

NSW ® Winding Wires for Submersible Motors




NORDDEUTSCHE SEEKABELWERKE GMBH (NSW)


After NSW was founded in 1899 by Felten & Guillaume and the Deutsch-Atlantische Telegraphengesellschaft, Siemens became one of its major shareholders in 1931, and acquired the remaining stock in 1995. In 2000, NSW became a subsidiary of Corning Cable Systems. Since 2007, NSW has been a 100-percent member of the General Cable Corporation (NYSE:BGC) and has become the competence center for submarine cables for the General Cable Group.

NSW benefits not only from General Cable's profound expertise but also from its global reach in the wire and cable industry. Quality, state-of-the-art technology and customer focus are General Cable's top priorities.


NSW ® Winding Wires for Submersible Motors

Submersible motors are made to function under water (or other fluids) and the winding wires used in them accordingly require high quality insulation which is impervious to liquids.

NSW ® Winding Wires are specially designed to meet the requirements of this application. They have proven their durability and reliability over many decades and ensure trouble-free operation and long motor life.

NSW ® Winding Wires consist of a solid or multistranded bare copper conductor insulated by means of a plastic sheath either made of PVC or PE2. PVC-insulated winding wires are generally

used for voltages up to 1,000V and at temperatures up to 75 °C*. PE2-insulated winding wires can be used in submersible motors operating at higher voltages as well and at temperatures of up to a maximum of 90 °C*. Increased heat resistance is achieved by cross-linking the polyethylene.

The insulation wall thickness depends on the operating voltage. For voltages of 3kV and more, NSW recommends the use of a semiconducting layer (HL) between the copper conductor and the insulating sheath. The surface of NSW ® Winding Wires which are insulated with PE2 have a thin outer layer of polyamide (PA) for surface protection.



* The temperature specifications are valid for winding wires under normal mechanical stress. The temperatures must be reduced if necessary in the case of winding wires subjected to pronounced mechanical loading.

NSW QUALITY STANDARDS

ISO 9001 & 14001

The criteria for production and environmental management systems contained in the ISO 9001/14001 standards apply throughout the world, and of course NSW cables and jointing technologies possess the full range of quality approvals (Elettra, IEC, ISO Certificates).

Out of conviction, NSW has implemented quality standards also in its company processes and expanded them to a comprehensive management system. Consequently, the synergies created by a total system can be employed in the interests of our customers.

Independent companies use regularly occurring inspections to check compliance with the requirements of the standards. The certification documents of the [Lloyd's Register Quality Assurance GmbH](#) attest that NSW uses an active and well functioning quality and environmental management system.

Measuring and Testing at NSW

A wide range of measuring and test equipment and trained staff experienced in all the relevant measuring methods and test standards is available. NSW works to national and international test standards. In addition NSW makes use of independent test bodies such as BAM, PTB, VDE, EPM, FHG/ILV as well as other certified laboratories.

In order to assure the quality of NSW products, intensive, long term investigations are carried out on the product and materials, going far beyond the specified test requirements.

The continuous checking, monitoring and evaluation of the tests is just as much a part of the investigations as the subsequent documentation of the results.



PRODUCT QUALITY AND TESTING

Final Testing

Dimension and mechanical routine tests at room temperature include

- diameter,
- wall thickness,
- concentricity,
- surface characteristics.

High voltage routine testing in mains water bath, alternating voltage (50 Hz), water temperature of approx. 15 °C for 24 hours.

Standard dimensions, for operating voltages of up to 1 kV:

$$U_{\text{test}} = 3 \text{ kV}$$

Test duration = 10 minutes

Special dimensions, for operating voltages of more than 1 kV:

$$U_{\text{test}} = 2 U_{\text{op}} + 1 \text{ kV}$$

Test duration = 1 minute

Directly after the alternating voltage test, the insulation resistance of the winding wire is tested in compliance with the NSW Quality Plan.

If a customer specification has been agreed, different testing requirements can be applied.

If desired by a customer, a Test Certificate 3.1. in accordance with the German industrial standard DIN EN 10204 can be issued certifying that the product has successfully passed the final test.

Type Tests

At regular intervals, samples of wire are taken from the current production batch and subjected to type testing.

During type tests

- specific insulation resistance,
- instantaneous breakdown voltage,
- instantaneous breakdown field strength are tested as a function of the temperature.

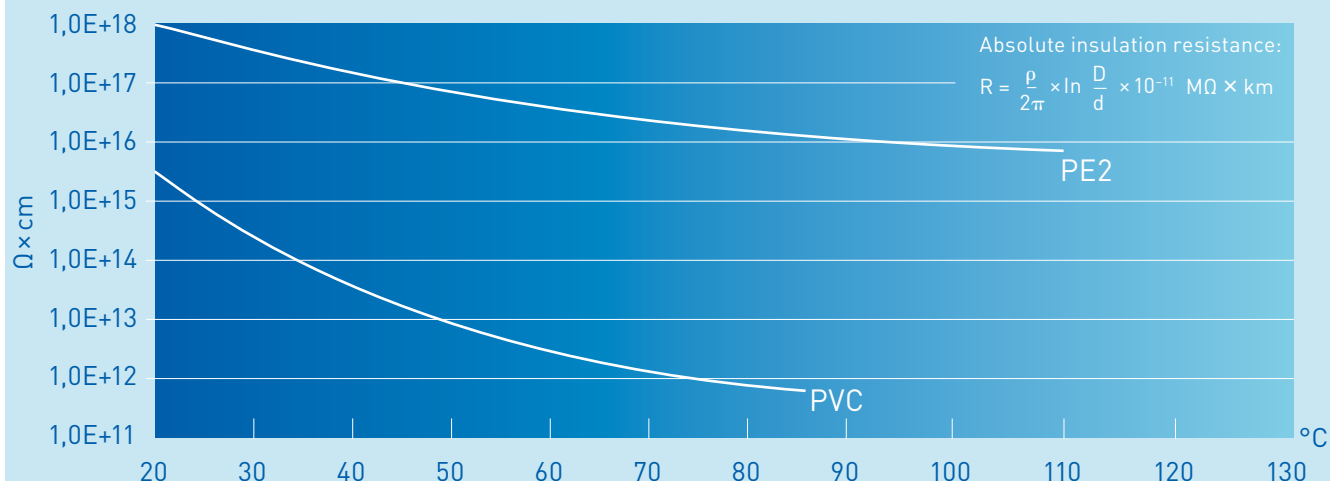
Samples of NSW  Winding

Wires are stored in a temperature-controlled testing basin filled with water. Starting at 20 °C, the temperature in the testing basin is increased in steps of 20 °C, with samples remaining at each temperature level until the insulation resistance is constant.

The specific insulation resistance of the samples is monitored over the entire duration of the test. In order to determine the instantaneous breakdown voltage and the instantaneous breakdown field strength, some of the samples are subjected to destructive testing at the end of each temperature level.

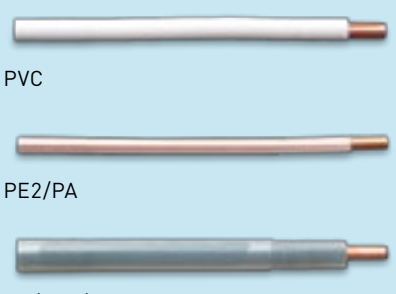
Electrical properties of NSW Winding Wires

Specific insulation resistance ρ ; $\Omega \times \text{cm}$



PRODUCT OVERVIEW

Solid Copper Conductors




PVC

PE2/PA

HL/PE2/PA*

* Special insulation

Stranded Copper Conductors



PVC

PE2/PA

HL/PE2/PA*

* Special insulation

Conductor Design

Solid Conductor

Diameter	0.6 to 4.6 mm
Cross section	0.28 to 16.60 mm ²

Stranded Conductor

Diameter	4.5 to 17.1 mm
Cross section	12.10 to 150.00 mm ²

Insulation Wall Thickness

Depending on dimensions and operating voltage

0.3 to 3.5 mm

PA-Sheathing for PE2-Insulated Wires

Depending on outer PE2 diameter

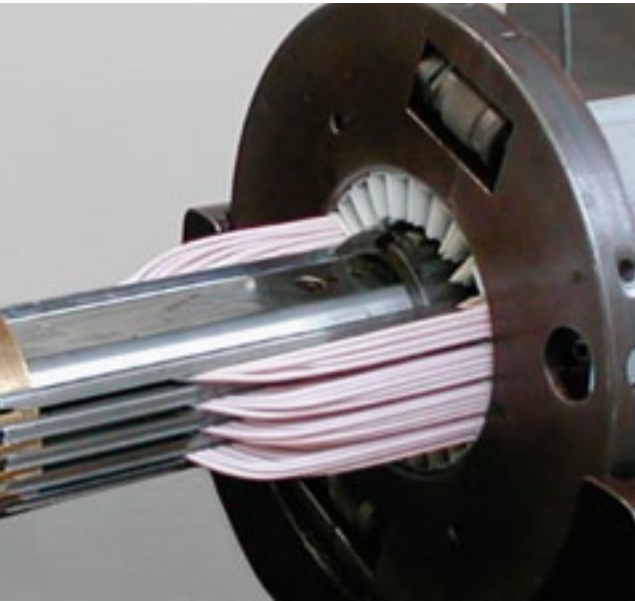
0.1 to 0.3 mm

Semiconducting Layer (HL) between Copper Conductor and PE2 Insulation

(for high voltage applications)

0.1 to 0.3 mm

Further dimensions or winding wires for special applications are available on request. Please contact us.



Automatic winding process for standard motors with PVC-insulated winding wires



Motors for special applications with PE2/PA insulated winding wires



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