Schedule – 4
Direct Cool Refrigerator

1. Scope

1.1 This scheme specifies the energy labelling requirements for electric mains powered Direct Cool refrigerating appliance of the vapour compression type intended for household and similar use being manufactures, imported, or sold in India.

1.2 This Standard shall be read in conjunction with AS/NZS 4474.1:1997: Energy Consumption and performance and AS/NZS 4474.2:2001: Energy labelling and minimum energy performance standard.[1]

1.3 In particular, this schedule specifies the following:

(a) Projected Annual Energy Consumption (PAEC)
(b) Tested Energy Consumption (E_t)
(c) Comparative Energy Consumption (CEC)
(d) Total Adjusted Storage Volume for Direct Cool ($V_{adj\_tot\_dc}$)
(e) Star Rating Plan
(f) Printing requirements for refrigerating appliances energy labels

The above terms have been defined in Annexure I – Section 1 (DEFINITIONS) of this schedule.

2. Schedule of tests

2.1 Method of tests

The testing code and procedure for Direct Cool Refrigerator would be as per AS/NZS 4474.1:1997: Energy Consumption and performance with all amendments.

2.2 Parameters to be tested

2.2.1 Energy Consumption

The Energy Consumption of the Direct Cool refrigerator will be tested as per Appendix K & Appendix O of AS/NZS 4474.1:1997.

NOTE: Exception to AS/NZS 4474.1:1997 Part 1: For Direct-Cool refrigerators the target temperature for the freezer compartment is - 6°C till further notification.

2.2.2 Rated Volume (Storage and Gross)

Each compartment gross and storage volume of the appliance shall meet the requirements set out in Section 3 and Appendix A of AS/NZS 4474.1:1997.

[1] **THE AS/NZS 4474.1:1997 TEST PROCEDURES ARE BEING USED IN THE INTERIM, TILL IS 1476 (Part -1): 2000 IS REVISED**

2.3 Test Report

The results of tests shall be reported as per Appendix Q of the AS/NZS 4474.1:1997 with the relevant sections from the mentioned appendix applicable and will clearly mention the gross volume and the storage volume.

3. Tolerance Limit

The tolerance limit for the volume (storage & gross), pull-down, and operating temperature performance shall be as defined in AS/NZS 4474.1:1997.

4. Conditions of Compliance

The conditions of compliance shall be as specified in AS/NZS 4474.1:1997.

5. Rating Plan

Rating plan will be as per Annexure I – Section 2 (CALCULATIONS FOR THE ENERGY LABEL) of this schedule.

6. Sampling

The samples will be picked up by Bureau of Energy Efficiency (BEE) or its designated agency for testing as per the following sampling plan:

- **a)** One sample will be picked up at random from the manufacturing facility or warehouse.
- **b)** One sample will be picked from a retail outlet.

7. Qualification

a) Pull Down Test

The appliance shall meet the requirements set out in Section 3 and Appendix G of AS/NZS 4474.1.

b) Operating Temperature Performance Test

Operating Temperature Performance Test as defined in Section 2 and Appendix J of AS/NZS 4474.1:1997 shall be required only if consideration for special compartment(s) is taken in calculating adjusted volume.

While all units within a model are required to meet the Pull-down test (and Operating Temperature Performance test as applicable), a test report for a single unit is required to confirm this for the purposes of energy labelling.

8. Label Design, manner of display

The label design and manner of display will be as per Annexure I - Section 3 (LABEL DESIGN AND MANNER OF DISPLAY) of this schedule.

9. Fees

- **a)** Registration fee is payable on application for assignment of authority is Rs. 1000 (One thousand only).
- **b)** Registration fee is payable on application for renewal of authority to affix labels is Rs. 500 (Five hundred only).
- **c)** Labelling fee for affixation of label on each piece of Direct Cool (DC) refrigerator is Rs. 5 (Five only).

ANNEXURE – I

SECTION 1
DEFINITIONS

1 Definitions

For the purposes of this schedule, the definitions given in AS/NZS 4474.1:1997 and AS/NZS 4474.2: 2001 and those below apply. The definitions below take preference over the ones in the above mentioned standards.

1.1 Direct Cool (DC) Appliance

These are the refrigerators with or without crisper, ice making or frozen food storage compartments and are NOT cooled by internal forced air circulation. Cooling is primarily obtained by natural convection only. However some products may have fan to avoid internal condensation but not to claim as frost free.

1.2 Projected Annual Energy Consumption (PAEC)

The estimated energy used by a single unit during one year's use. This is calculated from Tested Energy Consumption (E_t) (refer 2.1.1 of this Annexure). (Units: kWh/Year)

1.3 Tested Energy Consumption (E_t)

The value of energy consumption as determined by Appendix K of AS/NZS 4471.1:1997. This is calculated for a period of 24 hours. (Units: Wh)

1.4 Comparative Energy Consumption (CEC)

The nominal energy consumption of a model of refrigerating appliance. It is based on the $PAEC_{av}$ of the model (refer 2.2 of this Annexure). The CEC appears on the energy label. (Units: kWh/Year)

1.5 Total Adjusted Storage Volume for Direct Cool ($V_{adj\_tot\_dc}$)

The rated storage volume of a compartment adjusted to compensate for heat loadings on spaces which are at temperature other than that of fresh food type space.

NOTE: The adjusted volume shall be calculated on the basis of the **STORAGE VOLUME** of each compartment.

1.6 Star Rating

The number of stars displayed on the energy label. The available stars are between a minimum of one and a maximum of five shown in one star interval. The star rating is calculated from the Star Rating Band (refer 2.5 of this Annexure) The Star Rating determination will vary for different models based on the storage volume**.** (No units)

1.7 Star Rating Band

The Star Rating Band is a range of energy efficiency (kWh/Year) which is arrived by calculations (refer 2.5 of this annexure), and is used for determining the number of stars displayed on the energy label.

1.8 Family of models

Family of models is the range of models of one particular brand, to which a single set of test reports is applicable and where each of the models has the same relevant physical characteristics, comparative energy consumption, and energy efficiency rating and performance characteristics. The term 'model' is synonymous with 'family of models'.

1.9 Variant

A model variant is an alternative version of a model which has the same sales specification and the same model number or other form of designation as another version of the model, and offers the same performance except that it has a different PAEC and may have a different Star Rating.

SECTION 2
CALCULATIONS FOR THE ENERGY LABEL

2.1 GENERAL

This Section sets out the equations and procedures for calculating values of Projected Annual Energy Consumption (PAEC) & Comparative Energy Consumption (CEC) and the Star Rating which appear on the energy label.

2.1.1 Projected Annual Energy Consumption (PAEC)

The process consists of measuring the tested energy consumption (E_t) (Appendix K of AS/NZS 4471.1:1997), of each unit tested, then calculating the projected annual energy consumption (PAEC) of the unit.

$$PAEC = E_t * (365/1000) \qquad \text{(kWh/Year)}$$

E_t = tested energy consumption expressed in Wh per 24 hours, rounded to the nearest whole number.

2.2 NUMBER OF TEST AND PROCESSING OF DATA

2.2.1 Number of units required

For the purpose of determining the CEC of a model for labelling, three separate units of the nominated model shall be tested for energy consumption in accordance with Section 2 of AS/NZS 4474.1:1997.

2.2.2 Number of tests per unit

Each unit shall be tested with sufficient test runs to enable a valid E_t to be determined for that unit. This determination shall be documented in a test report containing the test result for all test runs used to derive E_t (refer to AS/NZS 4474.1:1997, Appendices K and Q).

2.2.3 Results

After testing three or more separate units the separate values of PAEC shall be averaged and referred to as $PAEC_{av.}$

2.2.4 Rounding

Unless otherwise stated, number shall be rounded and recorded to five significant figures. The values of PAEC, $PAEC_{av}$, CEC, and Star Rating Band shall be rounded of (< 0.5 to lower whole number and = 0.5 to higher whole number) to the nearest whole number.

2.3 COMPARATIVE ENERGY CONSUMPTION

2.3.1 General

The CEC for a model shall not be less than the average (rounded to a whole integer) PAEC value (i.e. $PAEC_{av}$) for the three (or more) units which are tested to determine the label particulars. The CEC shall be an integer in units of kWh/Year.

The CEC and Total Adjusted Storage Volume for Direct Cool ($V_{adj\_tot\_dc}$) shall be used to determine the Star Rating Band and Star Rating of the model.

2.3.2 Variant

Two or more variants of a model may use a common label with a CEC not less than the highest $PAEC_{av}$ (rounded to the nearest whole number) of those variants.

2.4 TOTAL ADJUSTED STORAGE VOLUME FOR Direct Cool ($V_{adj\_tot\_dc}$)

Fresh Food Chamber Target Temperature = +3 Degree Celsius
Freezer Chamber Target Temperature = -6 Degree Celsius

Adjusted Volume Factor = (Test room Temperature – Freezer Temperature) /
(Test room Temperature – Fresh Food Temperature)
= [32 - (-6)] / [(32 - 3)]
= 1.31

Total Adjusted Volume for Direct Cool refrigerator ($\mathbf{V_{adj\_tot\_dc}}$)
= Fresh Food Storage Volume + 1.31 * Freezer Storage Volume

2.5 STAR RATING

The star rating parameters **k_{dc} (Constant Multiplier (kWh/Litre/Year)) & c_{dc} (Constant Fixed Allowance (kWh/Year))** shall be obtained from TABLE 2.1 / 2.2 / 2.3, depending on the year of manufacturing/import/assembling

S. No	Product Manufactured/Imported/Assembled	Table to be used
1	1 November 2006 to 31 December 2008	2.1
2	1 Jan 2009 to 31 December 2011	2.2
3	1 Jan 2012 to 31 December 2014	2.3

The following equation shall be used to determine the Star Rating Bands for a particular model:

$$\textbf{Star Rating Band (SRB)}_{dc} = k_{dc} * V_{adj\_tot\_dc} + c_{dc}$$

Where,

K_{dc} = Constant Multiplier (kWh/Litre/Year)
$V_{adj\_tot\_dc}$ = Total Adjusted Storage Volume for Direct Cool (Litre)
C_{dc} = Constant Fixed Allowance (kWh/Year)

TABLE 2.1: Star Rating Band valid from 01 November 2006 to 31 December 2008

Star Rating Band	k_{dc} Constant Multiplier	c_{dc} Constant Fixed Allowance
1 Star *	0.645	541
2 Star * *	0.516	432
3 Star * * *	0.413	346
4 Star * * * *	0.330	277
5 Star * * * * *	0.264	221

TABLE 2.2: Star Rating Band valid from 01 January 2009 to 31 December 2011

Star Rating Band	k_{dc} Constant Multiplier	c_{dc} Constant Fixed Allowance
1 Star *	0.413	346
2 Star * *	0.330	277
3 Star * * *	0.264	221
4 Star * * * *	0.211	177
5 Star * * * * *	0.169	141

TABLE 2.3: Star Rating Band valid from 01 January 2012 to 31 December 2014

Star Rating Band	k_{dc} Constant Multiplier	c_{dc} Constant Fixed Allowance
1 Star *	0.330	277
2 Star * *	0.264	221
3 Star * * *	0.211	177
4 Star * * * *	0.169	141
5 Star * * * * *	0.108	91

The above equation provides for the value of the various Star Rating Bands for a particular model. The CEC of the model as determined from 2.3.1 will be compared with the various Star Rating Bands. The Star Rating chosen for the model will be based on the above comparison. CEC will be

compared to the lower and the upper limits of each Star Rating Band. The Star Rating corresponding to the band whose lower rating is less than CEC and upper limit is greater than or equal to CEC will be assigned to the model.

Lower Limit of **SRB** < **CEC** = Upper Limit of **SRB**

There is **no tolerance** for the Star Rating Bands. All tested products must meet the minimum threshold for each Star Rating Band. The scope for manufacturing tolerance and other variations shall be accounted for when determining the Star Rating.

2.6 ENERGY LABEL VALIDITY

The CEC value shall be accepted as valid if, when a single sample of a labelled model is tested for an initial screening test and its PAEC is such that:

$$PAEC \leq 1.1 * CEC$$

If this is not the case, the CEC shall be accepted as valid if three additional units are tested and the average PAEC of these additional units is such that:

$$PAEC_{(av)} \leq 1.1 * CEC$$

Additionally the PAEC shall be less than the upper limit of the corresponding Star Rating Band of the Star Rating of a single model tested or if two additional units are tested then PAEC of two out of three and $PAEC_{av}$ should be less than then upper limit of the corresponding Star Rating Band.

SECTION 3
LABEL DESIGN AND MANNER OF DISPLAY

3.1 PLACEMENT

The energy label shall be adhered to the upper portion of each appliance on the outside of the door.

3.2 MATERIAL AND SHAPE

The label shall be self –adhesive and shall be designed as set out in Figure 3.1.

However, in the case of a stainless steel or other finishes that may be permanently marked or stained by the adherence of a label, the use of a double sided swing tag or single sided non-rotating swing tag is permitted.

3.3 COLOURS

The label shall be printed as per the specifications in Figure 3.2

3.4 SAMPLE LABEL

An example of a printed energy label for a refrigerating appliance is shown in Figure 3.3.

The label will mention the following:

1. Appliance: Refrigerator
2. Brand
3. Model Name/Number, Year of Manufacturing
4. Type: Direct Cool
5. Energy Consumption per Year (CEC)
6. Gross Volume
7. Storage Volume

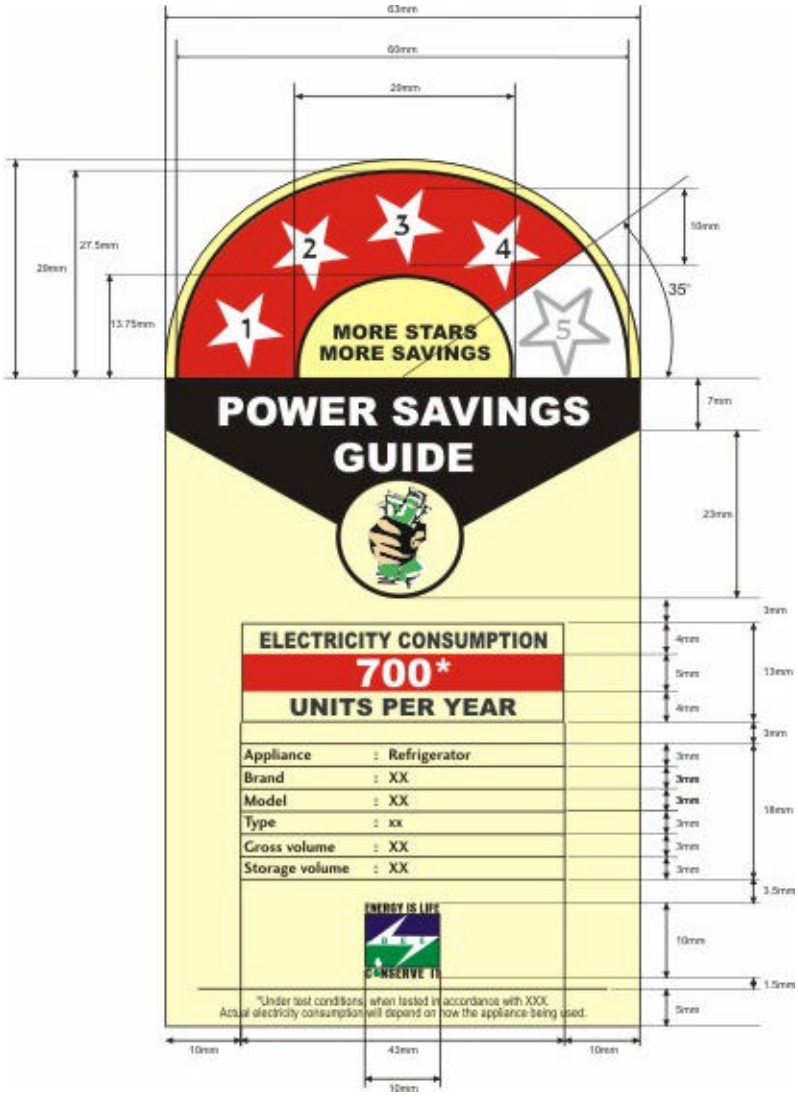

Figure 3.1: Design Scheme for the Label (Sample).

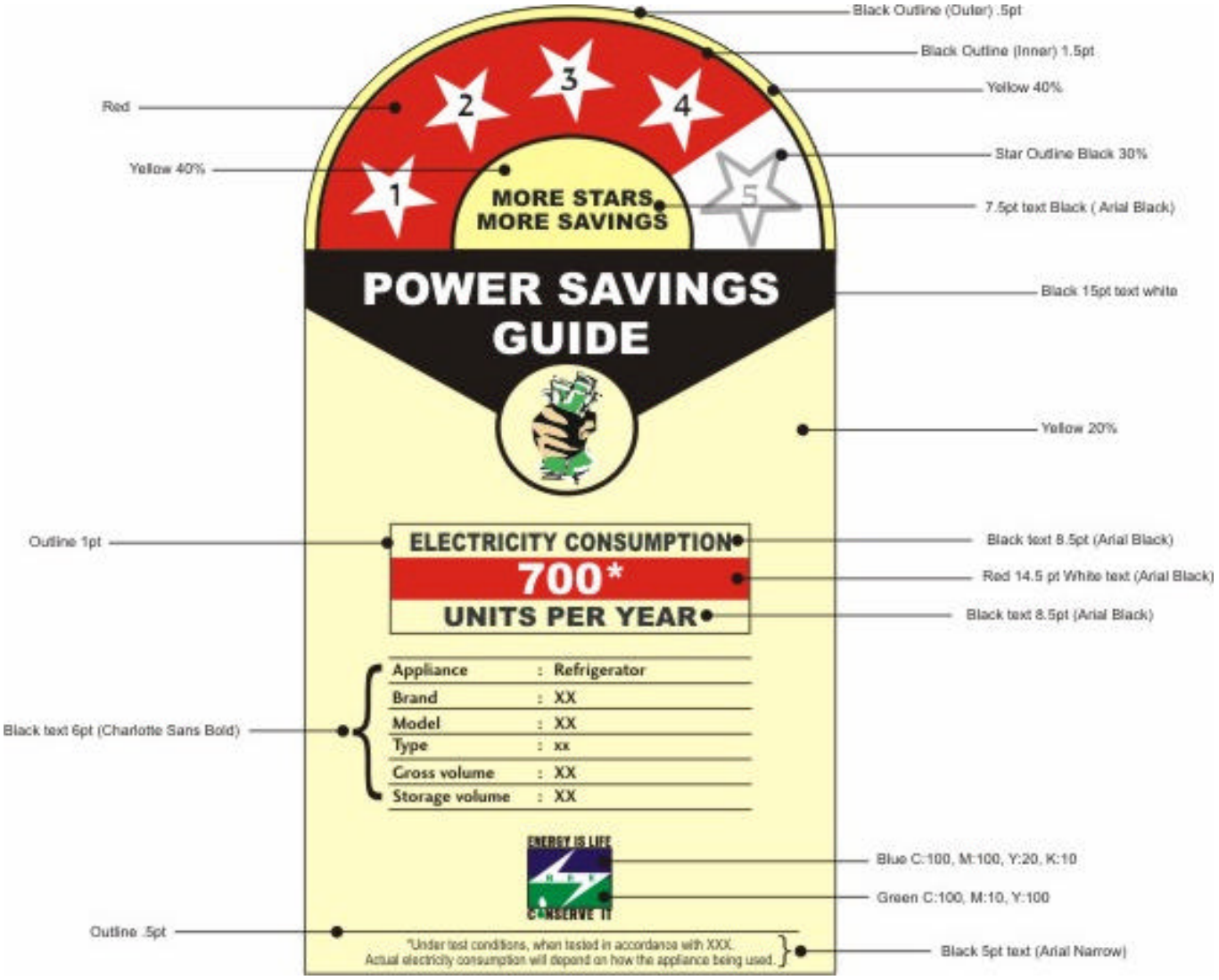

Figure 3.2: Colour Scheme for the Label (Sample).

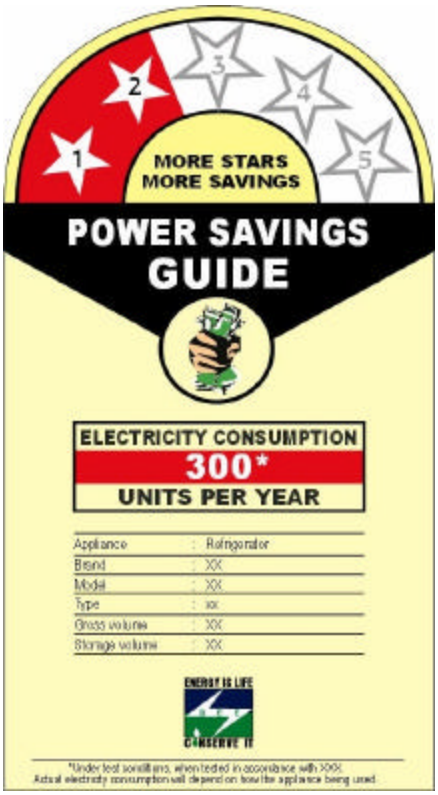

Figure 3.3: Sample Label