Schedule XX

Standards and Labelling of Solar Photovoltaic Panels

1. SCOPE

This schedule specifies the energy-labelling requirement for Solar Photovoltaic (PV) panels imported or sold in India for electricity generation and similar use. The schedule covers all types and sizes/capacity of Solar Photovoltaic Panels.

For this schedule, the star rating shall be based on SPV panel's conversion efficiency as per appendix A of this schedule.

This schedule does not apply to:

- Concentrator Photovoltaic (CPV) Panels
- Photovoltaic Thermal (PVT) hybrid solar collectors

2. NORMATIVE REFERENCES

This schedule shall be read in conjunction with the following standards with all amendments, for the purpose of star labelling

Number	Standard
1.	IS 14286: 2010 Crystalline Silicon terrestrial photovoltaic (PV) modules-Design qualification and type approval
2.	IS 16077:2013 Thin film terrestrial photovoltaic (PV)- Design qualification and type approval
3.	IS 16170 part1:2015 Photovoltaic (PV) Module Performance Testing and Energy Rating; Irradiance and Temperature Performance Measurements and Power Rating
4.	IS 12834: 2013 Photovoltaic Energy Systems – Terms, Definitions and Symbols

3. TERMINOLOGY

For this schedule, the following definitions shall apply. However, in case of dispute, the definitions given in '*IS 12834 :2013 Solar Photovoltaic Energy Systems – Terms, Definitions and Symbols*' can be referred.

3.1. Photovoltaic cell/ Solar Photovoltaic Cell / Solar Cell

Most elementary photovoltaic device.

3.1.1. Crystalline silicon PV cell

PV cells made of crystalline silicon.

3.1.1.1. Crystalline silicon

General category of silicon materials exhibiting a crystalline structure, i.e., showing long range ordering of the silicon atoms.

3.1.2. Thin film PV cell

Photovoltaic cell made of thin layers of semiconductor material

3.2. Photovoltaic Device

Component that exhibits the photovoltaic effect

3.3. Photovoltaic effect

Production of DC voltage by the absorption of photons.

3.4. PV module

Complete and environmentally protected assembly of interconnected photovoltaic cells.

3.5. PV Module efficiency

Ratio of the electric power generated by a PV module to its incident irradiance as measured under standard test conditions (STC).

4. TESTING GUIDELINES AND REQUIREMENTS

For star labelling, it is required to determine the maximum power $(P_{max,t°C})$of the PV module at an irradiance value of 1000 Wm^{-2} at 25°C, 50°C and 75°C of module temperatures as per the clause 8 of IS16170part1:2015. The power output values need to be noted in Table 2 given in appendix A. The maximum efficiency $(\eta_{max,t°C})$ of the module at 't°C' is calculated by equation-1 given in appendix A

4.1.1. Test report

The results of test shall be reported in the prescribed format as given in Annexure B of this schedule. Only BIS approved lab/NABL/ILAC/APLAC approved lab test report is acceptable.

4.2. Tolerance limit

However, there is no negative tolerance for star rating band; the products tested must be at par or better than the star rating band threshold.

5. RATING PLAN / LABELLING PLAN

The rating plan is based on effective efficiency $(\%\boldsymbol{\eta}_{eff.})$. The performance levels are given in Table 1. The effective efficiency is calculated using equation 2 given in appendix A

5.1. Qualification Criteria for labelling:

It is mandatory to meet the general requirements of design qualification and type approval as per *'IS 14286: 2010'* for crystalline PV panels and as per *'IS 16077: 2013'* for thin film PV panels. Also, it is mandatory to participate in the Compulsory

Registration Scheme (CRS) of BIS (Bureau of Indian Standards). In addition, to qualify for star labelling the PV panels must meet the performance standards mentioned in Table 1

Table 1 Star labelling scheme for PV panels 1.08.2019-31.12.2019

	1 Star	2 Star	3 Star	4 Star	5 Star
$\%\eta_{eff.}$	≥11.5	≥13	≥14.5	≥16	≥17.5

5.2. Tolerance limit

However, there is no negative tolerance for star rating band; the products tested must be at par or better than the star rating band threshold.

5.3. Check testing

The samples will be picked up by Bureau of Energy Efficiency (BEE) or its designated agency for testing as per the following sampling plan:
Five sample will be picked up at random from the manufacturing facility or warehouse.

6. FEES

6.1. Application fee payable on application for assignment of the authority to affix label is INR1000/- (Rupees One thousand only)
6.2. Application fee payable on application for renewal of authority to affix labels is INR 500/- (Rupees Five hundred only).
6.3. Labelling fee for affixation of label on each unit of Solar PV panel is INR 0.02/W /- (2 Paisa per Watt only)-
6.4. Labelling fees will be waived off for 5 star rated solar PV panels.

7. LABEL DESIGN AND MANNER OF DISPLAY

7.1. **Placement:** All PV panels must display the label. The label shall also be displayed on the packaging.
7.2. **Material, Dimension and Shape:** The label shall be of durable material and be printed as per the size given below.

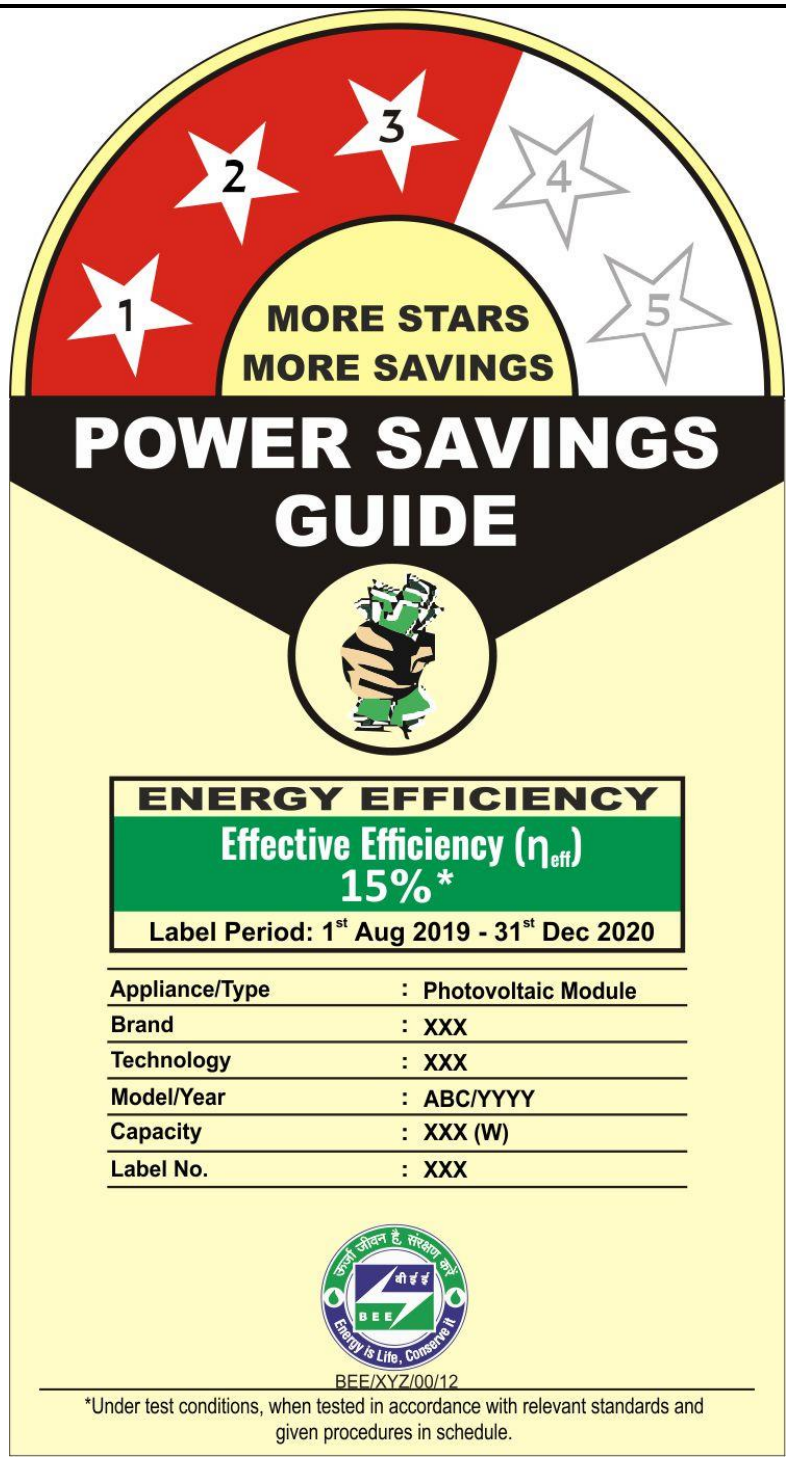

Figure 1 Label for PV panel

APPENDIX -A

Symbol	Description
$\eta_{max,t℃}$ (%)	Module Efficiency at t℃ (Calculated as per equation 1).
I (Wm^{-2})	Total Irradiance incident on the module
A (m^2)	Area of the module
$P_{max,t℃}$ (W)	Maximum power output of the PV module at 't℃' & an irradiance of 1000 Wm^{-2} when tested as per the clause 8 of IS16170 part 1:2015

The maximum efficiency of the module is calculated by equation 1, and the values of maximum power output$(P_{max,t℃})$ at different temperatures from Table 2 are used to calculate the maximum efficiency $(\eta_{max,t℃})$.

$$\eta_{max,t℃} = \frac{P_{max,t℃}}{I \times A} \times 100 \quad \ldots\ldots \quad \text{Equation 1}$$

Table 2 Power output of PV modules at different module temperatures

Irradiance (Wm^{-2})	**Spectrum**	**Module temperature**		
		25℃	50℃	75℃
1000	AM 1.5	$P_{max,25℃}$	$P_{max,50℃}$	$P_{max,75℃}$

$$\eta_{eff} = (0.14 \times \eta_{max,25℃}) + (0.62 \times \eta_{max,50℃}) + (0.24 \times \eta_{max,75℃}) \quad \ldots\ldots \quad \text{Equation 2}$$

APPENDIX-B

Table 3 Information to be submitted by manufacturer to BEE

Laboratory name	
Address	
Date of receipt	
Test report No.	
Tested by	
Date of testing	
Reviewed by	
Brand name	
Model name / number	
Serial number	
Year of manufacture	
Nameplate capacity of the PV panel	
Effective Efficiency $(\%\,\boldsymbol{\eta}_{eff.})$.	