

**THE RESEARCH COMMITTEE FOR TOTAL ENERGY
THE ENERGY CONSERVATION STANDARDS
WORKING GROUP**

**THE SUB-COMMITTEE FOR
JUDGEMENT CRITERIA
FOR TRANSFORMERS**

SUMMARY OF FINAL CRITERIA

April 3, 2002

This Sub-Committee deliberated on matters that would serve as criteria for manufacturers and importers of transformers (hereinafter referred to as "manufacturers and the like") in making decisions about energy consumption efficiency and the like of transformers and compiled a summary as follows.

1. Scope

Transformers for high-voltage receiving and distribution, excluding gas insulating transformers, H class dry-type transformers, single-phase transformers with capacity not more than 5kVA or three-phase transformers with capacity not more than 10kVA, transformers with capacity over 2000kVA, Scott-connected transformers, transformers in mold structure for shared use between lighting and power, transformers with low voltage output voltage below 100V or above 600V, forced-air-cooled or water cooled type transformers, and multi-winding transformers.

(See Attachment 1)

2. Judgement Criteria for Manufacturers and the Like (See Attachments 2 to 4)

(1) Target year

1) Oil-filled transformers: FY 2006

2) Mold transformers: FY 2007

(2) Target standard value

Regarding the transformers shipped to the domestic market by each manufacturer or the like in the target years, a weighted average of energy consumption efficiency must not exceed the target standard value in each category in the following table. The weighted average is calculated for each category as follows: first, the energy consumption efficiency should be measured by the measuring method set forth in Paragraph (3), and then it should be averaged using the number of units shipped by each manufacturer as the weight.

[Target Standard Values of Energy Consumption Efficiency]

Product category	No. of phases	Rated frequency Rated capacity	Formula for target standards (Note)	Class
Oil-filled transformers	Single phase	50 Hz - 500 kVA or less	$E=15.3 \cdot (\text{kVA})^{0.696}$	I
		60 Hz - 500 kVA or less	$E=14.4 \cdot (\text{kVA})^{0.698}$	II
	Three phase	50 Hz - 500 kVA or less	$E=23.8 \cdot (\text{kVA})^{0.653}$	III-1
		50 Hz - over 500 kVA	$E=9.84 \cdot (\text{kVA})^{0.842}$	III-2
		60 Hz - 500 kVA or less	$E=22.6 \cdot (\text{kVA})^{0.651}$	IV-1
		60 Hz - over 500 kVA	$E=18.6 \cdot (\text{kVA})^{0.745}$	IV-2
Mold transformers	Single phase	50 Hz - 500 kVA or less	$E=22.9 \cdot (\text{kVA})^{0.647}$	V
		60 Hz - 500 kVA or less	$E=23.4 \cdot (\text{kVA})^{0.643}$	VI
	Three phase	50 Hz - 500 kVA or less	$E=33.6 \cdot (\text{kVA})^{0.626}$	VII-1
		50 Hz - over 500 kVA	$E=24.0 \cdot (\text{kVA})^{0.727}$	VII-2
		60 Hz - 500 kVA or less	$E=32.0 \cdot (\text{kVA})^{0.641}$	VIII-1
		60 Hz - over 500 kVA	$E=26.1 \cdot (\text{kVA})^{0.716}$	VIII-2

E: Total loss (W) of transformer

*The reference load factor is 40% for a transformer capacity of 500kVA or less, and 50% for a transformer capacity over 500 kVA.

kVA: Capacity of transformer (kVA)

Note: Regarding target standard values for semi-standard products, the value obtained by the target-standards formula for each category is multiplied by the appropriate one of the following factors.

Oil-filled transformers	1.10
Mold transformers	1.05

(3) Measuring method (see Attachment 5)

The energy consumption efficiency of the transformer is represented by total loss (W), which is calculated from the following formula using no-load loss (W) and load loss (W) measured by the method stipulated by JIS C 4304 and JIS C 4306.

$$\text{Total loss (W)} = \text{No-load loss (W)} + (m/100)^2 \times \text{Load loss (W)}$$

m: Reference load factor

Transformers with capacity of 500kVA or less: 40 (%)

Transformers with capacity over 500kVA: 50 (%)

(4) Labeling method

1) Items to be indicated are as follows.

- Product name and model name
- Structure (oil-filled or mold)
- Rated capacity (kVA)
- Number of phases
- Rated frequency (Hz)
- Rated voltage (V)
- Energy consumption efficiency (total loss (W))
- Reference load factor (%)
- Standard (Standard (JIS or JEM) or semi-standard)
- Name of manufacturer or the like

2) Use three or more significant digits (two or more significant digits for 100 (W) or less) when indicating energy consumption efficiency and items to be complied with.

3) Indicate the above items indelibly in an easily viewable place on catalogs containing performance data and on other documents presented by manufacturers and the like for equipment selection.

3. Recommendations for Energy Saving

(1) Users' Efforts

Users should try to select products with high energy consumption efficiency and appropriate capacity when purchasing transformers and make efforts to save energy by using transformers in an appropriate and efficient manner.

(2) Efforts by manufacturers and the like

1) Manufacturers and the like should make efforts to promote technology development for energy saving of transformers and to develop products with high energy consumption efficiency.

2) Manufacturers and the like should make efforts to gain users' understanding to promote widespread use of transformers with high energy consumption efficiency.

(3) Government's efforts

In order to promote widespread use of transformers with high energy consumption efficiency, the government should try to gain users' understanding and encourage manufacturers' efforts by taking necessary measures such as assistance policies and encouragement of widespread use.

4. Circumstances of Discussion

(1) Circumstances leading to organization of sub-committee (see Attachment 6)

(2) Committee member list (see Attachment 7)