GB

NATIONAL STANDARD OF THE

PEOPLE'S REPUBLIC OF CHINA

ICS 29.020

K 04

GB/T 40093-2021

Life cycle assessment method for transformer

变压器产品生命周期评价方法

Issued on: May 21, 2021 **Implemented on: December 01, 2021**

Issued by: State Administration for Market Regulation;
Standardization Administration of the People's Republic of China.

Table of Contents

Life cycle assessment method for transformer

1 Scope

This Standard specifies the life cycle assessment and life cycle report of transformer products.

This Standard applies to the life cycle assessment of transformer products; transformer products make Type III environmental declaration in accordance with GB/T 24025-2009.

Note: According to GB/T 24025-2009, this Standard is a product category rule for transformer products to carry out type III environmental declaration. The use of product category rules when making type III environmental declaration helps to ensure the credibility and comparability of life cycle assessment conclusions.

This Standard applies to the power transformers that are specified in GB/T 1094.1, including transformers directly supplied to end users (final products) and transformers as part of equipment (intermediate products). It can also be used as reference for other similar transformer products.

2 Normative references

The following documents are indispensable for the application of this document. For dated references, only the dated version applies to this document. For undated references, the latest edition (including all amendments) applies to this document.

GB/T 1094.1, Power transformers - Part 1: General

GB/T 24025-2009, Environmental labels and declaration - Type III environmental declarations - Principles and procedures

GB/T 24040-2008, Environmental management - Life cycle assessment - Principles and frameworks

GB/T 24044-2008, Environmental management - Life cycle assessment - Requirements and guidelines

GB/T 37552-2019, Guidance on life cycle assessment for electrical and electronic products

The product description shall enable users to clearly identify the product, such as:

a) product name;

b) product model, specification or dimensions;

c) parameters related to product weight;

d) main technical parameters and performance of the product;

e) relevant quality standards that the product meets;

f) other marks obtained by the product, etc.

It can be described with reference to the requirements of relevant transformer standards.

4.2 Product life cycle assessment scope

4.2.1 Functional unit

This Standard takes "1 transformer" as the functional unit; the description of the functional unit shall include, but is not limited to:

a) function of the product (that is, the service to the user);

b) rated capacity;

c) rated voltage;

d) rated frequency;

e) phase number;

f) cooling method;

g) reference life time (design life).

Note: For 1 three-phase dry-type distribution transformer, the rated capacity is 315 kVA; the rated voltage is 10/0.4 kV; the rated frequency is 50 Hz; the cooling method is AN/AF; the reference life time is 20 years.

The reference flow of the corresponding functional unit includes:

a) reference product that realizes the functions described in the functional unit;

ΔP – active power loss, in kilowatts (kW);

P_0 – no-load loss, in kilowatts (kW);

β – average annual load rate of the transformer, dimensionless;

P_K – rated load loss, in kilowatts (kW).

$$\Delta Q = Q_0 + K_Q \times \beta^2 \times Q_K \quad \cdots\cdots (2)$$

Where:

ΔQ – reactive power loss, in kilowatts (kW);

Q_0 – No-load reactive power loss, in kilovars (kvar);

K_Q – reactive economic equivalent, in kilowatts per kilovar (kW/kvar);

β – average annual load rate of the transformer, dimensionless;

Q_K – rated load leakage magnetic power, in kilovars (kvar).

$$Q_0 = I_0 \times S_N \quad \cdots\cdots (3)$$

Where:

Q_0 – No-load reactive power loss, in kilovars (kvar);

I_0 – percentage of no-load current of the transformer, in percentages (%);

S_N – rated capacity of the transformer, in kilovolt-amperes (kVA).

$$Q_K = U_K \times S_N \quad \cdots\cdots (4)$$

Where:

Q_K – rated load leakage magnetic power, in kilovars (kvar);

U_K – percentage of the short-circuit impedance, in percentages (%);

S_N – rated capacity of the transformer, in kilovolt-amperes (kVA).

$$\Delta P_Z = \Delta P + K_Q \times \Delta Q \quad \cdots\cdots (5)$$

Where:

ΔP_Z – total loss, in kilowatts (kW);

ΔP – active power loss, in kilowatts (kW);

K_Q – reactive economic equivalent, in kilowatts per kilovar (kW/kvar);

ΔQ – reactive power loss, in kilowatts (kW).

The above parameters shall be determined according to the specific conditions of the product. Examples are as follows:

When taking the minimum load of the 6 kV ~ 10 kV step-down transformer which is used in urban power grids and industrial enterprise power grids, its reactive power equivalent K_Q = 0.1 kW/kvar; the average annual load rate of the transformer, for agricultural transformers, may be β = 20%; for industrial enterprises of three-shift system, it may be β = 75%; for P_0, P_K, I_0%, U_K%, see product information.

4.3.1.2.2 Maintenance requirements

If applicable, the maintenance frequency of the product and the parts and materials used for maintenance shall be stated.

4.3.1.3 End-of-life stage

The following processing links shall be considered for all elements of the life cycle and recorded in the life cycle assessment report:

a) product/material disposal process (energy recovery, landfill);

b) product/material recycling (reuse, recycling or energy recovery).

If the data processed at the end-of-life stage is not available, the transportation of end-of-life waste and the types of waste materials shall be considered.

4.3.2 Data unit

4.3.2 in GB/T 37552-2019 applies.

4.3.3 Data collection requirements

4.3.3 and 4.3.4 in GB/T 37552-2019 apply.

4.3.4 Data quality assessment

4.4 in GB/T 37552-2019 applies.

4.3.5 Cut-off criteria

4.5 in GB/T 37552-2019 applies.

This is an excerpt of the PDF (Some pages are marked off intentionally)

------ The End ------