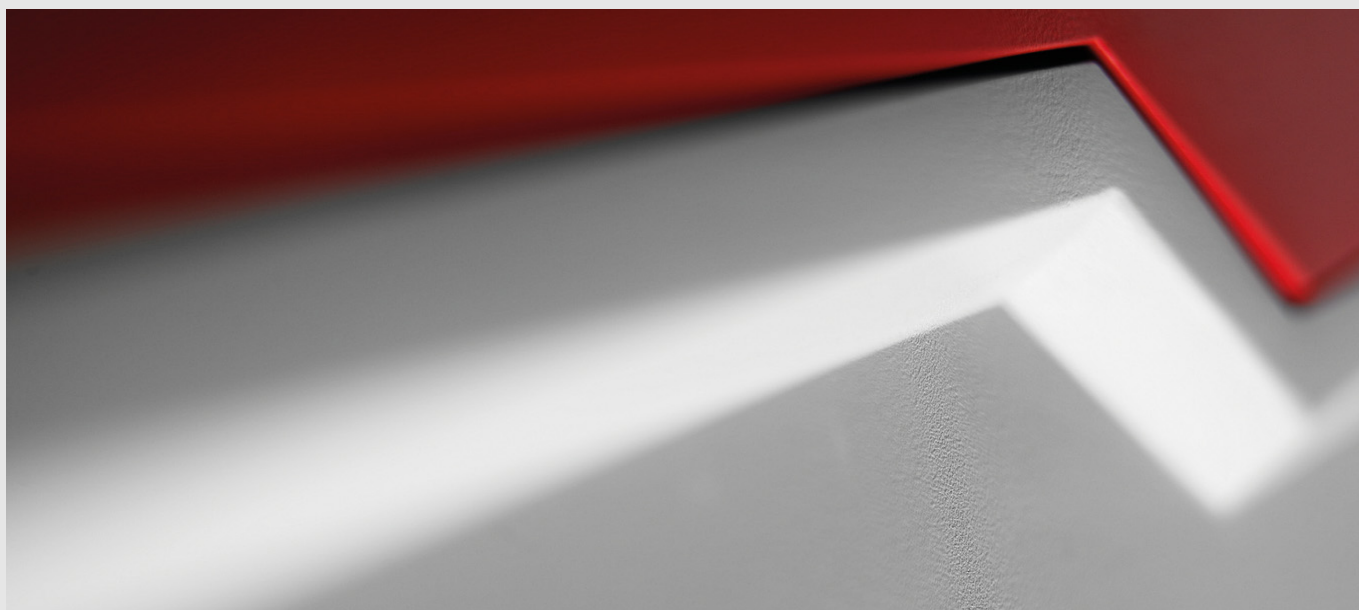


# Medium-voltage Transformers

Important requirements for medium-voltage transformers for

**SUNNY BOY, SUNNY MINI CENTRAL and SUNNY TRIPOWER**



## Contents

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This document describes the requirements of medium-voltage transformers which are connected to the SMA inverters:

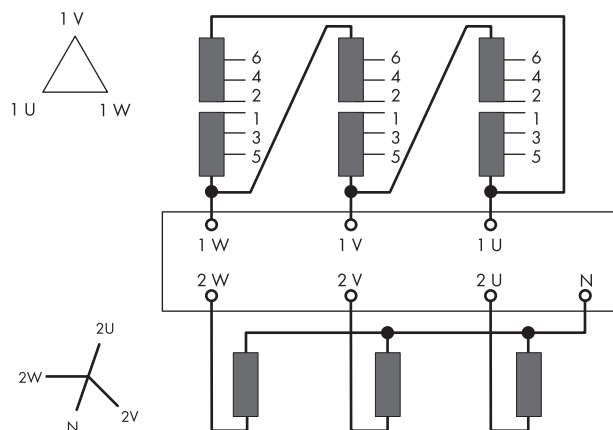
SMA Solar Technology AG only provides statutory warranty for transformers purchased from SMA Solar Technology AG.

# 1 General Technical Properties

The transformers used must comply with the following technical specifications:

- The transformer for the inverter can be a distribution transformer, however it must be designed for the typical cyclical loads of a PV system (load in the day and possibly no load at night).
- The transformer can be of the liquid-immersed type (e.g., with mineral oil or bio-degradable oil) or dry type.
- The transformer can be an autotransformer.
- Connection to the low-voltage grid, medium-voltage grid or high-voltage grid is permissible. The voltage level on the high-voltage side of the transformer must be selected according to the grid-connection point. For connection to the medium-voltage grid, SMA Solar Technology AG recommends using an MV transformer with a tap changer on the high-voltage side to enable alignment to the voltage level of the utility grid.
- Several inverters can be connected parallel to one low-voltage winding on the transformer. The maximum number of devices that can be connected to the communications structure must be observed if primary communication with the inverter is intended.
- Shield winding is not necessary.
- The low-voltage side of the transformer must be configured in a star formation. The neutral point must be lead out.
- SMA Solar Technology AG recommends the following vector group for SMA inverters for different neutral-point treatments:

Insulated neutral point on high-voltage side	Led-out neutral point on the high-voltage side
Dyn1, Dyn5, Dyn11	YNyn0, YNyn6



- Please observe the "PV Systems Utilizing the SUNNY TRIPOWER and Effective Grounding Requirements" technical information for using low-resistance treatments on the high-voltage side.
- A THD of < 3% must be observed for the inverter types named above, although the THD can possibly be much lower.
- For thermal rating, the load curve of the transformer and the ambient conditions at the respective installation site must be taken into account.
- The maximum nominal AC current of all connected inverters must be taken into account (see the installation manual of the respective inverter). The inverter power is not permitted to exceed the transformer power.
- The transformer must be protected from overloading and short circuiting.
- The impedance of the transformer has a considerable influence on the short-circuit current. For rating the system, the level of the short-circuit current must be observed.
- Potential error sources (e.g. short-circuit, ground fault or power failure) must be taken into account when selecting a transformer.
- The country-specific power frequency must be taken into account.
- The applicable country-specific standards must be taken into account.

## 2 Technical Properties of the Sunny Tripower

- The voltage on the low-voltage side of the transformer must be equal to the output voltage of the inverter.

Inverter	Line conductor nominal voltage on the low-voltage side
Sunny Tripower 5000TL / 6000TL / 7000TL / 8000TL / 9000TL / 10000TL / 12000TL / 15000TL / 15000TLEE / 15000TLHE / 17000TL / 20000TL / 20000TLEE / 20000TLHE / 25000TL	3 x 230 V / 400 V
Sunny Tripower 12000TL-US / 15000TL-US / 20000TL-US / 24000TL-US	3 x 277 V / 480 V
Sunny Tripower 60	3 x 400 V
Sunny Tripower 60-US	3 x 480 V

- The led-out neutral point of the transformer is distributed to a neutral conductor and a grounding conductor according to the type of network. The neutral point must be grounded so that the grounding of the inverter is ensured.

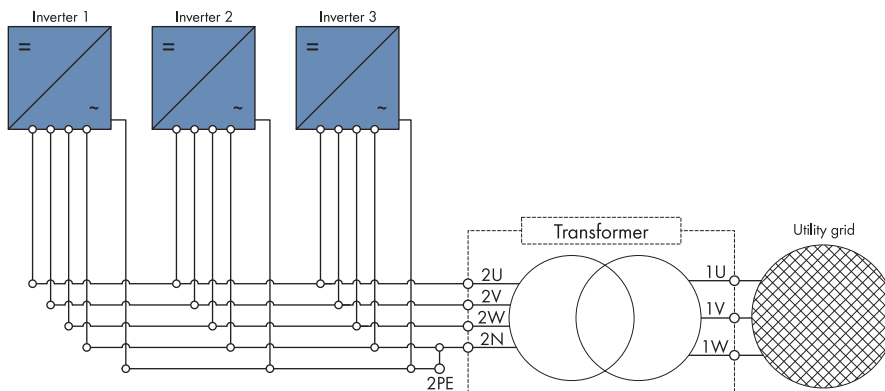


Figure 1: Using the example of Sunny Tripower 20000TL

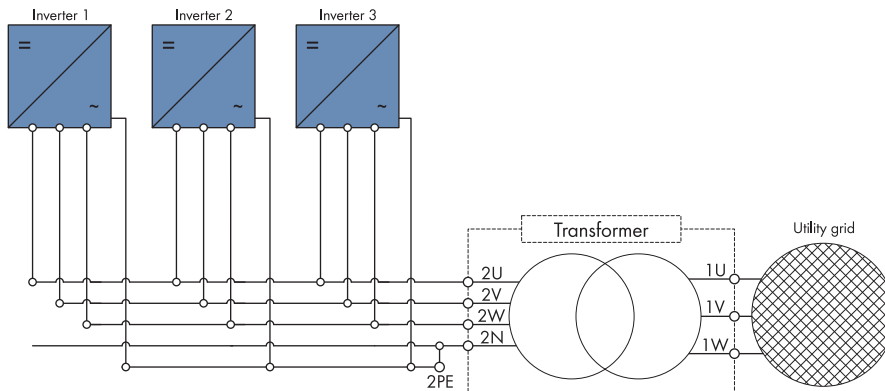


Figure 2: Using the example of Sunny Tripower 60

## 3 Technical Properties of the Sunny Boy and Sunny Mini Central

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### Operation between 2 phases

Each of the following single-phase inverters can be operated between two line conductors on a three-phase electricity grid under the following conditions:

Inverter	Rated voltage of the inverter	Voltage range of the grid side
Sunny Boy 3000-US / 3800-US / 4000-US / 5000-US / 6000-US / 7000-US / 8000-US	208 V	183 V ... 229 V
Sunny Boy 3000-US / 3800-US / 4000-US / 5000-US / 6000-US / 7000-US / 8000-US	240 V	211 V ... 264 V
Sunny Mini Central 4600A / 5000A / 6000A / 7000HV	230 V	160 V ... 265 V
Sunny Boy 6000TL-US / 7000TL-US / 8000TL-US / 9000TL-US / 10000TL-US / 11000TL-US	208 V	183 V ... 229 V
Sunny Boy 6000TL-US / 7000TL-US / 8000TL-US / 9000TL-US / 10000TL-US / 11000TL-US	240 V	211 V ... 264 V

- The rated voltage of the inverter must be in the voltage range of the network side, which is equal to a 3-phase system of the line-to-line voltage.
- The led-out neutral point of the transformer is distributed to a neutral conductor and a grounding conductor according to the type of network. The neutral point must be grounded so that the grounding of the inverter is ensured.

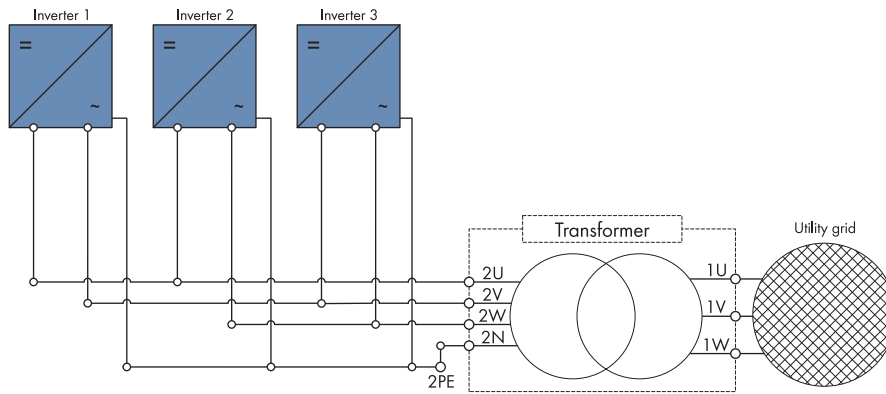


Figure 3: Example of inverters with transformers

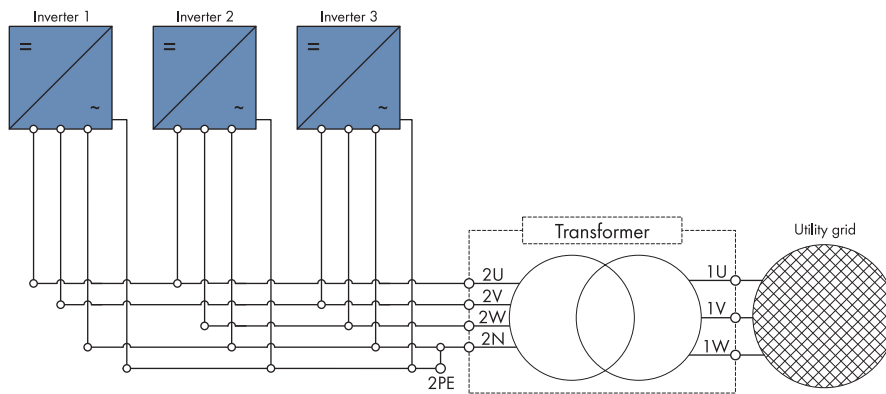


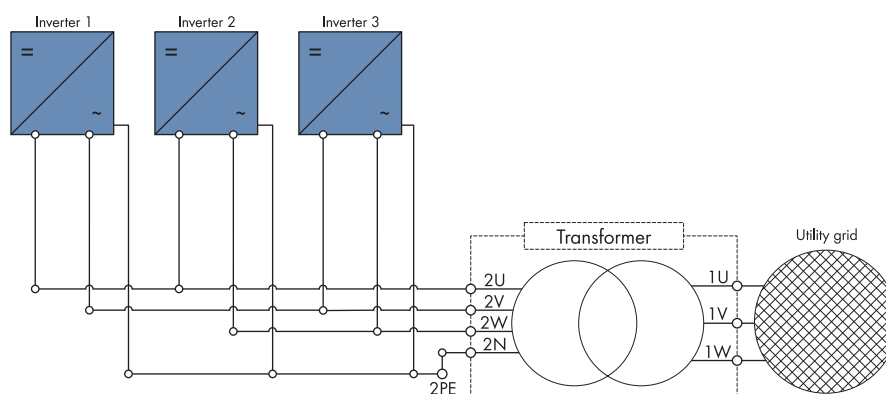
Figure 4: Example of inverters without transformers

### Operation between a line conductor and neutral conductor

On a three-phase electricity grid, each of the following single-phase inverters can be operated between one phase conductor and the neutral conductor under the following conditions:

Inverter	Rated voltage of the inverter	Voltage range of the grid side
Sunny Boy 3000-US / 3800-US / 4000-US / 5000-US / 6000-US / 7000-US / 8000-US	277 V	244 V ... 305 V
Sunny Mini Central 4600A / 5000A / 6000A	230 V	160 V ... 265 V
Sunny Mini Central 7000HV	230 V	160 V ... 265 V
Sunny Mini Central 6000TL / 7000TL / 8000TL / 9000TL / 10000TL / 11000TL / 9000TLRP / 10000TLRP / 11000TLRP	230 V	180 V ... 265 V

- A neutral point is required and must lead outward. The neutral point will be distributed to a neutral conductor and a grounding conductor according to the type of network.



- The unbalanced load capacity of the transformer must be taken into account for operating the Sunny Boy and Sunny Mini Central single-phase inverters.