TÜV 2 PFG 1169/08.2007 · EN 60228 CLASS 5

PV1-F

Single Core Photovoltaic Cable · Halogen-Free, Cross-Linked



1.8	0.6/1	120	25
KV · DC MAX	KV · AC U0/U	°C · MAX CONDUCTOR	YR · DESIGN LIFE

Jiangsu Grand Cable Co., Ltd.
Photovoltaic Cable Systems · Yixing, Jiangsu, China

Standard & type designation

PV1-F is the type designation defined by TÜV Rheinland in the test specification 2 PfG 1169/08.2007 — a single-core flexible cable with tinned copper conductors for the d.c. side of photovoltaic systems. Compliance is demonstrated by third-party certification from TÜV Rheinland; the specification is not a self-declarable EN standard.

Standard	TÜV Rheinland 2 PfG 1169/08.2007 — test specification for photovoltaic system cables
Certification	Type certification by TÜV Rheinland — certificate numbers available on request
Conductor range	1.5 – 35 mm² (specification preferred sizes: 2.5 / 4 / 6 / 10 / 16 mm²)
Wall thicknesses	Manufacturer-declared, minimum 0.5 mm per the specification
EU market position	H1Z2Z2-K to EN 50618 is the successor type for European projects

> The designation PV1-F is defined in the TÜV specification itself. Preferred sizes cover the standard string cabling programme; larger cross-sections follow EN 50618 dimensions and are subject to certificate coverage.

Verification & test programme

- Voltage test on completed cable — AC 6.5 kV or DC 15 kV, 5 min (type test) · AC 10 kV (routine test, 100 % of production length)
- Damp heat — 1 000 h at 90 °C / 85 % RH (EN 60068-2-78), tensile and elongation change max −30 %
- UV weathering — 720 h xenon-arc to HD 605/A1 §2.4.20 — no cracking
- Ozone resistance — EN 50396 Method B, $(200 \pm 50) \times 10^{-6}$, 72 h — no cracking
- Cold bending and cold shock at −40 °C — no cracking
- Dynamic penetration — mean penetration force ≥ 50 × O.D. (Annex F)
- Long-term d.c. resistance — 240 h at 85 °C in 3 % NaCl water, 0.9 kV (Annex D)
- Notch propagation and acid/alkali resistance — Annex G and EN 60811-2-1

Supply programme

Single core 1.5 – 35 mm² · Tinned copper, class 5 · Halogen-free, black sheath · UV and ozone resistant · −40 °C cold flexibility · 25-year design life

Applications

Direct current side of photovoltaic power supply systems — rooftop and ground-mounted arrays, utility-scale solar plants, industrial and agricultural installations. Indoor and outdoor use, in equipment with protective insulation (Class II) and in explosion hazard areas.

Installation

Fixed installation or freely suspended and movable. Suitable for installation in cable trays and conduits, on and in walls, between module arrays, string and junction boxes and inverters. Flexible at low temperature for fast on-site handling.

Certification

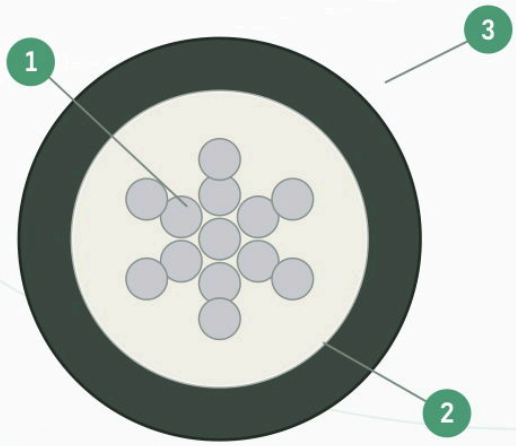
Compliance is demonstrated by TÜV Rheinland type certification to 2 PfG 1169/08.2007 — the specification itself is a TÜV test standard, not a self-declarable EN document. Certificate numbers and copies are available on request. For European projects the successor type is H1Z2Z2-K to EN 50618 (see separate catalogue).

Construction

Single core construction with a finely stranded tinned copper conductor — flexible for fast installation on roofs, in trays and behind module arrays. Cross-linked halogen-free compounds give a 25-year outdoor design life.

1. **Conductor** — tinned flexible copper, class 5 to EN 60228.
2. **Insulation** — cross-linked halogen-free compound (XLPO), compound designation FPV120-1.
3. **Outer sheath** — cross-linked halogen-free compound (XLPO), black, compound designation FPV120-2.

> Insulation and sheath are halogen-free: HCl ≤ 0.5 %, pH ≥ 4.3, conductivity ≤ 10 µS/mm. Cross-linked for a 120 °C temperature index (EN 60216-1, 20 000 h).



Cross-section — single core, schematic; numbers refer to the layers listed opposite.

Standards

- TÜV 2 PfG 1169/08.2007 — cables for photovoltaic systems
- EN 60228 class 5 — tinned flexible copper conductors
- EN 60332-1-2 — vertical flame propagation
- HD 605/A1 §2.4.20 — UV weathering, 720 h
- EN 50267-2-1/-2 — halogen-free (HCl, pH, conductivity)

Technical data

Rated voltage	AC U_0/U 0.6/1 kV · DC max. 1.8 kV (conductor–conductor, non-earthed, no load)
DC system rating	1.5 kV conductor–conductor · 0.9 kV conductor–earth
Voltage test, 5 min	AC 6.5 kV or DC 15 kV (20 m sample, in water at 20 ± 5 °C)
Ambient temperature	−40 °C to +90 °C
Max. conductor temperature	120 °C — temperature index 120 per EN 60216-1 (20 000 h)
Short-circuit temperature	200 °C, 5 s max.
Design service life	25 years
Flame retardance	EN 60332-1-2 · halogen-free
Conductor range	1.5 – 35 mm²

UV weathering & ozone

720 h xenon-arc exposure to HD 605/A1 §2.4.20 (63 °C black panel, 65 % RH, water spray/dry cycles) — no cracking. Ozone resistance to EN 50396 Method B. Damp heat 1 000 h at 90 °C / 85 % RH to EN 60068-2-78 — tensile and elongation change max −30 %.

Cold performance

Cold bending and cold shock at −40 °C — no cracking. Sheath surface resistance ≥ 10^9 Ω. Halogen-free per Annex B test methods (EN 50267 / EN 50525-1).

PV1-F — dimensions, weights & current ratings

Dimensions & weights

Single core · tinned flexible copper conductor · cross-linked halogen-free insulation and sheath

Section mm²	Insulation mm	Sheath mm	O.D. max mm	Weight kg/km	R 20 °C max Ω/km
1 × 1.5	0.7	0.8	5.4	37	13.7
1 × 2.5	0.7	0.8	5.9	49	8.21
1 × 4	0.7	0.8	6.6	67	5.09
1 × 6	0.7	0.8	7.4	92	3.39
1 × 10	0.7	0.8	8.8	134	1.95
1 × 16	0.7	0.9	10.1	199	1.24
1 × 25	0.9	1	12.5	305	0.795
1 × 35	0.9	1.1	14	428	0.565

Wall thicknesses are manufacturer-declared values within TÜV 2 PfG 1169/08.2007 (minimum 0.5 mm); dimensions and weights per Grand Cable design. D.C. resistance: maximum values at 20 °C for metal-coated (tinned) class 5 conductors per EN 60228.

Rated current

Ambient temperature 60 °C · maximum conductor temperature 120 °C · single core d.c. circuit

Section mm²	In free air A	On a surface A	Two cores adjacent A
1.5	30	29	24
2.5	41	39	33
4	55	52	44
6	70	67	57
10	98	93	79
16	132	125	107
25	176	167	142
35	218	207	176

Rated currents per 2 PfG 1169/08.2007, Table 1 — ambient 60 °C, conductor 120 °C. Grouping reduction per IEC 60364-5-52, Table B.52-17.

Conductor resistance at operating temperature

R at 20 °C, max	13.7 · 8.21 · 5.09 · 3.39 · 1.95 · 1.24 · 0.795 · 0.565 Ω/km — 1.5 to 35 mm²
R at 90 °C, max	17.5 · 10.5 · 6.49 · 4.32 · 2.49 · 1.58 · 1.01 · 0.72 Ω/km — for voltage-drop sizing

90 °C values derived from the 20 °C maxima with the copper temperature coefficient 0.00393 / K.

Derating & system guidance

Ambient temperature correction

Correction factors for a conductor temperature of 120 °C: ≤ 60 °C — 1.00 · 70 °C — 0.91 · 80 °C — 0.82 · 90 °C — 0.71 · 100 °C — 0.58 · 110 °C — 0.41.

System voltage

Maximum permissible d.c. system voltage 1.8 kV (conductor–conductor, non-earthed, no load); rated d.c. system voltage ≤ 1.5 kV conductor–conductor / 0.9 kV conductor–earth. For 1 500 V d.c. plants, H1Z2Z2-K to EN 50618 is recommended.

How to specify

Information needed	Example
Type designation	PV1-F · TÜV 2 PfG 1169/08.2007
Rated voltage	AC 0.6/1 kV · DC max. 1.8 kV
Number of cores × cross-section	1 × 6 mm²
Sheath colour	Black (other colours on request)
Options and delivery	Drum lengths and cut lengths · cable ends sealed against moisture ingress

Quality & testing

Routine tests — every production length

Absence-of-faults voltage test with AC 10 kV carried out on 100 % of the production length, plus conductor resistance measurement to EN 60228 before despatch.

Certification & documentation

TÜV Rheinland type certificate to 2 PfG 1169/08.2007. Type test reports and detailed test documentation issued on request with each delivery.

Packing & delivery

Drums & lengths

Supply on wooden or steel drums in standard or agreed cut lengths. Cable ends are sealed against moisture ingress; drums are battened and marked for identification.

Export packing

Drum lagging and additional weather protection available for sea freight and long-term outdoor storage. Delivery ex works or CIF — Incoterms 2020 — as agreed.

CONTACT

Jiangsu Grand Cable Co., Ltd.

TEL +86-510-80711619

EMAIL sales@grandcable.com sales@grandcable.cn

WEB www.grandcable.com www.grandcable.cn