SLOVENSKI STANDARD
SIST EN 50299-2:2015

01-maj-2015

Nadomešča:
SIST EN 50299:2004

Povezovalni sestavi oljnih kablov za transformatorje in dušilke, pri katerih je najvišja napetost opreme Um od 72,5 kV do 550 kV - 2. del: Suhi kabelski priključki

Oil-immersed cable connection assemblies for transformers and reactors having highest voltage for equipment Um from 72,5 kV to 550 kV - Part 2: Dry-type cable terminations

Ölgefüllte Kabelanschlusseinheiten mit Kompaktkabelanschlüssen für Transformatoren und Drosselspulen mit einer höchsten Spannung für Betriebsmittel Um von 72,5 kV bis 550 kV - Teil 2: Kompaktkabelan-schlüsse

Boîte de raccordement de câble pour transformateurs immergés et bobine d'inductance de tensions comprises entre 72,5 kV et 550 kV - Partie 2: Extrémité de câble sèche

Ta slovenski standard je istoveten z: **EN 50299-2:2014**

ICS:

29.060.20	Kabli	Cables
29.180	Transformatorji. Dušilke	Transformers. Reactors

SIST EN 50299-2:2015 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 50299-2

November 2014

ICS 29.180

Supersedes EN 50299:2002 (PART)

English Version

Oil-immersed cable connection assemblies for transformers and reactors having highest voltage for equipment Um from 72,5 kV to 550 kV - Part 2: Dry-type cable terminations

Boîte de raccordement de câble pour transformateurs immergés et bobine d'inductance de tensions comprises entre 72,5 kV et 550 kV - Partie 2: Extrémité de câble sèche

Ölgefüllte Kabelanschlusseinheiten mit Kompaktkabelanschlüssen für Transformatoren und Drosselspulen mit einer höchsten Spannung für Betriebsmittel Um von 72,5 kV bis 550 kV - Teil 2: Kompaktkabelanschlüsse

This European Standard was approved by CENELEC on 2014-10-13. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN 50299-2:2014 E

Contents

Figures

Foreword

This document (EN 50299-2:2014) has been prepared by CLC/TC 14 "Power transformers".

The following dates are fixed:

• latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2015-10-13
• latest date by which the national standards conflicting with this document have to be withdrawn	(dow)	2017-10-13

This document partially supersedes EN 50299:2002, together with EN 50299-1:2014.

The new standard EN 50299-2 is issued which describes requirements for dry-type cable terminations only.

Dimensions mentioned in EN 50299-1 are valid for fluid-filled cable terminations. Dry-type cable terminations may also fit to these requirements.

1 Scope

This European Standard covers the oil-immersed single-phase connection assemblies of cables for transformers and reactors designed in accordance with EN 60076 series.

NOTE The term "transformer" is used as common definition for transformer and reactor.

If no separate cable connection box is used and dry-type cable terminations are directly installed into the transformer tank the requirements of this standard should be followed.

The purpose of EN 50299-2 is to establish for the cable connection assemblies:

- electrical and mechanical requirements including interchangeability;
- limits of supply;
- tests to be carried out.

It complements and amends, if necessary, the relevant standards and applies to dry-type cable terminations for power cables with extruded insulation which may be used with similar interfaces for the cable entrance in switchgear applications according to EN 62271-209.

This standard applies to oil-filled cable connection boxes of transformers with highest voltage for equipment from U_m = 72,5 kV to 550 kV, including the conductor current terminal with removable link between the transformer and the dry-type cable termination.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 60076 Series — *Power transformers (IEC 60076 Series)*

EN 60076-3:2013 — *Power transformers —Part 3: Insulation levels, dielectric tests and external clearances in air (IEC 60076-3:2013)*

EN 60296 — *Fluids for electrotechnical applications — Unused mineral insulating oils for transformers and switchgear (IEC 60296)*

EN 60422 — *Mineral insulating oils in electrical equipment — Supervision and maintenance guidance (IEC 60422)*

EN 60529 — *Degrees of protection provided by enclosures (IP code) (IEC 60529)*

EN 61099 — *Insulating liquids — Specifications for unused synthetic organic esters for electrical purposes (IEC 61099)*

EN ISO 1302 — *Geometrical product specifications (GPS) — Indication of surface texture in technical product documentation (ISO 1302)*

IEC 60076-7 — *Power transformers — Part 7: Loading guide for oil-immersed power transformers*

IEC 60840 — *Power cables with extruded insulation and their accessories for rated voltages above 30 kV (U_m = 36 kV) up to 150 kV (U_m = 170 kV) — Test methods and requirements*

IEC 62067 — *Power cables with extruded insulation and their accessories for rated voltages above 150 kV (U_m = 170 kV) up to 500 kV (U_m = 550 kV) — Test methods and requirements*

HD 632 S2 — *Power cables with extruded insulation and their accessories for rated voltages above 36 kV (U_m = 42 kV) up to 150 kV (U_m = 170 kV)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
cable connection assembly
combination of a dry-type cable termination and a cable connection box which mechanically and electrically connects the cable to the transformer

3.1.1
dry-type cable termination
cable termination which comprises an elastomeric electrical stress control component in intimate contact with a separating insulation barrier (insulator or socket) between the extruded cable insulation and the liquid insulation of the transformer cable connection box. The cable termination does not require any insulating fluid

3.1.1.1
socket
part to be installed in the cable connection box to plug the cable connector. Insulating barrier (socket) between cable connector and the insulating fluid of the cable connection box enabling the mechanical and electrical connection to the transformer

3.1.1.2
plug-in cable connector
equipment fitted to the end of a cable to ensure in combination with the socket an electrical connection to the transformer

3.1.1.3
dummy plug
insulating device for voltage proof sealing of the socket

3.1.1.4
sealing cap
for protection of the socket against environmental conditions

3.1.2
cable connection box
part of the transformer which houses the dry-type cable termination and the conductor current terminal with removable link

3.1.2.1
conductor current terminal with removable link
interface to the transformer with removable connection between transformer and socket which allows the transformer to be electrically separated from the cable

4 Limits of supply

The limits of supply between the transformer and the dry-type cable termination are defined in Figure 1. The manufacturer of the dry-type cable termination supplies the parts inside of the dotted line. The manufacturer of the transformer supplies the other components. Typically, the socket will be installed in the cable connection box by the transformer manufacturer. For details refer to table of Figure 1.

5 Rated values

When dimensioning the cable connection assembly the following rated values shall apply:

a) highest voltage for equipment (U_m);

b) rated currents (I_r);

c) rated short-time and peak withstand currents;

d) rated duration of short circuit;

e) test voltages and test currents for testing the transformer;

f) test voltage for cable commissioning.

6 Preferred values

6.1 Highest voltage for equipment (U_m)

The highest voltage for equipment U_m of the dry-type cable termination shall be equal to the values for the cable and the transformer and shall be selected from the following standard values:

72,5 kV – 100 kV – 123 kV – 145 kV – 170 kV – 245 kV – 300 kV – 362 kV – 420 kV – 550 kV.

6.2 Rated currents (I_r)

Sockets shall be selected with a rated current I_r higher than 1,2 times of the rated current of the transformer. They are qualified without performing additional tests or qualifications, to ensure withstand capability of overloading conditions of transformer according to IEC 60076-7.

The rated current I_r shall be selected from the following standard values which are 20 % higher than the rated current of the transformer:

1 000 A – 1 600 A – 2 000 A – 2 500 A – 3 150 A.

Short-time and peak withstand currents as well as the duration of short circuit shall refer to the levels provided by the cable system, not exceeding the values given in IEC 60076-7 loading guide.

6.3 Transformer test voltages

Transformer test voltages shall conform to EN 60076-3.

6.4 Transformer test currents

Transformer test currents shall conform to IEC 60076-7.

6.5 Cable installation test voltage

The cable installation test voltage shall conform to HD 632 S2, IEC 60840 or IEC 62067.

7 Requirements

7.1 Isolation of transformer during cable installation tests

Means shall be provided to achieve a temporary separation of the transformer during electrical tests to verify the cable installation. Therefore a removable link located in the interface to the transformer has to be foreseen.

The removable link can be omitted in case the plug-in cable connector is separated from the socket when performing the commissioning tests.

7.2 Connection interface

The current-carrying contact surfaces of the connection interface (items 2 and 3 in Figure 1) shall be either bare copper or silver-coated or tin-coated copper or silver-coated or copper-coated aluminium.

The connection interface is defined in Figure 2.

As the maximum conductor temperature for cables is limited by the maximum operating temperature for the insulation, there are certain cable insulations which cannot withstand the maximum temperature specified for the transformer if there is heat transfer across the connection interface of the cable termination. For cases when the temperature limit given by HD 632 S2, IEC 60840 and IEC 62067 cannot be achieved, the supplier of the transformer should provide data on temperature rise of the main circuit end terminal and the insulation liquid as function of current.

7.3 Mechanical requirements

The cable connection box and its internal components shall have the same degree of vacuum tightness, leak tightness and oil tightness as the transformer according to EN 60076 series.

The dry-type cable termination shall be able to withstand a static mechanical force of 2 kN applied transversely to its interface point.

Forces and movements from the transformer can be experienced due to temperature variations and vibrations in service. These forces can act on both transformer as well as on the dry-type cable termination

and largely depend on transformer design, installation of the dry-type cable termination, cable design and the type of mechanical support. The design of any support structure should take into account these forces and movements. It is particularly important that the support for the cable connection box should not be fastened to the clamping flange and/or the cable gland (Figure 1, item 8 and 11).

7.4 Shielding electrode

The fastening of the shielding electrode (item 4 in Figure 1) shall not restrict the current-carrying contact surfaces of the connection interface (items 2 and 3 in Figure 1). The shielding electrode shall be designed so that it can be vented in every installation position. There is a field-free region within the shielding electrode, i.e. the connection interface does not contribute to control the electrical field.

7.5 Insulating liquids

Filling of the cable connection box is usually performed under vacuum conditions with degassed insulating liquid. However, if the transformer tank is not designed to withstand vacuum, the filling of the cable connection box shall be carried out under the same conditions as for the main transformer tank.

The insulating liquid used for filling the cable connection box shall comply with the requirements of EN 60296 or EN 61099 and shall meet the requirements of EN 60422.

The breakdown voltage of the insulating liquid in new equipment should be > 60 kV. Depending on the nominal system voltage the breakdown voltage of insulating liquid of equipment in service can be lower.

7.6 Dimensions

Figure 1 and 2 shows a typical arrangement of a cable connection assembly with entry of the cable from below. Dimensions for cable connection assemblies are defined in Table 1.

The information about surface conditions in Figure 2 is stated in accordance with EN ISO 1302.

NOTE Dimensions, as far as applicable, are harmonised with EN 62271-209:2007, Figure 5.

7.7 Protection against corrosion

The cable connection assembly shall have the same degree of protection against corrosion as the associated transformer tank.

7.8 Measuring tap

If a socket is equipped with a measuring tap, the manufacturer shall specify the following information:

- capacitance to earth;
- capacitance to high voltage;
- dielectric strength (insulation level).

If not used, the measuring tap shall be earthed with suitable earthing equipment to secure against accidentally detachment.

7.9 Earthing

The clamping flange of the socket shall allow an earth connection to the cable connection box.

7.10 Sealing cap

Sealing caps are used for protection of the socket against environmental conditions in case that no plug-in cable connector is installed. If a socket is equipped with a sealing cap, the degree of protection shall be IP66 according to EN 60529. Sealing caps are not voltage proof.

NOTE The necessity of a sealing cap is agreed between parties. When necessary, the sealing cap is provided by the supplier of the socket.

7.11 Dummy plug

A dummy plug is a voltage proof sealing of the socket, e. g. for testing purposes, in case that no plug-in cable connector is installed. If the socket is equipped with a dummy plug, it shall be able to withstand all testing and operation conditions.