7MPVE 1200 MCS UL 4p 1500VDC 4PS	1SDA082915R1	1SDA083039R1
T7MPVB1200DL-4	T7MPVE 1200 MCS UL 4P 1500VDC 2+2	1SDA082915R1	1SDA083038R1



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