HIGH-FLEX LV REELING CABLE · RTG / RMG / STS | 0.6/1 kV | CSP rubber | Article FC-LV29-003

# NSHTÖU 3×35+3G6+12FO 0.6/1 kV

Low-Voltage Port Reeling Cable 0.6/1 kV – 3 power cores + 3 split PE conductors + 12-fibre single-mode optical element, CSP rubber sheath. Complete technical data sheet of this single model: cross-section drawing, dimensions, weight, current ratings, reel design data, standards and ordering information.

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## 01 Application and Product Overview

**NSHTÖU 3×35+3G6+12FO** is a CSP rubber-sheathed high-flex reeling cable rated 0.6/1 kV for rubber-tyred gantry (RTG), rail-mounted gantry (RMG) and ship-to-shore (STS) cranes in container terminals. The configuration is 3 power cores + 3 split PE conductors + 12-fibre single-mode optical element, with power cores of 35 mm², an outer diameter of 26.5 – 28.5 mm, a weight of about 1,580 kg/km and a rated current of 162 A at 30 °C ambient. Fine-wire class 5 copper conductors and short-lay stranding allow continuous winding on and off a cable reel at a minimum bending radius of 228 mm.

### Typical applications

- Remote-controlled and automated cranes that need a data link through the reel in addition to power
- Rubber-tyred gantry (RTG), rail-mounted gantry (RMG) and electrified RTG cranes fed through spring-driven or motor-driven cable reels
- Ship-to-shore (STS) crane auxiliary drives, automated stacking cranes, ship unloaders and bulk-handling machines in terminals
- Outdoor quayside and yard operation with exposure to seawater spray, salt mist, UV radiation and ozone
- Reeling operation at travel speeds up to 60 m/min with repeated tensile and torsional loads
- Outdoor duty that calls for a rubber sheath with proven weather, ozone and oil resistance

### Design

Power and split-PE construction with a central 12-fibre single-mode (G.652.D) optical element. The fibre element sits close to the neutral axis of the cable, where bending strain is lowest, and is protected by a compression-resistant buffer tube. It lets data links such as crane control, remote operation or camera signals run through the same reel.

| 26.5 – 28.5 mm | 1,580 kg/km | 162 A | 228 mm |
|---|---|---|---|
| Outer diameter | Approx. weight | Rated current, 30 °C | Min. bending radius |

### Key features

- Fine-wire class 5 copper conductors and a very short core lay length for repeated reeling
- Three split PE conductors in the interstices keep the cross-section round and balanced
- Designed for 20 N/mm² continuous tensile load (on the total copper cross-section of the power cores)
- CSP rubber sheath with proven weather, ozone and oil resistance
- Single-mode G.652.D optical fibres (12 per element) in a compression-resistant buffer tube
- Flame retardant to IEC 60332-1-2

### Type designation

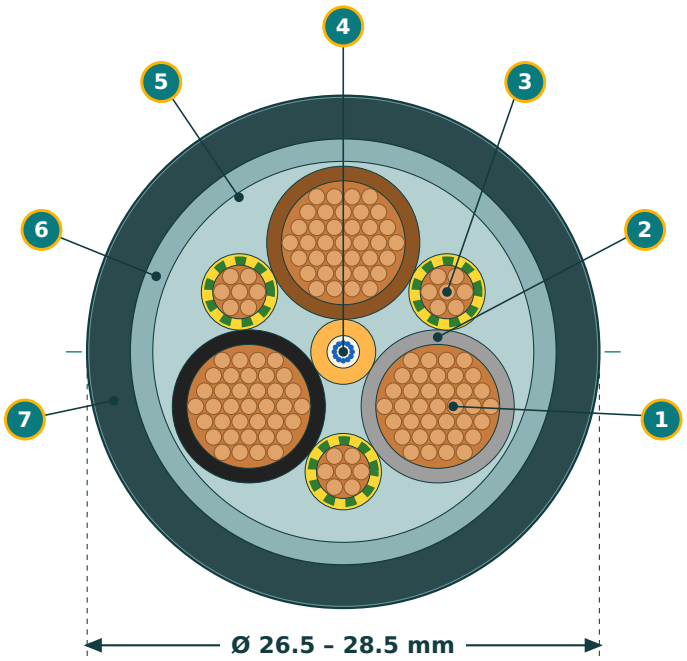
NSHTÖU (also typed NSHTOEU) is the German VDE-style type designation used in the trade for rubber-insulated, oil-resistant, rubber-sheathed reeling cables rated 0.6/1 kV with split protective conductors, used on cable reels of cranes. The designation identifies the cable class and is used so that engineers can find and compare the product. Construction, dimensions and data in this datasheet are FeiChun's own.

## 02 Construction

**FEICHUN · CROSS-SECTION A–A · 0.6/1 kV**

**NSHTÖU 3×35+3G6+12FO**

Article FC-LV29-003 · Rev 0 · Illustrative, not to scale




| No. | Component | Material |
|---|---|---|
| 1 | Conductor | Bare annealed fine-wire copper, class 5 to IEC 60228 |
| 2 | Insulation | Halogen-free EPR/HEPR rubber |
| 3 | Split PE conductor | Class 5 copper, green-yellow insulation, laid in the interstices between the power cores |
| 4 | Optical element | 12 single-mode G.652.D fibres per element in a compression-resistant loose tube |
| 5 | Filler and binder tape | Halogen-free compound, polyester tape |
| 6 | Inner sheath | Halogen-free polymer compound |
| 7 | Outer sheath | Chlorosulfonated polyethylene (CSP) rubber, resistant to weather, ozone and oil |

**Figure 1.** Cross-section of NSHTÖU 3×35+3G6+12FO 0.6/1 kV. The drawing is generated from the geometry of this exact size; elements are shown to scale relative to each other and do not overlap.

### Construction details

| | |
|---|---|
| **Conductor** | Bare annealed fine-wire copper, class 5 to DIN EN 60228 / IEC 60228 / VDE 0295 |
| **Insulation** | Halogen-free EPR/HEPR rubber to IEC 60502-1, maximum conductor temperature 90 °C |
| **Core identification** | Power cores brown, black, grey to DIN VDE 0298-300 |
| **Protective conductor** | Three PE conductors (3G), green-yellow, 6 mm² each, laid in the interstices between the power cores |
| **Optical element** | One element of 12 single-mode G.652.D fibres in a loose tube with compression-resistant buffer, located at the cable core |
| **Stranding** | Power cores, split PE conductors and control or optical elements are stranded together with a very short lay length |
| **Inner sheath** | Halogen-free polymer compound, extruded tightly over the stranded cores |
| **Outer sheath** | Chlorosulfonated polyethylene (CSP) rubber, resistant to weather, ozone and oil |

### Sheath material

The chlorosulfonated polyethylene (CSP) rubber sheath is a proven reeling-cable material for open-air cranes: excellent resistance to weather, ozone and mineral oil, good mechanical robustness and low-temperature flexibility to −30 °C in motion. CSP contains halogen; where halogen-free cables are specified, select the PUR version of the same construction.

## 03 Electrical, Thermal and Mechanical Characteristics

### Electrical data

| | |
|---|---|
| **Rated voltage $U_0/U$** | 0.6/1 kV AC |
| **Test voltage** | 2.5 kV AC (power cores); 2 kV AC (control cores) |
| **Maximum operating voltage, DC** | 0.9/1.8 kV |
| **Current-carrying capacity** | To DIN VDE 0298-4 at 30 °C ambient; the table gives rated design values |
| **Conductor resistance** | Maximum at 20 °C, class 5 to IEC 60228 |

### Thermal and mechanical data

| | |
|---|---|
| **Maximum conductor temperature** | +90 °C |
| **Maximum temperature at short circuit** | +250 °C |
| **Ambient temperature, fixed installation** | −40 °C to +90 °C |
| **Ambient temperature, in motion** | −30 °C to +90 °C |
| **Minimum bending radius** | 4 × D fixed; 8 × D on a cable reel (DIN VDE 0298-3) |
| **Maximum tensile load** | 20 N/mm² continuous, on the total copper cross-section of the power cores |
| **Maximum torsional load** | ±50 °/m |
| **Maximum travelling speed** | 60 m/min on a cable reel; higher speeds on request |
| **Flame propagation** | IEC 60332-1-2 / DIN EN 60332-1-2 |
| **Halogen-free** | No (CSP rubber sheath) |
| **UV and ozone resistance** | Resistant |
| **Mineral oil resistance** | Resistant, IEC 60811-404 |

### Sheath material comparison

| Property | PUR | PUR low-temp | CSP rubber | CPE rubber |
|---|---|---|---|---|
| **Abrasion resistance** | Excellent | Excellent | **Good** | Good |
| **Cut and tear resistance** | Excellent | Excellent | **Good** | Good |
| **Mineral oil resistance** | Very good | Very good | **Very good** | Very good |
| **Weather, UV and ozone resistance** | Very good | Very good | **Excellent** | Very good |
| **Cold flexibility (moving)** | −30 °C | −40 °C | **−30 °C** | −30 °C |
| **Halogen-free (IEC 60754-1/-2)** | Yes | Yes | **No** | No |

The column of the sheath used in this cable is highlighted. Ratings are qualitative; ask FeiChun for test data on a specific requirement.

## 04 Technical Data of NSHTÖU 3×35+3G6+12FO 0.6/1 kV

| | | | |
|---|---|---|---|
| **Type designation** | **NSHTÖU 3×35+3G6+12FO** | **FeiChun article no.** | FC-LV29-003 |
| **Power cores** | 3 × 35 mm² | **Protective conductor** | 3 × 6 mm² (split PE, 3G) |
| **Optical elements** | 1 × 12 fibres, single-mode G.652.D | **Rated voltage $U_0/U$** | 0.6/1 kV AC |
| **Test voltage** | 2.5 kV AC (power cores); 2 kV AC (control cores) | **Conductor** | Class 5 fine-wire copper, Ø max 7.8 mm |
| **Insulation** | EPR / HEPR, 0.9 mm nominal | **Inner sheath** | ≈ 1.2 mm nominal |
| **Outer sheath** | CSP rubber, ≈ 2.3 mm nominal | **Outer diameter** | 26.5 – 28.5 mm |
| **Weight, approx.** | 1,580 kg/km | **Copper weight** | 1,090 kg/km |
| **$R_{20}$ max** | 0.554 Ω/km | **$R_{90}$ (calculated)** | 0.706 Ω/km |
| **Rated current** | 162 A (free air, 30 °C) | **$I_k$ (1 s, 90 → 250 °C)** | 5.00 kA |
| **Min. bending radius, reeling** | 228 mm (8 × D) | **Max. pull force** | 2,100 N |
| **Min. reel core Ø** | 456 mm (2 × bending radius) | **Max. travelling speed** | 60 m/min on a reel |
| **Max. torsion** | ±50 °/m | **Halogen-free** | No (CSP rubber sheath) |

Diameters, dimensions and weights are nominal design values and vary within manufacturing tolerances; confirm critical dimensions before dimensioning reels, guides or festoon systems. Current ratings are design values to DIN VDE 0298-4 for flexible cables in free air at 30 °C ambient. Pull force = 20 N/mm² × total copper cross-section of the power cores. Other sizes and configurations are produced to order.

### Calculated electrical data

| Quantity | Value | Basis |
|---|---|---|
| **Conductor resistance at 90 °C** | 0.706 Ω/km | $R_{90} = R_{20} \times (1 + 0.00393 \times 70)$ |
| **Voltage drop at rated current** | 19.8 V per 100 m | Three-phase, resistive, cos φ = 1, conductor at 90 °C |
| **Conductor loss at rated current** | 55.6 W/m | All 3 load-carrying cores at 90 °C |
| **Length for 3 % voltage drop, 400 V** | 60 m | At the rated current, 3-phase, resistive |
| **Length for 3 % voltage drop, 690 V** | 104 m | At the rated current, 3-phase, resistive |

### Current-carrying capacity by ambient temperature and number of layers on the reel

| Layers on reel / ambient °C | 20 | 25 | 30 | 35 | 40 | 45 | 50 |
|---|---|---|---|---|---|---|---|
| **1 layer (×0.80)** | 140 | 135 | 130 | 124 | 118 | 113 | 106 |
| **2 layers (×0.61)** | 107 | 103 | 99 | 95 | 90 | 86 | 81 |
| **3 layers (×0.49)** | 86 | 83 | 79 | 76 | 72 | 69 | 65 |
| **4 layers (×0.41)** | 72 | 69 | 66 | 64 | 60 | 58 | 54 |

Permissible current = table current × layer factor × ambient temperature factor (conductor 90 °C). Factors: 20 °C: 1.08, 25 °C: 1.04, 30 °C: 1.00, 35 °C: 0.96, 40 °C: 0.91, 45 °C: 0.87, 50 °C: 0.82.

### Short-circuit current rating of the power cores

| Duration t (s) | 0.1 | 0.2 | 0.5 | 1 | 2 | 3 | 5 |
|---|---|---|---|---|---|---|---|
| **$I_k$ (kA)** | 15.83 | 11.19 | 7.08 | 5.00 | 3.54 | 2.89 | 2.24 |

$I_k$ = 0.143 kA/mm² × 35 mm² for 1 s (conductor 90 °C → 250 °C); for another duration t: $I_{k,t} = I_{k,1s} / \sqrt{t}$ (0.1 s ≤ t ≤ 5 s).

## 05 Reeling Performance and Reel Design Data

For NSHTÖU 3×35+3G6+12FO the minimum reel core diameter is 456 mm and the cable weighs 158.0 kg per 100 m. The table gives the indicative length that fits on standard reel sizes when the reel is wound with this cable at the minimum core diameter and 90 % fill; use it for a first reel selection, not as a substitute for the reel manufacturer’s calculation.

| Reel flange Ø × traverse width | Min. core Ø mm | Indicative capacity m | Cable weight on reel kg |
|---|---|---|---|
| **Ø 1,600 × 800 mm** | 456 | 1,625 | 2,568 |
| **Ø 2,000 × 1,000 mm** | 456 | 3,275 | 5,174 |
| **Ø 2,500 × 1,000 mm** | 456 | 5,035 | 7,955 |
| **Ø 3,000 × 1,200 mm** | 456 | 8,935 | 14,117 |
| **Ø 3,500 × 1,500 mm** | 456 | 15,325 | 24,214 |

### Reel design guidance

- Minimum reel core diameter = 2 × minimum bending radius = 16 × D (outer diameter D).
- Spring reels suit short travel and low tensile load; motor-driven reels with torque control keep the cable under constant, low tension.
- Fit a guide or level-wind that keeps the cable parallel to the reel axis to prevent crossing turns.
- Rated current falls with the number of layers on the reel because heat is not dissipated; see the layer factors below.

## 06 Sizes in this Series and Selection Aid

NSHTÖU 0.6/1 kV CSP rubber is offered in 12 sizes from 16 to 400 mm². Each size has its own datasheet; the size of this document is highlighted. The next smaller or larger size can be opened directly from the table.

| Type designation | Article no. | Outer Ø max mm | Weight kg/km | Current A | Bend radius mm |
|---|---|---|---|---|---|
| 3×16+3G4+12FO | FC-LV29-001 | 22.5 | 860 | 99 | 180 |
| 3×25+3G6+12FO | FC-LV29-002 | 23.8 | 1,150 | 131 | 190 |
| **3×35+3G6+12FO** | **FC-LV29-003** | **28.5** | **1,580** | **162** | **228** |
| 3×50+3G10+12FO | FC-LV29-004 | 33.0 | 2,260 | 202 | 264 |
| 3×70+3G16+12FO | FC-LV29-005 | 38.5 | 3,220 | 250 | 308 |
| 3×95+3G16+12FO | FC-LV29-006 | 44.0 | 3,870 | 302 | 352 |
| 3×120+3G25+12FO | FC-LV29-007 | 47.5 | 4,980 | 350 | 380 |
| 3×150+3G25+12FO | FC-LV29-008 | 53.5 | 6,010 | 402 | 428 |
| 3×185+3G35+12FO | FC-LV29-009 | 57.5 | 7,560 | 459 | 460 |
| 3×240+3G50+12FO | FC-LV29-010 | 65.5 | 9,900 | 540 | 524 |
| 3×300+3G50+12FO | FC-LV29-011 | 71.5 | 11,870 | 621 | 572 |
| 3×400+3G70+12FO | FC-LV29-012 | 81.0 | 15,720 | 743 | 648 |

**Example.** NSHTÖU 3×35+3G6+12FO wound in two layers on the reel at 40 °C ambient may carry 162 × 0.61 × 0.91 = 90 A continuously. At 400 V this is an apparent power of about 62.4 kVA (S = √3 × U × I).

## 07 Standards and Testing

| Standard | Scope |
|---|---|
| **DIN EN 60228 / IEC 60228 / VDE 0295** | Conductors, class 5 |
| **IEC 60502-1** | Insulation compound, power cables up to 1 kV |
| **DIN VDE 0298-3** | Application of cables – bending radii and tensile loads |
| **DIN VDE 0298-4** | Application of cables – current-carrying capacity |
| **DIN EN 60332-1-2 / IEC 60332-1-2** | Flame propagation, single cable |
| **DIN VDE 0298-300** | Core identification |
| **IEC 60811-404** | Mineral oil immersion test |
| **DIN VDE 0292** | Type designation of cables (designation practice) |

### Routine and type tests

- AC voltage test on every reel length (routine test): 2.5 kV AC (power cores); 2 kV AC (control cores)
- Conductor resistance and checks of dimensions, insulation thickness and sheath thickness
- Continuity of conductors and protective earth
- Bending, tensile and reeling torsion tests (type test)
- Flame propagation (IEC 60332-1-2)
- Optical attenuation test of every fibre after cabling

**Test documentation:** every delivery is accompanied by a test certificate from FeiChun's own laboratory. Third-party witnessed tests can be arranged at the buyer's cost.

## 08 Installation, Marking, Delivery and Ordering

### Installation guidance

- Use a spring-driven or motor-driven cable reel with a core diameter of at least twice the minimum bending radius (16 × D).
- Unwind from the shipping reel tangentially; never pull the cable over the flange of the drum, and avoid loops and kinks.
- Keep torsion within the permitted limit (±50 °/m) and tensile load within the value in the table.
- Guide the cable so that it is not run over by vehicles or crushed; inspect the sheath regularly.
- Connect all parts of the split PE conductor at both ends of the cable.
- Suitable for wet conditions; consult FeiChun for continuous immersion.

### Sheath marking

FEICHUN NSHTÖU 3×35+3G6+12FO 0.6/1 kV CSP rubber [year] [serial no.] [metre mark]

### Packing and delivery

| | |
|---|---|
| **Reel** | Steel or fumigated wooden reels; cable ends sealed with heat-shrink caps |
| **Delivery length** | As ordered, in one continuous length without joints |
| **Lead time** | 2–3 weeks after technical approval |
| **Warranty** | At least 3 years against manufacturing defects |
| **Reel label** | Type, cross-section, length, gross/net weight, batch no., reel no. |

### Ordering information

| Field | Example | Meaning |
|---|---|---|
| **Type designation** | NSHTÖU | Cable type as used in the trade |
| **Core configuration** | 3×35+3G6+12FO | Number × cross-section (mm²) of the power cores, split PE conductors (G) and control or optical elements |
| **Rated voltage** | 0.6/1 kV | $U_0$/U, AC |
| **Sheath** | CSP rubber | Chlorosulfonated polyethylene (CSP) rubber, resistant to weather, ozone and oil |
| **Length and packing** | 500 m, steel reel | Delivery length in one piece; reel type on request |
| **FeiChun article no.** | FC-LV29-003 | Quote this number in enquiries and orders |

**Order example: NSHTÖU 3×35+3G6+12FO 0.6/1 kV CSP rubber** – 500 m on one steel reel (FeiChun article FC-LV29-003). When requesting a quotation, state the cable type, configuration, cross-section, voltage, length per piece, required standards and installation conditions.

## 09 Certification and Quality

All cable is subject to FeiChun's quality control, with routine testing over 100 % of the delivered length. Certificates, type tests and third-party tests (for example partial discharge or compatibility with cable accessories) are provided per project requirement; copies of the records are available on request.

The CE, EAC and UKCA certificates issued for the D2X11Y base type (LVD 2014/35/EU, TR CU 004/2011, UKCA) apply to that product group. Confirm with FeiChun that the certificate scope covers this construction before quoting it in a tender.

## 10 Related Datasheets and FAQ

Cables of the same class with a different sheath, configuration or voltage and the closest cross-section. All datasheets are PDF files.

- NSHTÖU 3×35+3G6+2×2.5 0.6/1 kV CSP rubber – 3 power cores + 3 split PE conductors + 2 pilot cores 2×2.5 mm²
- NSHTÖU 3×35+3G6+2×12FO 0.6/1 kV CSP rubber – 3 power cores + 3 split PE conductors + two 12-fibre single-mode optical elements
- NSHTÖU 3×35+3G6 C 0.6/1 kV CSP rubber – 3 power cores + 3 split PE conductors + overall screen
- D2X11Y 3×35+3G6+12FO 0.6/1 kV PUR – 3 power cores + 3 split PE conductors + 12-fibre single-mode optical element
- D2X11Y 3×35+3G6+12FO 0.6/1 kV low-temp PUR – 3 power cores + 3 split PE conductors + 12-fibre single-mode optical element
- NSHTÖU 3×35+3G6+12FO 0.6/1 kV CPE rubber – 3 power cores + 3 split PE conductors + 12-fibre single-mode optical element

Overview of all datasheets in this family: Low-Voltage Port Reeling Cables 0.6/1 kV

### Frequently asked questions

**What is NSHTÖU 3×35+3G6+12FO used for?**
NSHTÖU 3×35+3G6+12FO is intended for remote-controlled and automated cranes that need a data link through the reel in addition to power.

**What are the dimensions and weight of NSHTÖU 3×35+3G6+12FO 0.6/1 kV?**
The outer diameter is 26.5 – 28.5 mm and the weight is about 1,580 kg/km, of which copper is 1,090 kg/km. These are nominal design values and vary within manufacturing tolerances.

**What is the minimum bending radius of NSHTÖU 3×35+3G6+12FO?**
The minimum bending radius in moving or reeling operation is 228 mm (8 × D).

**What reel core diameter does NSHTÖU 3×35+3G6+12FO need?**
At least 456 mm, which is twice the minimum bending radius. On a reel with 2,500 mm flange diameter and 1,000 mm traverse width, about 5,035 m of cable fit at that core diameter (indicative).

**What current can NSHTÖU 3×35+3G6+12FO carry on a cable reel?**
The rated current in free air at 30 °C is 162 A. With one layer on the reel the permissible current is 130 A, with two layers 99 A, with three layers 79 A and with four layers 66 A (DIN VDE 0298-4 layer factors, 30 °C ambient).

**How far can NSHTÖU 3×35+3G6+12FO carry its rated current at 400 V?**
For a resistive voltage drop of 3 % at 400 V, three-phase, conductor at 90 °C, the length is about 60 m at the rated current of 162 A; shorter loads allow longer runs.

**Is NSHTÖU 3×35+3G6+12FO halogen-free?**
No. The CSP rubber sheath contains halogen. For a halogen-free cable select the PUR version of the same construction.

**Which other sizes of this type are available?**
NSHTÖU 0.6/1 kV CSP rubber is offered in 16, 25, 35, 50, 70, 95, 120, 150, 185, 240, 300, 400 mm². Each size has its own datasheet, linked in section 06.

## 11 Notices and Intellectual Property

NSHTÖU is a type designation used in the cable trade to name a class of cable; it is used here for identification and comparison only. The designation does not imply approval of the product by a third party unless a certificate is named in section 09.

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