Revision: 2
Date: 21/07/2009

Schedule 4 – Distribution Transformer

Technical Specifications - Distribution Transformer

1. Scope

1.1 This standard specifies the requirements for participating in the pilot energy labelling scheme for oil immersed, naturally air cooled, three phase, and double wound non sealed type out door distribution transformer.

1.2 The referred Indian Standard are IS 1180 (part I) Out door type three- phase distribution transformers upto and including 200 kVA, 11 kV – specification, IS 2026 (part 2) Specifications of power transformers – for Temperature-rise and IS 2500 (part-I) -2000: Sampling Schemes indexed by Acceptance Quality Limit (AQL) for lot-by-lot inspection.

1.3 The standard ratings covered under the pilot energy labelling scheme is 16, 25, 63, 100, 160 and 200 kVA and non standard ratings from 16 kVA to 200 kVA.

2. Schedule of Tests:

2.1 Method of Tests:

The testing code and procedure for distribution transformer would be as per IS 1180 (part 1): 1989 with all amendments as of date. The exception is conditions on limits of temperature rise. For the scheme the following would be used. Reduce the temperature rise limits of top oil and transformer winding from the existing IS 1180 (part 1): 1989 level of 45^0 C & 55^0 C to 35^0 C & 40^0 C.

2.2 Parameters to be tested:

Parameters for initial testing the type test parameters set out in IS 1180 (part 1) and the same is reproduced below:

a. Measurement of winding resistance [IS 2026 (part I):1977]
b. Measurement of voltage ratio and check of voltage vector relationship [IS 2026 (part I):1977]
c. Measurement of impedance voltage/short circuit impedance and load loss [IS 2026 (part I):1977]
d. Measurement of no-load loss and current [IS 2026 (part I):1977]
e. Measurement of insulation resistance [IS 2026 (part I):1977]
f. Induced over-voltage withstand test [IS 2026 (part 3):1981]
g. Separate-source voltage withstand test [IS 2026 (part 3):1981]
h. Lightning impulse test [IS 2026 (part 3):1981]
i. Temperature-rise test [IS 2026 (part 2):1977]
j. Short-circuit test [IS 2026 (part I):1977]
k. Air pressure test [IS 1180 (part 1): 1989]
l. Permissible flux density and over fluxing [IS 1180 (part 1): 1989]

Parameters for verification & challenge testing are as follows:

a. Measurement of winding resistance [IS 2026 (part I):1977]
b. Measurement of impedance voltage/short circuit impedance and load loss [IS 2026 (part I):1977]
c. Measurement of no-load loss and current [IS 2026 (part I):1977]
d. Temperature-rise test [IS 2026 (part 2):1977]

3. Tolerances:

No positive tolerance shall be allowed on the maximum losses displayed on the label for both 50% & 100% loading values.

4. Star rating plan:

4.1 Basis:

The existing efficiency or the loss standards are specified in IS 1180 (part 1). This standard defines load losses and no load losses separately. For the BEE labelling programme total losses at 50% and 100% load have been defined.
The highest loss segment is defined as star 1 and lowest loss segment is defined as star 5. The existing IS 1180 (part 1) specification losses are the base case with star 1.The basis for star rating plan is as follows:

Case	Basis of losses (Total at 50% Load Condition)
Base case Star 1	Current purchasing practice (IS 1180 (part 1)Max Losses)
Star 2	Some utility purchase specs like AP, NDPL
Star 3	Losses from TOC design (Moderate)
Star 4	Losses from lowest TOC design
Star 5	High efficiency design

4.2. Star Rating plan:

The total losses at 50% and 100% loading shall not exceed the values given below:

Rating	1 star		2 star		3 star		4 star		5 star	
kVA	Max Losses at 50% (Watts)	Max Losses at 100% (Watts)	Max Losses at 50% (Watts)	Max Losses at 100% (Watts)	Max Losses at 50% (Watts)	Max Losses at 100% (Watts)	Max Losses at 50% (Watts)	Max Losses at 100% (Watts)	Max Losses at 50% (Watts)	Max Losses at 100% (Watts)
16	200	555	165	520	150	480	135	440	120	400
25	290	785	235	740	210	695	190	635	175	595
63	490	1415	430	1335	380	1250	340	1140	300	1050
100	700	2020	610	1910	520	1800	475	1650	435	1500
160	1000	2800	880	2550	770	2200	670	1950	570	1700
200	1130	3300	1010	3000	890	2700	780	2300	670	2100

For non standard rated transformer from 16 kVA upto 200 kVA which is not listed above ,the total losses at 50% and 100% loading for a given non standard rated transformer is going to be determined by the following equations :

$$Y_0\ 50\% = \left[\frac{K_{X0} - K_{X1}}{K_{X2} - K_{X1}}\right] X \left[L_2 - L_1\right] + M_L X_1$$

$$Y_0\ 100\% = \left[\frac{K_{X0} - K_{X1}}{K_{X2} - K_{X1}}\right] X \left[L_2 - L_1\right] + M_L X_1$$

Where;

K = kVA rating of the transformer
L = losses
M_L = Maximum Losses for a given star rating.
X_0 = kVA rating of the Non Standard Rating transformer
X_1 = kVA rating of the Standard rated transformer below X_0
X_2 = kVA rating of the Standard rated transformer above X_0
L_2 = Maximum Losses for a given star rating of standard rating transformer above X_0 @ a particular loading.
L1 = Maximum Losses for a given star rating of standard rating transformer below X_0 @ a particular loading.
$M_L X_1$ = Maximum Losses of X_1 @ a particular loading for a given star rating.

5. Qualifications:

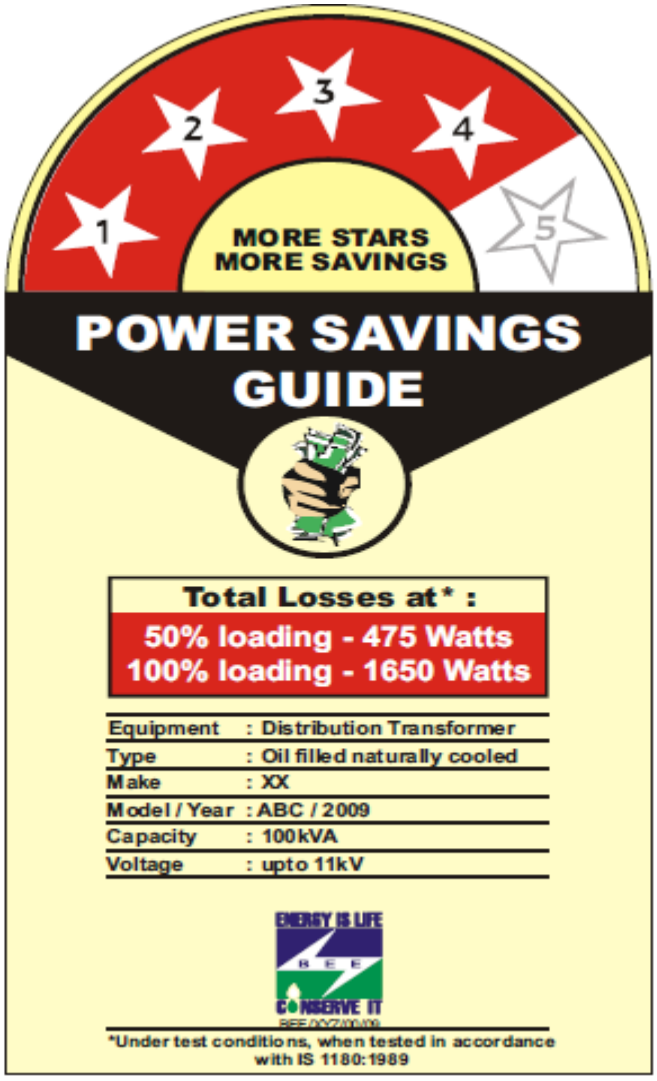
a) The products should conform to minimum requirements of IS 1180 (part 1): 1989 to participate in BEE S&L Programme.

b) BIS product certification or at-least, Quality Certification such as ISO -9000 should be required to participate in BEE S&L Programme.

6. **Sampling plan:**
Sampling for test checking would be carried out after the deliveries are made to the utility on the basis of tender. Sampling would be guided by IS 2500 (part-I) -2000: Sampling Schemes indexed by Acceptance Quality Limit (AQL) for lot-by-lot inspection

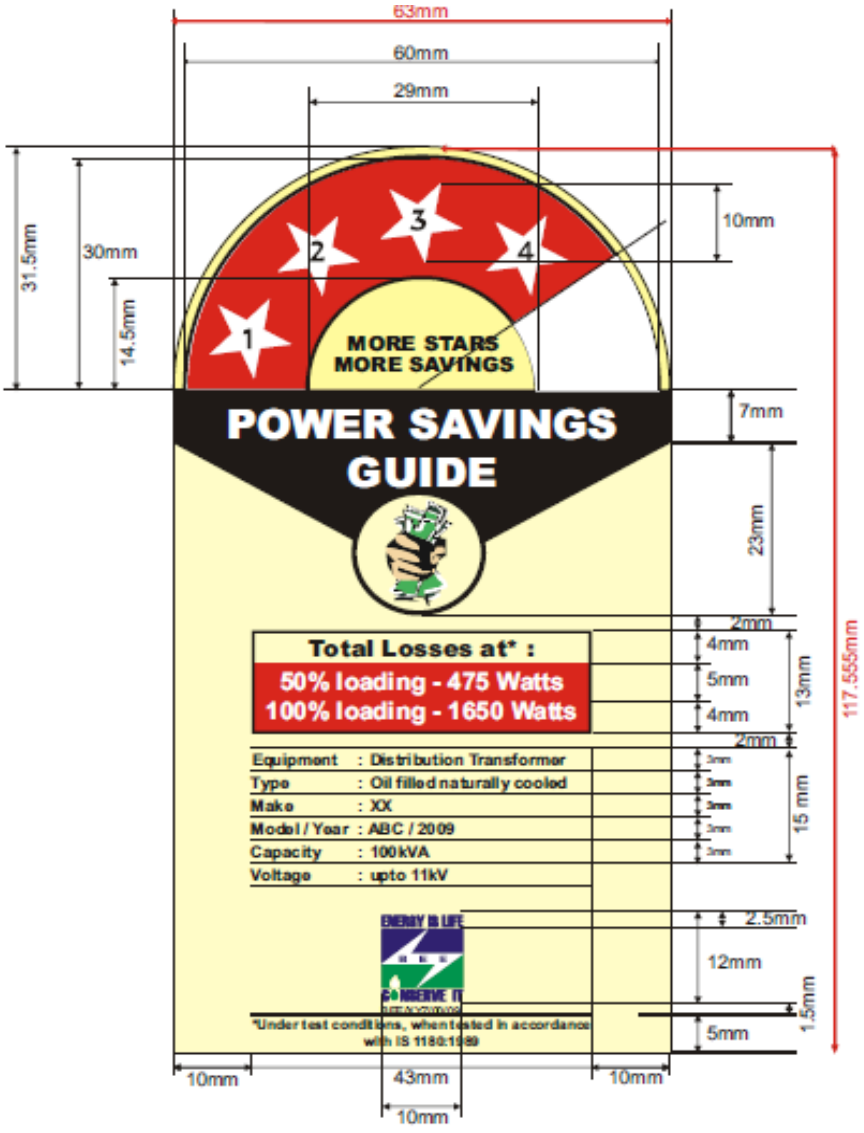
7. **Label design, manner of display:**

7.1. Detailed label specifications (size, colour scheme, font size, security features, if any, etc), content of the label (parameters displayed on the label) is provided below:

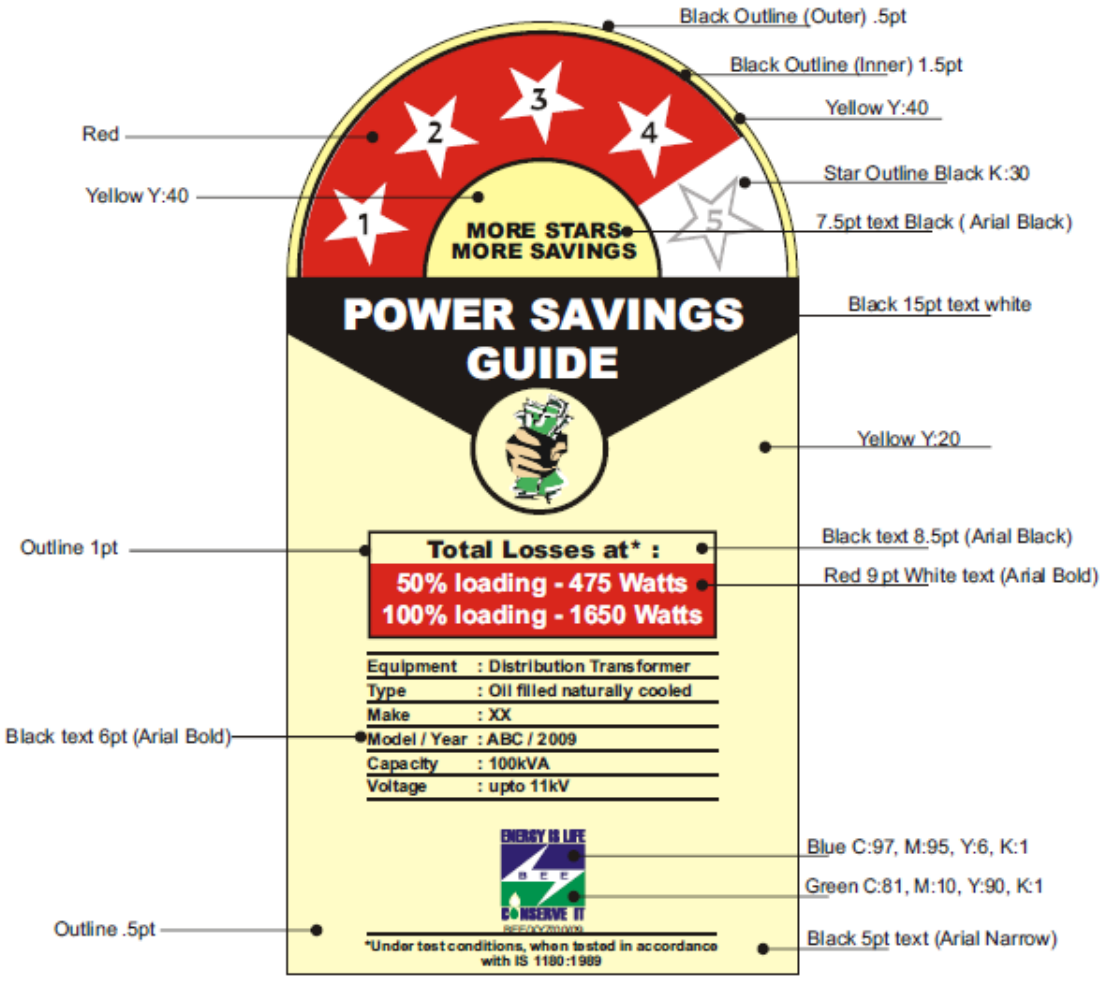


7.2. Manner of display of label:

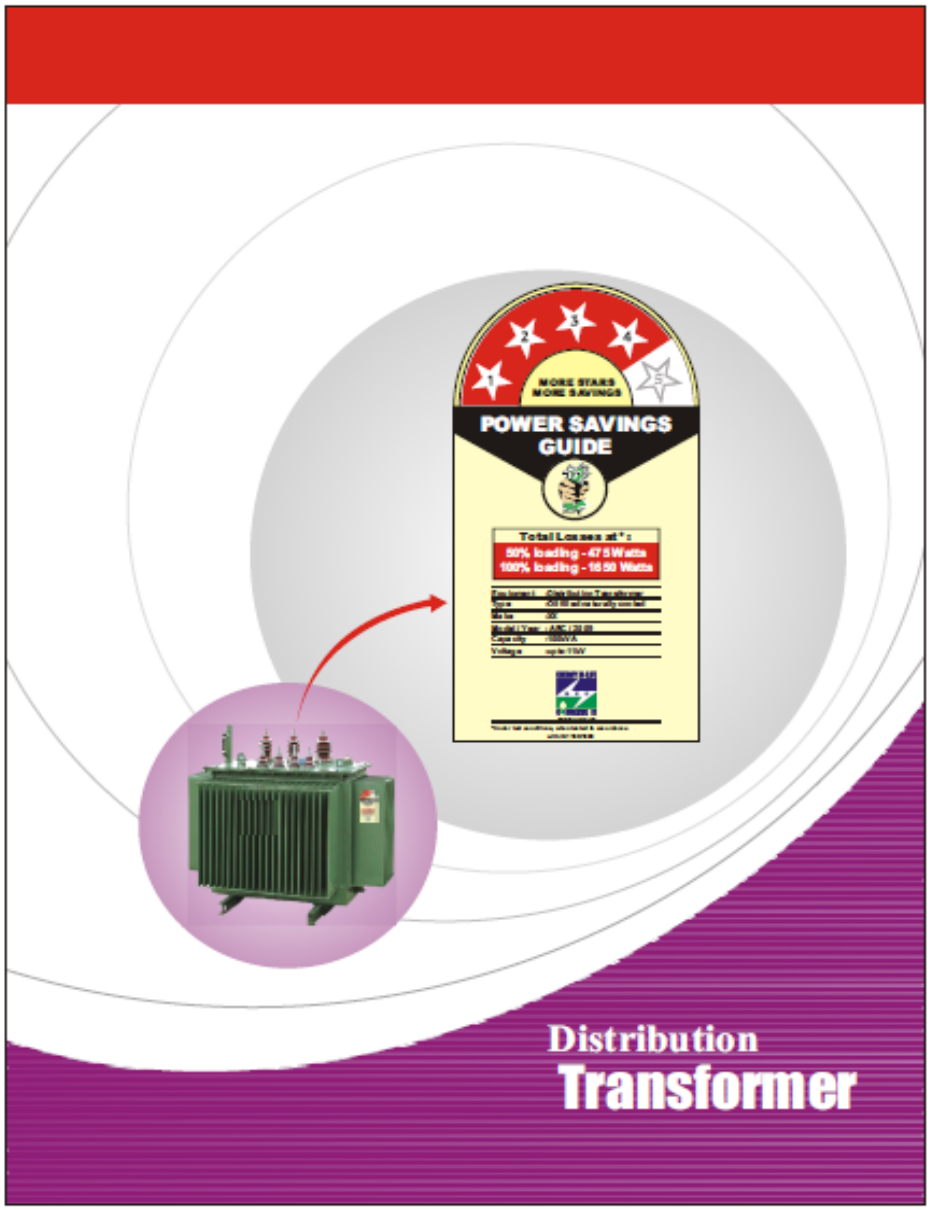
The label shall be applied on the front base of the equipment near the name plate, so as to be prominently visible on the equipment.



7.3. Colour Scheme:



Sample Picture of manner of affixing of Label:



8.0 Labelling Fees:

1. Registration fee is payable on application for authority to affix labels is Rs. 1000/- (Rupees one thousand only)
2. Registration fee is payable on application for renewal of authority to affix labels is Rs. 500/- (Rupees five hundred only)
3. Labeling fee for affixation of label on each Distribution Transformer is Rs. 100 (One hundred rupees only).