## Introduction



### Overview

Special demands are made on fuses for application in photovoltaic systems. These fuses have a high DC rated voltage and a tripping characteristic specially designed to protect PV modules and their connecting cables (the newly defined operational class gPV). It is also crucial that the PV fuses do not age in spite of strongly alternating load currents, in order to ensure high plant availability throughout the service life of the PV system. The fuses must also be able to withstand high temperature fluctuations without damage. These requirements were only incorporated into an international standard in recent years and have now been published as IEC 60269-6.

The latest standardization effort was published as a draft standard in 2017 and is expected to be available in the form of Amendment A1 to IEC 60269-6 in the middle of 2018; several months later than EN. It should be noted that renewed changes in low and high test currents, as well as in conventional times, i.e. current-time characteristic curves, have been incorporated into this latest version. A distinction is now made between fuses for the protection of the strings and fuses for the protection of the array or subarray. This satisfies the different requirements in the PV panel (protection against reverse currents) and in the area downstream (viewed from the infeed direction) of the generator terminal boxes (essentially short-circuit protection).

The PV cylindrical fuses of size 10 mm x 38 mm offer an especially space-saving solution for the protection of the strings.

The fuse holders of size 10 x 38 mm can be supplied in single-pole and two-pole versions with and without signal detectors. In the case of devices with signal detector, a small electronic device with LED is located behind an inspection window in the plug-in module. If the inserted fuse link is tripped, this is indicated by the LED flashing. The devices have a sliding catch that enables removal of individual devices from the assembly. The infeed can be from the top or the bottom. Because the cylindrical fuse holders are fitted with the same anti-slip terminals at the top and the bottom, the devices can also be bus-mounted at the top or the bottom.

The PV fuses in LV HRC design are usually used as cumulative fuses upstream of the inverter. In addition, they can also be used for protecting groups (PV subarrays). For the PV cumulative fuses of size 1, the standard LV HRC fuse bases are available. For PV cumulative fuses of size 1L, 1XL, 2L, 2XL and 3L, we have developed a special 3NH7...-4 fuse base with a swiveling mechanism which combines maximum touch protection with maximum user-friendliness. This makes it possible to change fuses safely and without the need for any tools, such as a fuse handle. This provides safe and fast access even in an emergency.

Our cylindrical fuse holders and fuse bases with swiveling mechanism comply with the IEC 60269-2 standard and are considered as fuse disconnectors as defined in the IEC 60947 switchgear and controlgear standard. Under no circumstances are they suitable for switching loads.

To ensure that PV fuses are correctly selected and dimensioned, the specific operating conditions and the PV module data must be taken into account when calculating voltage and current ratings.

### Benefits

- Protection of the modules and their connecting cables in the event of reverse currents
- Safe tripping in case of fault currents reduces the risk of fire due to DC electric arcs
- Safe separation when the fuse holder/fuse base is open


PV cylindrical fuse system, 3NW70..-4, 3NW60..-4

PV LV HRC fuse systems, 3NH73..-4, 3NE13..-4D



Minimum order quantity (PS) or a multiple thereof can be ordered.

## Technical specifications

| | | Cylindrical fuse links | | Cylindrical fuse holders | |
|---|---|---|---|---|---|
| | | **3NW60..-4** | **3NW66..-4** | **3NW70..-4** | **3NW76..-4** |
| **Size** | mm x mm | 10 x 38 | 10 x 85 | | |
| **Standards** | | IEC 60269-6 | | IEC 60269, IEC 60269-2, IEC 60947, UL 4248-1, -18 | IEC 60269, IEC 60269-2, IEC 60947, UL 4248-1, -18 |
| **Approvals** | | UL 248-13, waiver certification for China (2 to 16 A) | (File No. E469670) | (File No. E355487), , (variants without signal detector) | (E355487) |
| **Operational class** | | gPV | | | |
| **Rated voltage $U_n$** | V DC | 1000 | 1500 (20 A: 1200 V) | 1000 | 1500 |
| **Rated current $I_n$** | A DC | 2 to 20 | 4 to 20 | 30 | 32 |
| **Rated short-circuit strength** | kA | -- | | 30 | |
| **Rated breaking capacity** | kA DC | 30 | 10 | -- | |
| **Breaking capacity**<br>• Utilization category | | -- | | AC-20B, DC-20B | |
| **Max. power dissipation of the fuse link** | W | -- | | 4 | 6 |
| **Rated impulse withstand voltage** | kV | -- | | 6 | -- |
| **Overvoltage category** | | -- | | II | -- |
| **Pollution degree** | | -- | | 2 | -- |
| **No-voltage changing of fuse links** | | -- | | Yes | |
| **Sealable when installed** | | -- | | Yes | |
| **Mounting position** | | Any, preferably vertical | | | |
| **Current direction** | | -- | | Any (signal detector with antiparallel LED) | |
| **Degree of protection acc. to IEC 60529** | | -- | | IP20, with connected conductors[1] | |
| **Terminals with touch protection according to BGV A3 at incoming and outgoing feeder** | | -- | | Yes | |
| **Ambient temperature** | °C | -25 ... +55°C, humidity 90% at +20°C | | | |
| **Conductor cross-sections**<br>• Finely stranded, with end sleeve<br>• AWG (American Wire Gauge) | <br>$mm^2$<br>AWG | <br>--<br>-- | | <br>0.75 ... 25<br>18 ... 4 | |
| **Tightening torque** | Nm | -- | | 2.5 | |

[1] Degree of protection IP20 is tested according to regulations using a straight test finger (from the front), with the device mounted and equipped with a cover, housing or some other enclosure.

## Selection and ordering data

| | Size | $I_n$ | $U_n$ | $P_v$ | $P_{v\ at\ 70\%}$[1] | SD | Article No. www.siemens.com/product?Article No. | Price per PU | PU (UNIT, SET, M) | PS | PG |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | mm x mm | A DC | V DC | W | W | d | | | | | |
| | **Cylindrical fuse links, operational class gPV** | | | | | | | | | | |
|  3NW6004-4 | 10 x 38 | 2 | 1000 | 1.4 | 0.6 | ▶ | **3NW6002-4** | | 1 | 20 units | 1DN |
| | | 4 | | 1.6 | 0.7 | | **3NW6004-4** | | 1 | 20 units | 1DN |
| | | 6 | | 1.7 | 0.7 | | **3NW6001-4** | | 1 | 20 units | 1DN |
| | | 8 | | 1.9 | 0.8 | | **3NW6008-4** | | 1 | 20 units | 1DN |
| | | 10 | | 2.3 | 1.0 | | **3NW6003-4** | | 1 | 20 units | 1DN |
| | | 12 | | 2.7 | 1.1 | | **3NW6006-4** | | 1 | 20 units | 1DN |
| | | 16 | | 3.2 | 1.3 | | **3NW6005-4** | | 1 | 20 units | 1DN |
| | | 20 | | 3.4 | 1.4 | | **3NW6007-4** | | 1 | 20 units | 1DN |
|  3NW6604-4 | 10 x 85 | 4 | 1500 | 2.7 | 1.1 | | **3NW6604-4** | | 1 | 10 units | 1DN |
| | | 6 | | 3.0 | 1.2 | | **3NW6601-4** | | 1 | 10 units | 1DN |
| | | 8 | | 3.6 | 1.5 | | **3NW6608-4** | | 1 | 10 units | 1DN |
| | | 10 | | 3.7 | 1.6 | | **3NW6603-4** | | 1 | 10 units | 1DN |
| | | 12 | | 3.3 | 1.4 | | **3NW6606-4** | | 1 | 10 units | 1DN |
| | | 16 | | 3.7 | 1.6 | | **3NW6605-4** | | 1 | 10 units | 1DN |
| | | 20 | 1200 | 4.0 | 1.7 | | **3NW6607-4** | | 1 | 10 units | 1DN |

[1] Tested in the fuse holder 3NW7013-4 or 3NW7613-4.

## PV cylindrical fuses

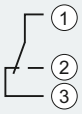
| | Number of poles | $I_n$ | For fuse links of size | Width | SD | Article No. www.siemens.com/product?Article No. | Price per PU | PU (UNIT, SET, M) | PS | PG |
|---|---|---|---|---|---|---|---|---|---|---|
| | | A DC | mm x mm | MW | d | | | | | |
|  3NW7014-4 | **Cylindrical fuse holders, 1000 V with signal detector** | | | | | | | | | |
| | 1P | 30 | 10 x 38 | 1 | | **3NW7014-4** | | 1 | 12 units | 1DN |
| | 2P | 30 | 10 x 38 | 2 | | **3NW7024-4** | | 1 | 6 units | 1DN |
| | **Without signal detector** | | | | | | | | | |
| | 1P | 30 | 10 x 38 | 1 | | **3NW7013-4** | | 1 | 12 units | 1DN |
| | 2P | 30 | 10 x 38 | 2 | | **3NW7023-4** | | 1 | 6 units | 1DN |
|  3NW7613-4 | **Cylindrical fuse holders, 1500 V** | | | | | | | | | |
| | 1P | 32 | 10 x 85 | 1.3 | | **3NW7613-4** | | 1 | 5 units | 1DN |

5



**Minimum order quantity (PS) or a multiple thereof can be ordered.**

## Technical specifications

| | | Fuse links 3NE1...-4 / -4D / -4E / -5E | | | | | | Fuse bases 3NH7...-4 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Size** | | 1 | 1L | 2L | 3L | 1XL | 2XL | 1 | 1L | 2L | 3L | 1XL | 2XL |
| **Standards** | | IEC 60269-6 | | | | | | IEC 60269, IEC 60269-2, IEC 60947 | | | | | |
| **Operational class** | | gPV | | | | | | | | | | | |
| **Rated voltage $U_n$** | V DC | 1000 at time constant (L/R) 3 ms<br>1500 at time constant (L/R) 3 ms | | | | | | 1000 | | | | 1500 | |
| **Rated current $I_n$** | A DC | 63 ... 160 | 200/250 | 315/400 | 500/630 | 63 ... 200 | 250/315 | 160 | 250 | 400 | 630 | 250 | 400 |
| **Rated short-circuit strength** | kA | -- | | | | | | 30 | | | | | |
| **Rated breaking capacity** | kA DC | 30 | | | | | | -- | | | | | |
| **Breaking capacity**<br>• Utilization category | | -- | | | | | | AC-20B, DC-20B (switching without load) | | | | | |
| **Max. power dissipation of the fuse link** | W | -- | | | | | | 40 | 90 | 110 | 130 | 90 | 110 |
| **No-voltage changing of fuse links** | | -- | | | | | | Yes | | | | | |
| **Sealable when installed** | | -- | | | | | | Yes | | | | | |
| **Mounting position** | | Any, preferably vertical | | | | | | | | | | | |
| **Current direction** | | -- | | | | | | Any | | | | | |
| **Ambient temperature** | °C | -25 ... +55°C, humidity 90% at +20°C | | | | | | | | | | | |
| **Tightening torque** | Nm | -- | | | | | | 20 | | | | | |
| **Microswitch for tripped signaling 5 A/250 V AC, 0.2 A/250 V DC** | | In the "fuse not blown" state, contacts 1 and 3 are closed.<br>  | | | | | | | | | | | |

## Selection and ordering data

| | Size | $I_n$ | $U_n$ | $P_v$ at $U_n$ | SD | Article No. www.siemens.com/product?Article No. | Price per PU | PU (UNIT, SET, M) | PS | PG |
|---|---|---|---|---|---|---|---|---|---|---|
| | | A DC | V DC | W | d | | | | | |
| | **Fuse links operational class gPV** | | | | | | | | | |
|  3NE1330-4D | 1 | 63 | 1000 | 19 | | **3NE1218-4** | | 1 | 2 units | 1DN |
| | | 80 | | 20 | | **3NE1220-4** | | 1 | 2 units | 1DN |
| | | 100 | | 24 | | **3NE1221-4** | | 1 | 2 units | 1DN |
| | | 125 | | 26 | | **3NE1222-4** | | 1 | 2 units | 1DN |
| | | 160 | | 32 | | **3NE1224-4** | | 1 | 2 units | 1DN |
| | 1L | 200 | | 51 | | **3NE1225-4D** | | 1 | 2 units | 1DN |
| | | 250 | | 54 | | **3NE1227-4D** | | 1 | 2 units | 1DN |
| | 2L | 315 | | 73 | | **3NE1330-4D** | | 1 | 2 units | 1DN |
| | | 400 | | 82 | | **3NE1332-4D** | | 1 | 2 units | 1DN |
| | 3L | 500 | | 100 | | **3NE1434-4E** | | 1 | 2 units | 1DN |
| | | 630 | | 110 | | **3NE1436-4E** | | 1 | 2 units | 1DN |
| | 1XL | 63 | 1500 | 20 | | **3NE1218-5E** | | 1 | 2 units | 1DN |
| | | 80 | | 25 | | **3NE1220-5E** | | 1 | 2 units | 1DN |
| | | 100 | | 30 | | **3NE1221-5E** | | 1 | 2 units | 1DN |
| | | 125 | | 29 | | **3NE1222-5E** | | 1 | 2 units | 1DN |
| | | 160 | | 34 | | **3NE1224-5E** | | 1 | 2 units | 1DN |
| | | 200 | | 41 | | **3NE1225-5E** | | 1 | 2 units | 1DN |
| | 2XL | 250 | | 53 | | **3NE1327-5E** | | 1 | 2 units | 1DN |
| | | 315 | | 63 | | **3NE1330-5E** | | 1 | 2 units | 1DN |

**Minimum order quantity (PS) or a multiple thereof can be ordered.**

## PV cumulative fuses

| | For fuse links of size | $I_n$ | $U_n$ | SD | Article No. www.siemens.com/product?Article No. | Price per PU | PU (UNIT, SET, M) | PS | PG |
|---|---|---|---|---|---|---|---|---|---|
| | | A DC | | d | | | | | |
| | **Fuse bases with flat terminal** | | | | | | | | |
| | Standard ceramic fuse base | | | | | | | | |
|  3NH3230 | 1 | 250 | 1000 | | **3NH3230** | | 1 | 3 units | 1BM |
| | **Fuse bases with swiveling mechanism** | | | | | | | | |
|  3NH7360-4 | 1L | 250 | 1000 | | **3NH7260-4** | | 1 | 1 unit | 1DN |
| | 2L | 400 | 1000 | | **3NH7360-4** | | 1 | 1 unit | 1DN |
| | 3L | 630 | 1000/1500 | | **3NH7460-4** | | 1 | 1 unit | 1DN |
| | 1XL | 250 | 1500 | | **3NH7261-4** | | 1 | 1 unit | 1DN |
| | 2XL | 400 | 1500 | | **3NH7361-4** | | 1 | 1 unit | 1DN |
| | **Fuse bases with swiveling mechanism and microswitch for tripped signaling of the fuse**[1] | | | | | | | | |
|  | 1 | 250 | 1000 | | **3NH7262-4KK01** | | 1 | 1 unit | 1DN |
| | 2L | 400 | 1000 | | **3NH7360-4KK01** | | 1 | 1 unit | 1DN |
| **Accessories** | | | | | | | | | |
| | **Terminal covers for PV fuse bases with swiveling mechanism** | | | | | | | | |
|  3NX3121 | 1, 1L, 1XL | | | | **3NX3121** | | 1 | 1 unit | 1DN |
| | 2L, 2XL | | | | **3NX3122** | | 1 | 1 unit | 1DN |
| | 3L | | | | **3NX3123** | | 1 | 1 unit | 1DN |

[1] Fuse must be inserted upside down.



Minimum order quantity (PS) or a multiple thereof can be ordered.