



Selection & reference guide

Solutions for photovoltaic applications

Low voltage breakers & switches

Power and productivity
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Photovoltaics

A growing focus on environmental protection, the need for increasingly efficient use of energy resources and an increasing awareness that fossil sources are by definition “finite”, are all directing large investments into sources of renewable energy.

Renewable energy sources have assumed a key role in the future of energy policy. Many governments, locally and globally, have taken an aggressive, long term stance that places increasing importance on “clean energies”. Specifically, in the United States, a trend toward solar generated power is emerging as a series of government incentive programs specific to this renewable energy form for residential and commercial applications is being released.

Transforming solar energy into electrical energy

Photovoltaic arrays can be installed virtually anywhere; on the ground, on flat or pitched roofs or attached to the sides of buildings. The energy is produced without any moving parts and is completely free of combustion or gas emissions, limiting environmental impact.

In recent years, even the rosiest growth forecasts for the photovoltaic market have proven to be well below the mark. This impressive growth is due largely to implementation of regional and national incentive and rebate plans.



In every application a single solution: ABB

ABB specializes in electrical engineering, automation and control. Extensive expertise is crucial for creating integrated solutions that continue to improve. ABB offers solutions in the photovoltaic market for every type of application from small integrated systems to large solar farms.

As a manufacturer and supplier, ABB has always chosen to offer products and solutions that aim to reduce environmental impact. ABB has focused its research into developing efficient and sustainable systems for the generation, transmission, distribution and use of electricity.

Thanks to its long standing experience in automation products, ABB consistently seeks new ways to expand and improve the technologies available, anticipating the needs of its customer base.

ABB has positioned itself as a key supplier for OEMs, installers and system integrators, offering a package of isolation and circuit protection products that can support development in the constantly evolving photovoltaic market. For photovoltaic plants, ABB provides a broad, complete and technologically cutting edge range of products to satisfy the spectrum of PV applications: from small residential installations, to medium-sized residential and commercial rooftop systems to large photovoltaic power stations/solar farms.

ABB's circuit protection and isolation offering specific for the photovoltaic market will be highlighted in this document.

ABB, a partner and supplier for OEMs, installers and system integrators

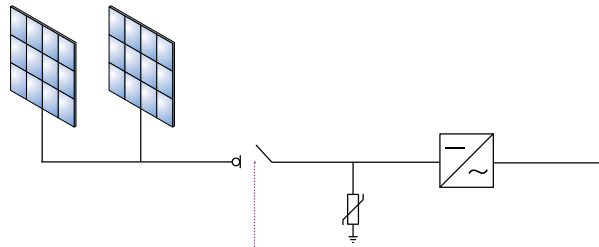
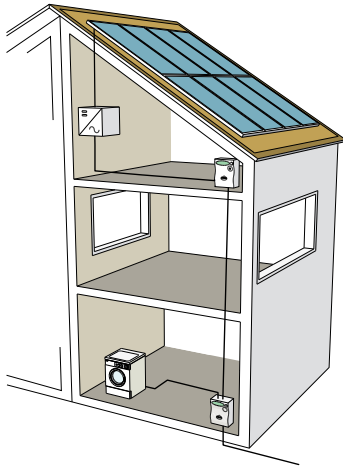
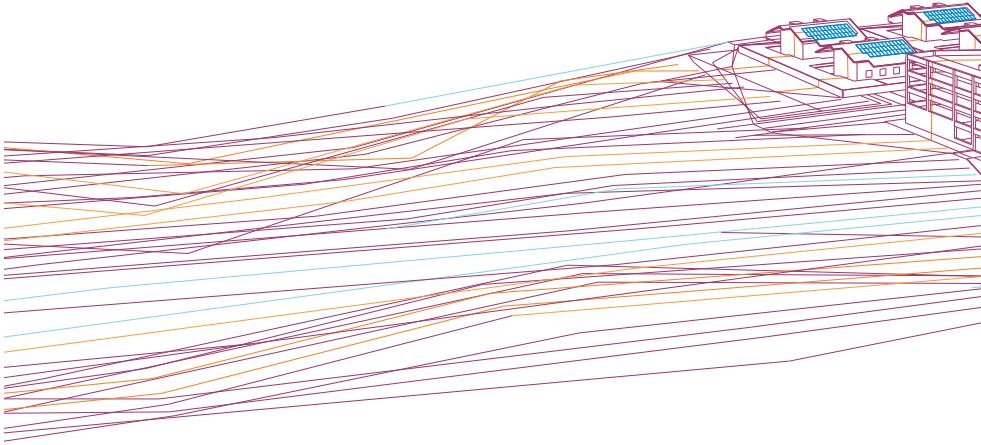
Thanks to its wide range of circuit protection and disconnect products and technologies, ABB is able to offer the best solutions to manufacturers of drives, combiner boxes and inverters to optimize investments and maximize results in terms of quality, cost reduction and operating efficiency. ABB is without doubt an ideal partner in the field with its widespread international presence and global market expertise.

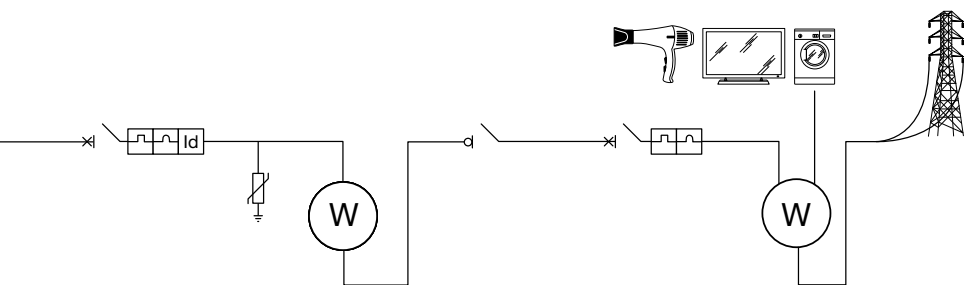
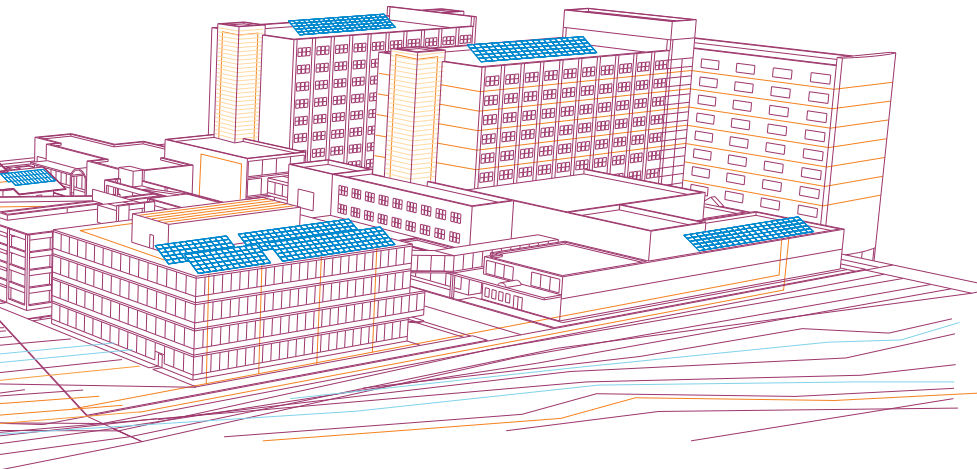
For photovoltaic applications, ABB has developed a comprehensive portfolio of components available for circuit protection and isolation. Along side its range for low voltage alternating current (AC), where ABB has always been a market leader, the company has also developed a wide range of components for direct current (DC) applications.



Small systems for residential & commercial applications

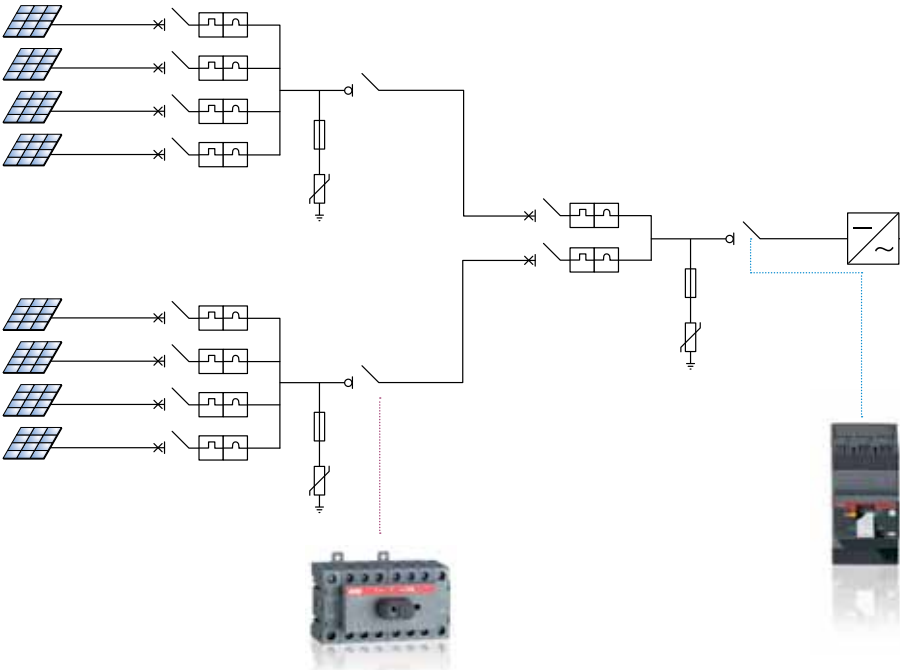
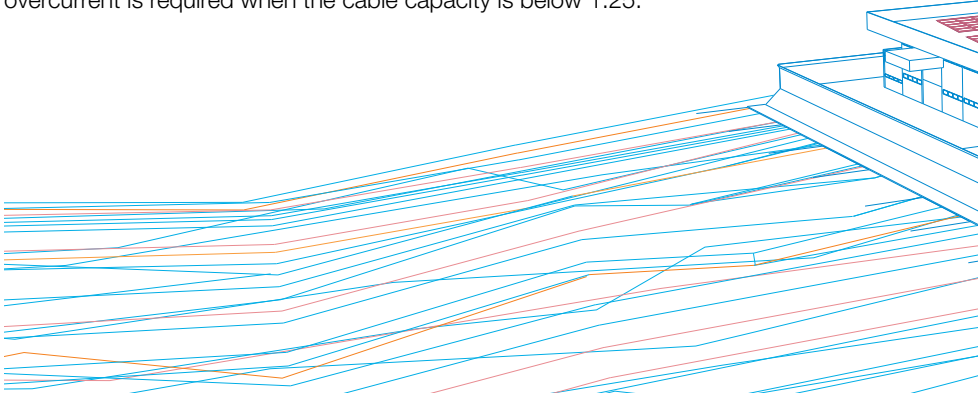
Smaller PV systems are characterized by a limited number of strings. In this type of system, the short circuit current value on the direct current (DC) side is almost always limited, so overcurrent protection is not typically required.

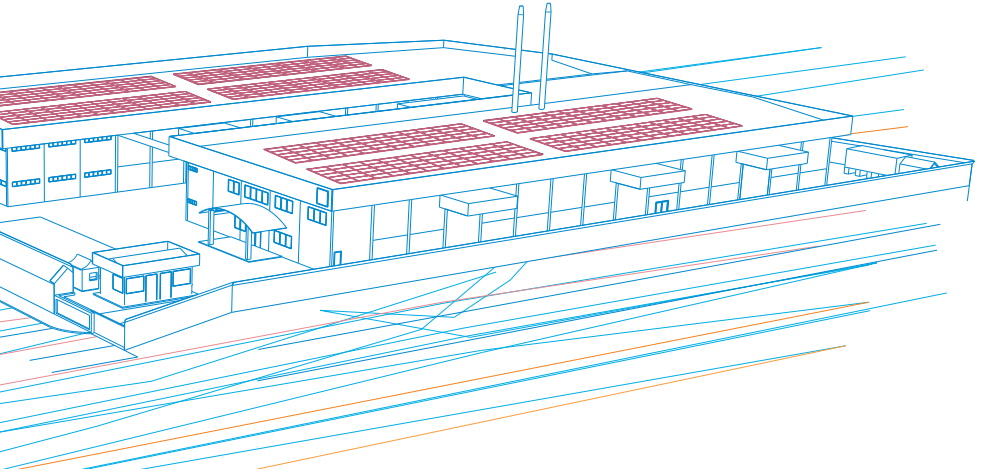




Medium-size systems for the service sector & industry

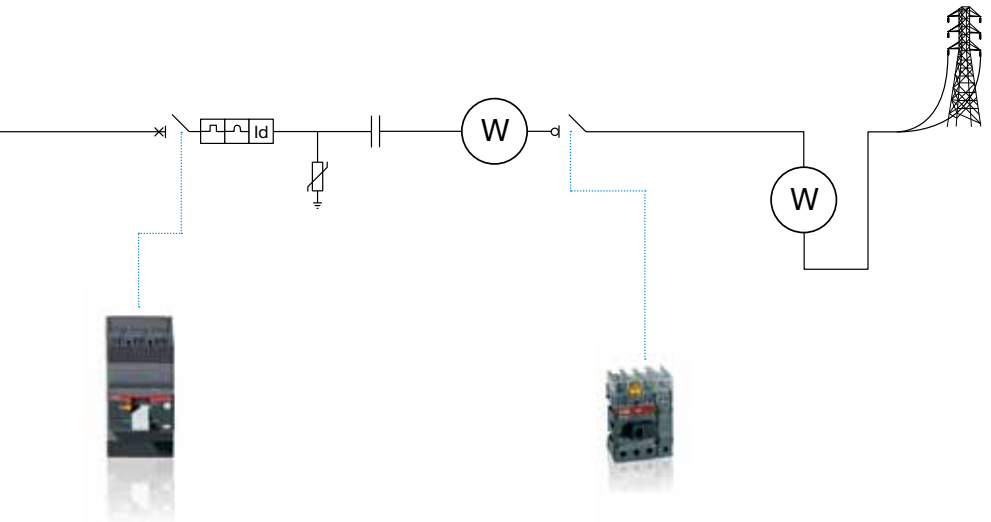
Depending on the designer's choices, these plants can be built using a single central inverter or plant power can be divided over multiple inverters. Protection against overcurrent is required when the cable capacity is below 1.25.





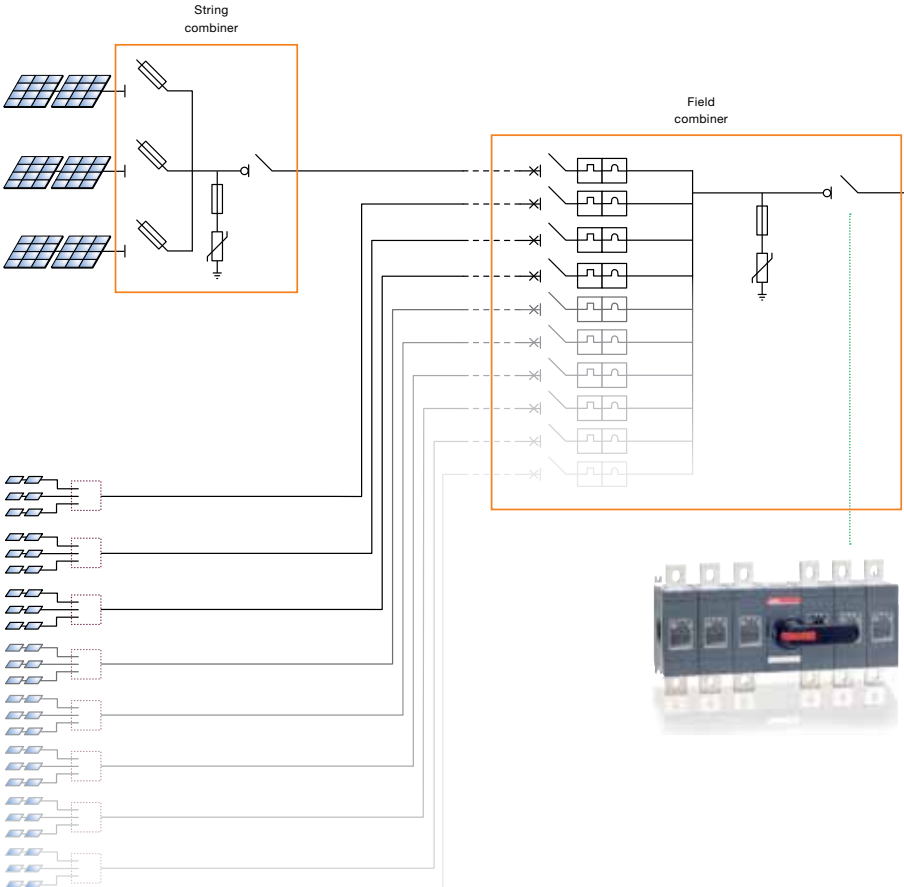
Photovoltaic plants generate direct current electrical energy. The energy produced is either made available to users or fed back to the grid as alternating current.

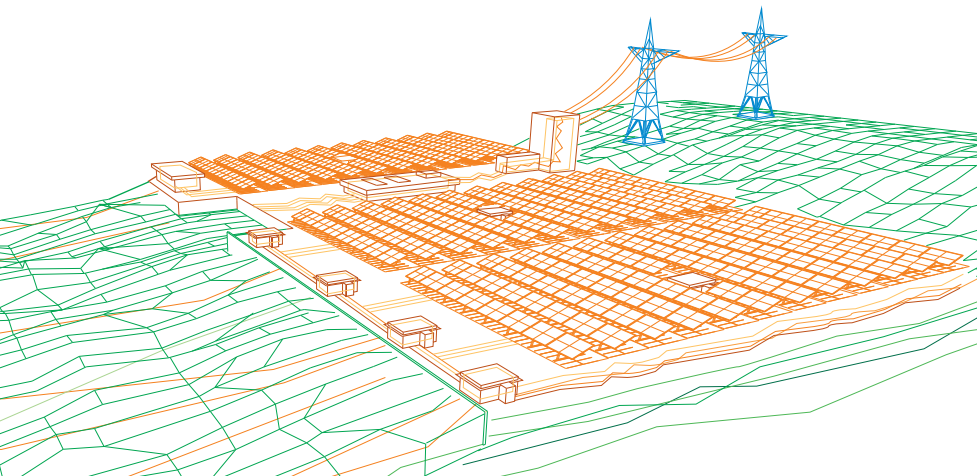
The machine that converts the energy is the DC/AC static converter, commonly known as an inverter. One of the main characteristics of inverters for solar power plants connected to the grid is that they have an electronic device that can optimize the energy delivered to the grid under all solar radiation conditions. Depending on the model, the inverter can be equipped with the same protective, control and disconnect devices required for the rest of the plant.



Large systems for solar farms

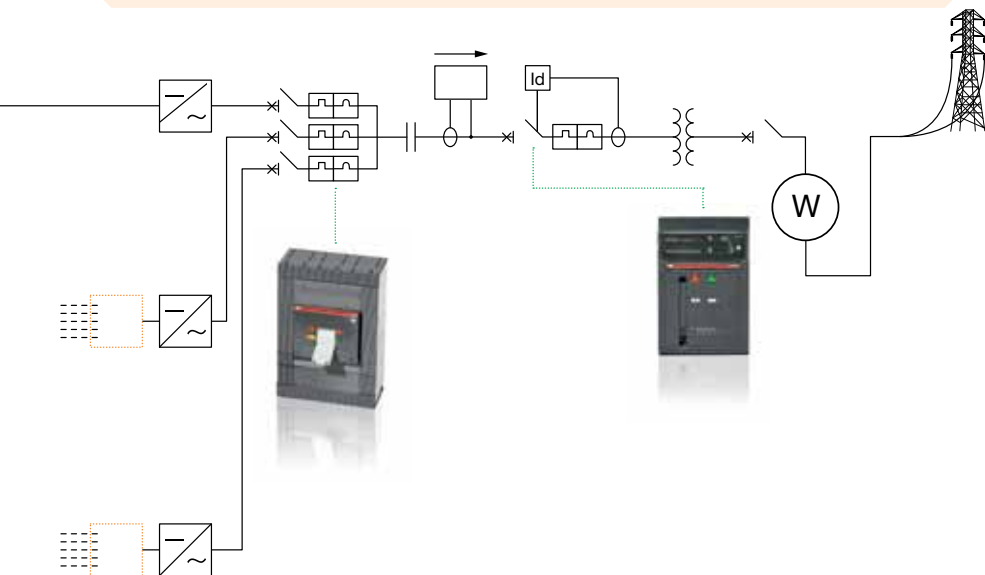
The distinguishing engineering feature of solar power stations is that they consist of a large number of installed modules connected to high-power inverters. Given the high value of the installation, electrical protection for the module and inverter strings is organized on multiple levels. Field combiner boxes are installed near the strings; containing overcurrent protection for the individual strings; line surge protection and a general rotary disconnect switch/breaker for the combiner box/switchboard.





In a typical photovoltaic installation the direct current section includes the field made of up strings of PV panels downstream of which isolation and/or protection and/or isolation may be provided through use of a circuit breaker, molded case switch, disconnect switch and coordinating trailing fuse.

Combiner boxes are utilized for consolidating multiple field strings of DC energy for input into inverters.



Large systems for solar farms

Isolation and protection

Circuit breakers



ABB's circuit breakers provide protection at any level of solar installation from combiner boxes to AC and DC inverters and main panels. With excellent ratings for both AC and DC applications, ABB circuit breakers provide a compact, high performance solution. ABB also offers a full line of UL 489, UL 1066 and IEC switches that can be fitted with accessories such as shunt trips for applications where overload protection is not needed.

Breaker photovoltaic range — AC/DC

Frame	Amperage range A	UL interrupting capacity at 480V kA	Poles	VAC (UL/IEC)	VDC (UL/IEC)	Standards rating
T1	15 - 100	22	1, 3, 4	600Y/347V / 500V	0 / 1100 ⊕	UL, IEC
T2	15 - 100	35, 65	3, 4	480 / 500	0 / 500	UL, IEC
T3	60 - 225	25, 35	3, 4	600Y/347V / 500V	0 / 500 / 1100 ⊕	UL, IEC
Ts3	15 - 150	25, 50, 65, 85	2, 3, 4	600 / 690	600 / 750	UL, IEC
T4	125 - 250	25, 35, 65, 100, 150	2, 3, 4	600 / 690	600 / 750 / 1100 ⊕	UL, IEC
T5	300 - 600	25, 35, 65, 100, 150	2, 3, 4	600 / 690	600 / 750 / 1100 ⊕	UL, IEC
T6	600 - 800	35, 50, 65, 100	3, 4	600 / 690	600 / 750 / 1100 ⊕	UL, IEC
T7	1000 - 1200	50, 65, 100	3, 4	600 / 690	0 / 0 / 1100 ⊕	UL, IEC
T8	1600 - 3000	100	3, 4	600 / 690	—	UL, IEC
E1	800 - 1200	42, 50	3, 4	600 / 690	1000	UL, IEC (DC only IEC)
E2	800 - 1600	42, 50, 65, 85	3, 4	600 / 690	1000	UL, IEC (DC only IEC)
E3	800 - 3200	50, 65, 85, 125, 200	3, 4	600 / 690	1000	UL, IEC (DC only IEC)
E4	3200 - 3600	65, 85, 100, 125	3, 4	600 / 690	1000	UL, IEC (DC only IEC)
E6	4000 - 5000	85, 125, 150, 200	3, 4	600 / 690	1000	UL, IEC (DC only IEC)

⊕ Molded case switch

Disconnect switches



OT Non-fusible disconnects

Disconnect switches are typically used in isolating individual strings of PV arrays and battery banks or as the main switch for the PV system, AC and DC. ABB's solar switches are compact, have exceptional DC voltage ratings and are available in both open and enclosed configurations.

This offering includes DC rated switches 16-630 A IEC and 28-400 A UL. For the AC side of solar circuits, ABB's standard UL fusible and non-fusible OS/OT disconnects provide a perfect solution.

DC Photovoltaic range — Open style

	Part Number	No. of poles	Standards rating	Amps	DC voltage	Physical characteristics		
						H	W	D
UL 250 VDC	OT200U02	2	UL 98	200	250	4.44	4.13	3.28
	OT400U02	2	UL 98	400	250	5.85	5.46	4.17
	OT600U02	2	UL 98	600	250	7.8	7.68	5.51
UL 600 VDC	OT40FD9N2	9	UL 508	28	600	2.36	4.29	2.65
	OT80FD8	8	UL 508	55	600	3.25	5.52	3.34
	OT100FD8	8	UL 508	75	600	3.54	7.6	3.38
	OT200U04	4	UL 98	100	600	4.44	6.86	3.28
	OT400U04	4	UL 98	200	600	5.85	8.89	4.17
IEC	OT25F8	8	IEC	25	750	2.36	3.74	2.65
	OT40F8	8	IEC	32	750	2.36	3.74	2.65
	OT16FF8	8	IEC	16	800	2.36	3.74	2.65
	OT200E23	5	IEC	200	800	4.76	8.6	3.28
	OT250E23	5	IEC	250	800	4.76	8.6	3.28
	OT315E23	5	IEC	315	800	5.85	11.08	4.17
	OT400E23	5	IEC	400	800	5.85	11.08	4.17
	OT630E23	5	IEC	600	800	7.8	15.59	5.51
	OT200E33	6	IEC	200	1000	4.76	9.96	3.28
	OT250E33	6	IEC	250	1000	4.76	9.96	3.28
	OT315E33	6	IEC	315	1000	5.85	12.79	4.17
	OT400E33	6	IEC	400	1000	5.85	12.79	4.17
	OT630E33	6	IEC	630	1000	7.8	18.15	5.51

Basic photovoltaic applications

Breaker & switch selection table

The following tables are not all inclusive and do not necessarily represent all PV application requirements. These tables should only be used for basic reference for the most common applications of ABB Breaker & Switch products. For assistance in selecting product for your specific application, contact our technical support team.

String disconnects / field combiner

Type	Product	Interrupting rating kA	Number of poles	Voltage DC	Amperage A	Standard
Disconnect	OT40FD9N2	-	8+1	600	28	cULus, IEC
Disconnect	OT80FD8	-	8	600	55	cULus, IEC
Disconnect	OT100FD8	-	8	600	75	cULus, IEC
Disconnect	OT200U04	-	4	600	100	cULus, IEC

Combiner box

Type	Product	Interrupting rating kA	Number of poles	Voltage DC	Amperage A	Standard
Disconnect	OT200E33	-	6	1000	200	IEC
Disconnect	OT400U04	-	4	600	200	cULus, IEC
Disconnect	OT250E33	-	6	1000	250	IEC
Disconnect	OT315E33	-	6	1000	315	IEC
MCCB	Ts3 frame	25, 50, 65, 80	2,3,4	600	15-150	UL
MCCB	T4 frame	25, 35, 65, 100, 150	2,3,4	600	125-250	UL, IEC

Inverter DC side

Type	Product	Interrupting rating kA	Number of poles	Voltage DC	Amperage A	Standard
Disconnect	OT200E33	-	6	1000	200	IEC
Disconnect	OT400U04	-	4	600	200	cULus, IEC
Disconnect	OT250E33	-	6	1000	250	IEC
Disconnect	OT315E33	-	6	1000	315	IEC
Disconnect	OT400E33	-	6	1000	400	IEC
Disconnect	OT630E33	-	6	1000	600	IEC
MCS	1SDA066881R1	-	4	1100	160	IEC
MCS	1SDA066882R1	-	4	1100	200	IEC
MCCB	Ts3H150DW	50	3	600	150	UL
MCCB	Ts3H225DW	50	3	600	225	UL
MCS	1SDA066883R1	-	4	1100	250	IEC
MCCB	T4N250DW	25	3	600	250	UL, IEC
MCCB	T4H250DW	65	3	600	250	UL, IEC
MCCB	T4V250DW	150	3	600	250	UL, IEC
MCS	1SDA066884R1	-	4	1100	500	IEC
MCCB	T5N400DW	25	3	600	400	UL, IEC
MCCB	T5H400DW	65	3	600	400	UL, IEC
MCCB	T5V400DW	150	3	600	400	UL, IEC
MCCB	T5N600DW	25	3	600	600	UL, IEC
MCCB	T5H600DW	65	3	600	600	UL, IEC
MCCB	T5V600DW	150	3	600	600	UL, IEC
MCS	1SDA066885R1	-	4	1100	800	IEC
MCCB	T6H800DW	65	3	600	800	UL, IEC
MCS	1SDA066886R1	-	4	1100	1600	IEC
MCS	1SDA066887R1	-	4	1100	1600	IEC

For the purpose of the charts on pages 14 & 15, the product type terminology is defined as follows:

Disconnect = Non-fusible, open style disconnect switch (OT range)

Fusible Sw = Fusible, open style disconnect switch (OS range)

MCS = Molded Case Switch (Tmax range)

MCCB = Molded Case Circuit Breaker (Tmax range)

PCB = Power Circuit Breaker (Emax range)

Ⓜ Molded case switch

Inverter AC side

Type	Product	Interrupting rating kA	Number of poles	Voltage V	Amperage A	Standard
Disconnect	OT200U03	-	3	600	200	cULus, IEC
Disconnect	OT400U03	-	3	600	400	cULus, IEC
Disconnect	OT600U03	-	3	600	600	cULus, IEC
Disconnect	OT800U03	-	3	600	800	cULus, IEC
MCCB	T1N100DL	50	3	240	100	UL, IEC
MCCB	T3S150DW	65	3	240	150	UL, IEC
MCCB	T3S225DW	35	3	480	225	UL, IEC
MCCB	Ts3H150DW	50	3	600	150	UL, IEC
MCCB	Ts3H225DW	50	3	600	225	UL, IEC
MCCB	T4N250DW	25	3	600	250	UL, IEC
MCCB	T4H250DW	65	3	600	250	UL, IEC
MCCB	T4V250DW	150	3	600	250	UL, IEC
MCCB	T5N400DW	25	3	600	400	UL, IEC
MCCB	T5H400DW	65	3	600	400	UL, IEC
MCCB	T5V400DW	150	3	600	400	UL, IEC
MCCB	T5N600DW	25	3	600	600	UL, IEC
MCCB	T5H600DW	65	3	600	600	UL, IEC
MCCB	T5V600DW	150	3	600	600	UL, IEC
MCCB	T6H800DW	65	3	600	800	UL, IEC
MCCB	T7H1200DW	-	3	600	1200	UL, IEC

Main panel (AC)

Type	Product	Interrupting rating kA	Number of poles	Voltage V	Amperage A	Standard
MCCB	T3 frame	25, 35	3,4	600 Y	60-225	UL, IEC
MCCB	T4 frame	25, 35, 65, 100, 150	2,3,4	600	100-250	UL, IEC
MCCB	T5 frame	25, 35, 65, 100, 150	2,3,4	600	300-600	UL, IEC
MCCB	T6 frame	25, 35, 65, 100	3,4	600	600-800	UL, IEC
MCCB	T7 frame	35, 50, 65, 100	3,4	600	1000-1200	UL, IEC
MCCB	T8 frame	125	3,4	600	1600-3000	UL, IEC
PCB	E1 frame	42, 50	3,4	600 AC, 1000 DC	800-1200	UL, IEC
PCB	E2 frame	42, 50, 65, 85	3,4	600 AC, 1000 DC	800-1600	UL, IEC
PCB	E3 frame	50, 65, 85, 125, 200	3,4	600 AC, 1000 DC	800-3200	UL, IEC
PCB	E4 frame	65, 85, 100, 125	3,4	600 AC, 1000 DC	3200-3600	UL, IEC
PCB	E6 frame	85, 125, 150, 200	3,4	600 AC, 1000 DC	4000-5000	UL, IEC
Fusible Sw	OS200J03	200 (class J)	3	600 AC	200	cULus, IEC
Fusible Sw	OS400J03	200 (class J)	3	600 AC	400	cULus, IEC
Fusible Sw	OS600J03	200 (class J)	3	600 AC	600	cULus, IEC
Fusible Sw	OS800L03	200 (class L)	3	600 AC	800	cULus, IEC

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1SXU001208B0201 December, 2009

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