

 DINVDE0250-812-1985	Cables, wires and flexible cords for power installation Rubber insulated flexible cables NSSHÖU	 DIN VDE 0250 Teil 812
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This standard is approved by the board of the Association of German Electrical Engineering (VDE) e.V. Hence it is also a VDE-Specification in the sense of VDE 0022. It was included in the VDE-Specification publications with the a.m. standard number and published in the journal *etZ Elektrotechnische Zeitschrift*.

Duplication is not allowed even for internal use.

Cables, wires and flexible cords for power installation; Rubber insulated flexible cables NSSHÖU	Partly supersedes VDE 0250/03.69 See also transition period!
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In terms of the scope of application of this standard, there is not an equivalent national or international standard.

Start of validity
This standard (VDE-Specification) is valid as of May. 1st, 1985.
While VDE 0250/03.69 § 812 remains valid until Oct. 31st, 1985.

German Electrical Commission under DIN and VDE (DKE)

1 Scope of application

This standard covers rubber insulated flexible cables NSSHÖU.

2 Designation

2.1 Type designation

NSSH...ÖU

The blank in the above type designation will be filled by the capital letters in paragraph 2.11 representing auxiliary components, while the designation of the auxiliary components in paragraph 2.12 will be marked after the cross-sectional area mark of the corresponding component.

The capital letters in paragraph 2.11 will be added to the type designation according to the position of the corresponding components in the cable in the order from the inside to outside.

2.1.1

- | | |
|-----|---|
| K | Crisscross rubber spacer in the centre of the cable |
| C | Metallic conductive layer on the cabled conductors or between inner and outer sheaths |
| CG | Nonmetallic conductive layer on the cabled conductors or between inner and outer sheath |
| CE | Metallic conductive layer on the insulation of the phase conductors |
| CGE | Nonmetallic conductive layer on the insulation of the phase conductors |

2.1.2

- | | |
|------|--|
| 1/3 | Grounding conductor evenly distributed in the interstices |
| 1/3E | Grounding conductor evenly distributed on the insulation of the phase conductors |
| KON | Concentric grounding conductor between inner and outer sheaths |
| ST | Control wire in the cable |
| FM | Communication wire in the cable |
| ÜL | Monitoring wire in the cable |

2.2 Example

Rubber insulated flexible cable with outer sheath made of polychloreprene-based rubber compound (NSSHÖU), with green-yellow conductor (J) , consisting of 4 conductors having nominal cross-sectional area of 16 mm^2 (4×16):

NSSHÖU-J 4×16

Rubber insulated flexible cable with outer sheath made of polychloreprene-based rubber compound (NSSHÖU), without green-yellow conductor (O) , consisting of 3 conductors having nominal cross-sectional area of 10 mm^2 (3×10):

NSSHÖU-O 3×10

Rubber insulated flexible cable with outer sheath made of polychloreprene-based rubber compound (NSSHÖU), consisting of 3 conductors having nominal cross-sectional area of 16 mm^2 (3×16) and concentric grounding conductor between inner and outer sheaths having nominal cross-sectional area of 16 mm^2 (16 KON)

NSSHÖU $3 \times 16/16 \text{ KON}$

Rubber insulated flexible cable with metallic conductive layer as monitoring wire between inner and outer sheaths made of polychloreprene-based rubber compound (NSSHCÖU), consisting of 3 conductors having nominal cross-sectional area of 16 mm^2 (3×16), grounding conductors having nominal cross-sectional area of 16 mm^2 evenly distributed on the insulation of the phase conductors ($3 \times 16/3E$), 3 control wires having nominal cross-sectional area of 1.5 mm^2 ($3 \times 1.5 \text{ ST}$) and a monitoring wire having nominal cross-sectional area of 6 mm^2 (6 ŮL):

NSSHCÖU $3 \times 16 + 3 \times 16/3E + 3 \times 1.5 \text{ ST} + 6 \text{ ŮL}$

Rubber insulated flexible cable with central crisscross rubber spacer and nonmetallic conductive layer on the insulation of the cabled conductors, outer sheaths made of polychloreprene-based rubber compound (NSSHKCGEÖU), with green-yellow conductor (J), consisting of 3 conductors having nominal cross-sectional area of 6 mm^2 (3×6), a 2-core communication wire having nominal cross-sectional area of 0.5 mm^2 ($2 \times 0.5 \text{ FM}$) and a monitoring wire having nominal cross-sectional area of 2.5 mm^2 (2.5 ŮL):

NSSHKCGEÖU-J $3 \times 6 + 2 \times 0.5 \text{ FM} + 2.5 \text{ ŮL}$

3 Rated voltage

U_0/U 0.6/1kV

4 Requirements

In addition to the requirements of DIN VDE 0250 Part 1, the cable shall comply with the requirements of paragraphs 4.1 - 4.10 and 7.

4.1 Number of cores and nominal cross-sectional area of the conductor

Single core	2.5 to 400 mm^2
2 to 4 cores	1.5 to 185 mm^2
3 cores with evenly distributed or concentrically arranged grounding conductor	2.5 to 150 mm^2
5 to 7 cores	1.5 to 95 mm^2
5 cores with grounding conductor concentric to the cable axis	2.5 to 6 mm^2
Above 5 cores, preferably 12 and 18 cores	1.5 to 4 mm^2

4.2 Conductor

Tinned copper, class 5 flexible conductor to DIN VDE 0295

For grounding conductors with smaller cross-sectional area than the phase conductor, Table 1, column 2 applies.

The conductor of the control wire and monitoring wire may also contain steel wire or other wire of suitable material to increase its mechanical strength.

Such conductor shall have a resistance not exceeding the value specified for a class 5 conductor having nominal cross-sectional area of 0.75mm^2 in DIN VDE 0295.

The conductor of the communication wire shall be a class 5 conductor having nominal cross-sectional area of at least 0.5mm^2

A layer made of textile or other suitable material may be applied on the conductor.

4.3 Insulation

Extruded rubber compound 3GI3 to DIN VDE 0207 Part 20.

Thickness to Table 1, column 3

A core covering may be applied.

The insulation of the control wire and communication wire shall consist of an insulation compound according to the series DIN VDE 0207 which is suitable for a maximum permissible conductor temperature of 90°C .

4.4 Conductive layer

A conductive layer may be applied on the grounding conductor, on the insulation of the insulated conductors, under the inner sheath or between sheaths.

When metal layer is used, it may be separated from insulation or sheath by a layer of tape or yarn.

Conductive layer may be used as a monitoring wire.

4.5 Conductor colour coding

4.5.1 According to DIN VDE 0293

4.5.2 The insulated grounding conductor shall be identified with the bicolour green-yellow. If the uninsulated grounding conductor (not distributed) is covered by a black conductive layer, then no other conductors shall be identified with black or green-yellow. For grounding conductors in paragraph 4.6.1.3 and 4.6.1.4, identification is omitted. Cables with these grounding conductors shall contain no green-yellow conductor.

4.6 Conductor assembly

The conductors of multicore cables shall be stranded.

In multicore cables, no straightened neutral is allowed, except for dummy made of suitable

material.

A central crisscross rubber spacer is permissible.

A layer of sparsely or intimately wrapped tape or yarn may be applied on the cabled conductors.

When the cable has a grounding conductor that is arranged on the insulation of the phase conductor, then an overlapped tape wrapping or a closed yarn wrapping shall be applied on the cabled conductors.

4.6.1 Arrangement of the grounding conductor

4.6.1.1 Stranded with phase conductors

4.6.1.2 Evenly distributed in the interstices

4.6.1.3 Evenly distributed on the insulation of the phase conductors

4.6.1.4 Concentric to the cable axis between inner and outer sheaths.

When the grounding conductor has insulation, it shall comply with the requirements in paragraph 4.3. The insulation thickness is optional.

4.6.2 Arrangement of the auxiliary control wire, conductors of the monitoring wire and communication wire

The control wire, conductors of the monitoring wire and communication wire may be embedded in the outer interstices of the cabled conductors, provided they do not protrude from the stranding diameter of the insulated conductors.

The communication wire shall be shielded from the phase conductor and control wire.

4.6.3 Thickness of the crisscross rubber spacer

Nominal cross-sectional area	Thickness of the spacer
Up to 35 mm ²	ca. 1.5 mm
50 to 95 mm ²	ca. 2.0 mm
120 to 185 mm ²	ca. 2.5 mm

4.7 Construction of the concentric grounding conductor

The grounding conductor in paragraph 4.6.1.3 is achieved by stranding. The diameter of the strands is according to Table 1, column 4. The grounding conductor in paragraph 4.6.1.4 is achieved by single or double stranding or by braiding. The diameter of the strands shall be not less than 0.3 mm. Under the concentric grounding conductor, a nonmetallic conductive layer may be closely applied. Over the concentric grounding conductor, a tape or yarn wrapping may be

applied.

4.8 Inner sheath and filler in multicore cables up to 5 cores

Rubber compound GM 1b to DIN VDE 0207 Part 21.

Thickness to Table 1, column 5 – 12 or Table 2

For number of cores not listed in Table 1, the thickness in Table 2, column 2 applies.

The inner sheath may be applied together with the outer sheath as single-layered sheath construction. In this case, the inner sheath shall consist of the same type of compound as the outer sheath.

Filler may be omitted when a layer of tape or yarn is applied on the cabled conductors.

The conductors shall be movable in the inner sheath or in the filler.

A tape may be applied on the inner sheath.

4.9 Outer sheath

Rubber compound 5GM5 to DIN VDE 0207 Part 21.

Thickness to Table 1, column 13 – 21 or Table 2

For number of cores not listed in Table 1, the thickness in Table 2, column 3 applies.

The outer sheath may be applied together with the inner sheath as single-layered sheath construction. In this case, the thickness shall be equal to the sum of the two sheath thicknesses. In the double-layered sheath construction, the outer sheath shall also be able to be separated or easily distinguished from the inner sheath, if no separating tape is applied on the inner sheath.

4.10 Overall diameter

For cables without rubber spacer; according to Table 3, column 2 – 10,

For cables with rubber spacer, according to Table 3, column 11 and 12

5. Testing

5.1. Check of the general requirements according to DIN VDE 0250 Part 1 by visual inspection and measurement.

5.2. Check of construction and dimensions by visual inspection and measurement.

5.3. The tests in Table 4 shall be carried out.

5.4 Resistance of the grounding conductor

A sample of 80 to 120 m long shall be taken for measurement. At one end of the sample, all the strands of the individual concentric grounding conductors shall be connected for measurement. At the other end, the maximum number of adjacent strands to be connected for measurement shall be

equal to the number listed in the following table for the corresponding total number of strands.
The maximum of the conductor resistance shall not exceed 125% of the rated value.

Total number of strands	Up to 29	30 to 49	50 to 69	70 to 89	90 to 109	110 and above
Number of strands to be connected at the second end	3	4	5	6	7	5%, but at least 8

6. Application

According to DIN VDE 0298 Part 3

7 Marking

In addition to the marking according to DIN VDE 0250 Part 1, possibly adjacent to the VDE mark (if any), the full type designation and also the number of cores and the nominal cross-sectional area of conductor as well as that of the grounding conductor (possibly with the suffix /3, /3E or KON), name of manufacture (or abbreviation) and year of manufacture (or abbreviation e.g. “85”) shall be marked continuously on the outer sheath with embossed characters.

Table 1. Coordination of the nominal cross-sectional area of the grounding conductor or neutral with that of the phase conductor, thickness of insulation, diameter of the strand in the grounding conductor on the insulation and thickness of sheath¹⁾

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Nominal cross-sectional area	Nominal cross sectional area of the grounding conductor or neutral	Thickness of insulation	Diameter of the strands in the grounding conductor on the insulation	Thickness in mm (nominal)																
mm ²	mm ²	Nominal mm	Real mm	Inner sheath with the number of cores of								Outer sheath with the number of cores of								
				2	3	4	5	6	7	12	18	1	2	3	4	5	6	7	12	18
1.5	1.5	0.8	-	1.0	1.0	1.0	1.0	1.2	1.2	1.4	1.4	1.6	1.6	1.6	1.6	1.6	2.0	2.0	2.2	2.2
2.5	2.5	0.9	0.3	1.0	1.0	1.2	1.2	1.2	1.2	1.4	1.6	1.6	1.6	1.6	2.0	2.0	2.0	2.0	2.2	2.5
4	4	1.0	0.3	1.2	1.2	1.2	1.2	1.4	1.4	1.6	1.8	1.6	2.0	2.0	2.0	2.0	2.2	2.2	2.5	3.0
6	6	1.0	0.3 or 0.4	1.2	1.2	1.2	1.4	1.4	1.4			1.6	2.0	2.0	2.0	2.2	2.2	2.2		
10	10	1.2	0.3 or 0.4	1.4	1.4	1.4	1.4	1.4	1.6			1.6	2.2	2.2	2.2	2.2	2.2	2.5		
16	16	1.2	0.3 or 0.4	1.4	1.4	1.6	1.6	1.6	1.8			1.6	2.2	2	2.5	2.5	2.5	3.0		
25	16	1.4	0.3 or 0.4	1.6	1.6	1.8	1.8	1.8	2.0			2.0	2.5		3.0	3.0	3.0	3.5		
35	16	1.4	0.3 or 0.4	1.6	1.8	1.8	2.0	2.0	2.0			2.0	2.5		3.0	3.5	3.5	3.5		
50	25	1.6	0.4 or 0.5	1.8	2.0	2.0	2.0	2.4	2.4			2.0	3.0		3.5	3.5	4.0	4.0		
70	35	1.6	0.4 or 0.5	2.0	2.0	2.0	2.4	2.4	2.8			2.2	3.5		3.5	4.0	4.0	4.5		
95	50	1.8	0.5 or 0.6	2.0	2.4	2.4	2.8	2.8	2.8			2.2	3.5		4.0	4.0	4.5	4.5		
120	70	1.8	0.6 or 0.7	2.4	2.4	2.8						2.5	4.0		4.5					
150	70	2.0	0.6 or 0.7	2.4	2.4	2.8						2.5	4.0		4.5					
185	95	2.2	0.6 or 0.7	2.8	2.8	3.2						3.0	4.5		5.0					
240	-	2.4	-									3.0								
300	-	2.6	-									3.5								
400	-	2.8	-									3.5								
															2					
															2.5					
															3.0					
															3.5					
															3.5					
															4.0					
															4.0					
															4.0					
															4.5					

up to 10	1.0	1.6
up to 15	1.2	2.0
up to 20	1.4	2.2
up to 25	1.6	2.5
up to 30	1.8	3~0
up to 40	2.0	3.5
up to 50	2.4	4.0
up to 60	2.8	4.5
up to 70	3.2	5.0
up to 80	3.6	5.5
over 80	4.0	6.0
1) For rubber insulated flexible cables NSSHÖU with grounding conductor in paragraphs 4.6.1.2 to 4.6.1.3, with conductive layer, control wire and communication wire and with other number of cores than in Table 1		

Table 3. Overall diameter^{1) 2)}

1	2	3	4	5	6	7	8	9	10	11	12
Nominal cross-sectional area	Overall diameter for construction										
	Without rubber spacer									With rubber spacer	
	Maximum in mm for number of cores of										
mm ²	1	2	3	4	5	6	7	12	18	3	4
1.5	8.0	14.5	15.0	16.0	17.0	19.5	19.5	25.0	28.0	17.0	19.0
2.5	8.5	16.0	16.5	19.0	20.0	21.5	21.5	28.0	33.0	19.5	21.0
4	9.5	19.5	20.0	21.5	23.0	25.5	25.5	33.5	39.0	21.5	23.5
6	10.5	21.0	22.0	23.0	26.5	28.5	28.5			23.5	26.5
10	12.0	24.5	25.5	27.5	30.0	29.0	32.0			27.5	31.5
16	13.5	27.5	28.5	37.0	34.0	36.0	40.0			31.5	35.0
25	16.5	32.5	34.5	39.0	42.0	42.5	47.5			37.5	41.0
35	18.0	36.0	39.0	42.5	47.0	49.5	53.0			41.0	46.0
50	20.0	42.0	45.0	49.0	53.0	57.5	62.0			47.0	51.0
70	22.0	46.5	49.0	53.5	60.0	64.5	72.0			51.0	57.0
95	25.0	51.5	56.0	61.5	65.5	73.0	79.0			59.0	64.0
120	27.5	57.5	60.5	68.0						63.0	71.0
150	30.0	62.0	65.5	73.0						70.0	76.0
185	34.0	69.0	73.0	81.5						76.0	84.5
240	37.0										
300	42.0										
400	46.0										
1) Not applicable to the rubber insulated flexible cables with the grounding conductors in paragraphs 4.6.1.2 and 4.6.1.3.											
2) For the rubber insulated flexible cables consisting of 3 or 4 conductors without the grounding conductors in paragraphs 4.6.1.1 und 4.6.1.4 and the rubber insulated flexible cables consisting of 2 or 3 conductors with these kinds of grounding conductors, the same values are used.											

Table 4 Testing

1	2	3
Category of test	Tests	Test standard
T, F	Electrical tests	
T	Conductor resistance	DIN VDE 0472 Part 501
T	Resistance of the grounding conductor with the construction in paragraphs 4.6.1.1 and 4.6.1.2	DIN VDE 0472 Part 501
T	Resistance of the grounding conductor with the construction in paragraphs 4.6.1.3 and 4.6.1.4	Paragraph 5.4
T	Resistance between the conductive layer and the attached longitudinal metallic conductor max. 500 Ω	DIN VDE 0472 Part 512
T, F	Voltage test	
	Voltage test on complete cable	DIN VDE 0472 Tell 508*), Method B ¹⁾
	Length of sample 5 m	
	Test voltage (A.C.)	
	Prime conductor 3kV	
	Control wire and conductors of the monitoring wire 2kV	
	Duration of voltage application, min 5 min	
	Communication wire	
	Test voltage (A.C.)	
	Between conductors 1kV	
	Between conductor and shield 500V	
	Duration of voltage application, min 1 min	
T	Voltage test on insulated conductors	DIN VDE 0472 Tell 508*), Method A
	Length of sample 5 m	
	Number of test pieces per conductor colour 1	
	Duration of immersion in water, min 2h	
	Temperature of water bath (20 $\pm$ 5)°C	
	Test voltage (A.C.)	
	Prime conductor 2.5kV	
	Control wire 2kV	
	Duration of voltage application, min 5 min	
T, F	Insulation resistance of communication wire	DIN VDE 0472 Tell 502, Method B
	The insulation resistance for 1km finished wire between each conductor and all the other conductors connected together and to shield at 20°C shall be measured.	
	Minimum min. 20M Ω	
T	Surface resistance of the sheath, min 10 ⁹ Ω	DIN VDE 0472 Part 503, Method B
1) For single core cables without conductive layer, the test is carried out according to DIN VDE 0472 Tell 508 (at present draft), Method A. The duration of immersion in water shall be at least 2h and the temperature of water bath (20 $\pm$ 5) °C. *) At present draft T Type test F Sampling test		

Table 4 (continued)

1	2	3
Category of test	Tests	Test standard
T, F	Check of construction and dimensions Thickness of the crisscross rubber spacer, Strand diameter of metallic layer and Cable overall diameter	DIN VDE 0472 Part 401.
T, F	Thickness of insulation	DIN VDE 0472 Part 402, Method A
T, F	Thickness of inner and outer sheaths	DIN VDE 0472 Part 402, Method B
T	Mechanical properties before and after ageing and thermal property Insulation²⁾ Tensile strength and elongation at break before and after ageing	DIN VDE 0472 Part 602
T	Ageing in air oven	DIN VDE 0472 Part 303, Ageing method A
T	Ageing in air bomb	DIN VDE 0472 Part 303, Ageing method C
T	Hot set test	DIN VDE 0472 Part 615
T	Inner sheath Tensile strength and elongation at break before and after ageing	DIN VDE 0472 Tell 602
T	Ageing in air oven	DIN VDE 0472 Tell 303, Ageing method A
T	Hot set test	DIN VDE 0472 Part 615
T	Outer sheath Tensile strength and elongation at break before and after ageing	DIN VDE 0472 Tell 602
T	Ageing in air oven	DIN VDE 0472 Tell 303, Ageing method A
T	Abrasion resistance	DIN VDE 0472 Part 605, Method A
T	Tear resistance	DIN VDE 0472 Part 613*)
T	Hot set test	DIN VDE 0472 Part 615
T	Testing of the performance against external influences Outer sheath Oil resistance	DIN VDE 0472 Part 803*), Method A
T	Test on the cable Reaction to fire	DIN VDE 0472 Part 804, Method B
2) For insulation of control wire and communication wire, the tests required for the corresponding type of compound in the series DIN VDE 0207 shall be carried out. *) At present draft T Type test F Sampling test		

Normative references

Series DIN VDE 0207	Insulation and sheathing compounds for wires and cables; list of standards in the series DIN VDE 0207
See attached page 1 to DIN VDE 0207	
DIN VDE 0207 Part 20	Insulation and sheathing compounds for wires and cables; rubber insulation compounds
DIN VDE 0207 Part 21	Insulation and sheathing compounds for wires and cables; rubber sheathing compounds
DIN VDE 0250 Part 1	Cables, wires and flexible cords for power installation; General requirements
DIN VDE 0293	Conductor colour coding of power cables and wires of rated voltages up to 1000V
DIN VDE 0295	Conductors of wires and cables for power installation
DIN VDE 0298 Part 3	Application of wires and cables for power installation; General requirements for cables, wires and flexible cords

For further normative references, see Table 4

Previous editions

VDE 0250: 03.69

For further editions, see DIN VDE 0250 Part 1 under the title *Standard development*

Modification

Compared with VDE 0250/03.69 § 812, the following revisions were made:

- The former paragraph 812 was revised and published as an independent standard of the series DIN VDE 0250
- By referring to other standards (see *Normative references*), repetition is avoided.
- The cable construction with 6kV rated voltage was cancelled

Remarks

This standard was prepared by the sub-commission 411.2 *Cables, wires and flexible cords for power installation* and the technical commission 411 *Power cables and wires* of German Electrical Commission under DIN und VDE (DKE).

International patent classification

H 01 B 7/00

FEICHUN SPECIAL CABLES



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