

Schedule-18

Voluntary Energy Efficiency Labeling Program for Diesel Generator Sets

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1. Scope

This schedule specifies the star labeling requirements for various classifications for the application, rating and performance of single/three phase Diesel Generating sets consisting of a Reciprocating Internal Combustion (RIC) engine driven by diesel as fuel, Alternating Current (a.c.) generator, any associated control gear, switchgear and auxiliary equipment. It applies to A. C. generating sets driven by RIC engines for land and marine use being manufactured, imported or sold in India.

It excludes generating sets used on aircraft or to propel land vehicles and Locomotives.

Diesel Generating (DG) Sets up to 19 kW ratings are covered under pilot energy labeling scheme for single/three phase DG Sets.

Generating sets meeting the requirements of this schedule are used to generate electrical power for continuous, peak-load and standby applications.

This document applies to new DG sets. Existing & Retrofitted DG sets shall not be required to be modified to conform to this schedule.

2. Normative Reference

This schedule shall be read in conjunction with Indian Standard IS 10000, IS 10001, IS 13364 & IS 4889: 1968 (all parts with amendments till date) & “Scheme for Energy Efficiency Labeling” covered under Standard Labeling Program, with all applicable amendments.

2. Terms & Definitions***Star Rating***

“Star rating or star level” means the grade of energy efficiency based on specific fuel consumption (SFC) in g/kWh (electrical unit), displayed on the label of the generating set. 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 5 of this Schedule).

Star Rating Band

The Star Rating Band is a range of SFC (g/kWh) which is arrived by clause 6 of this schedule, and is used for determining the number of stars displayed on the star label.

Equipment/Unit

A Generating set described under Section 1(scope) of this schedule.

Authority

Government of India.

Star Label

Star label as described in Section 6 of this schedule.

Participant

Manufacturers, trader, importers or retailers of the equipment participating under this program

Scheme for Energy Efficiency Labeling

The Bureau of Energy Efficiency's Labeling Scheme for all the voluntary products covered under Standard & Labeling Scheme.

3. Eligibility Criteria:

Participant involved in manufacturing, trading, importing or retailing in Diesel Generator sets as a finished product, are only eligible to participate in the scheme.

3.1 Pre- requisite

- Diesel Generator set must comply with latest statutory requirements (such as CPCB and others as applicable) of Govt. of India.
- Engine shall be ISI marked. Participant shall submit BIS certificate as a proof of same.

3.2 Requirements

Participant shall submit following in order to register under the scheme:

3.2.1 Mandatory:

- Participant shall submit test report of engine and alternator as per Indian Standard IS 10000, IS 10001 & IS 4889: 1968. However if engine & alternator are tested more stringently (compared to IS 10000, IS 10001 1980, IS 13364 & IS 4889: 1968), then the parameters where the greater stringency has been applied should be declared by the manufacturer in the test report.
- Participant shall submit CPCB compliance report/certificate for complete DG set.
- Participant shall submit BIS certificate for diesel engine.

3.2.2 Wiring Diagrams (Mandatory):

Submit wiring diagrams for diesel engine driven generator units showing connections to electrical power panels, feeders, and ancillary equipment. Differentiate between portions of wiring that are manufacturer installed and portions that are field installed.

3.2.3 Certifications (Mandatory):

Provide diesel engine driven generator sets certified test record of the following final production testing:

- ✓ Safety shutdown device testing
- ✓ Voltage regulation

3.2.4 Battery Charger (Voluntary):

The battery charger shall be readily accessible and designed that it shall not be damaged and shall not trip its circuit protective device during engine cranking or it shall be automatically disconnected from battery during cranking period. The charger shall be mounted inside the emergency generator enclosure. The charger shall have a 7-day/24-hour timer control.

3.2.5 Fault Indicators (Mandatory):

Individual press to test fault indicator lights for low oil pressure, high water temperature, low water level, over speed, over crank, and for aboveground storage tank and high and low fuel level shall be provided. Provide relay dry contacts for interface of fault alarms with SCADA system.

3.2.6 Circuit Breaker (Mandatory): A generator circuit breaker shall be installed as a manual load circuit interrupter and an automatic overload and short circuit protection device should be used to interrupt load circuit.

4. Testing Guidelines

4.1 Testing requirements:

The instruments as detailed below (as per Annexure VIII of IS: 10001 – 1981), need to be maintained by the testing agency (participants own lab or third party lab) for the testing of specific fuel consumption of DG sets. All the instruments shall have valid calibration certificates with traceability to NPL and facilities accredited by NABL: -

- Test bed with suitable electrical loading arrangement / Power analyzer.
- Energy Meter
- Pressure Gauges
- Barometer
- Hydrometer / Humidity indicator
- Tachometer / Stroboscope
- Fuel Measuring apparatus
- Stop watch
- Thermometer / Pyrometer / Temperature Gauges
- Exhaust Back Pressure Gauge / Manometer
- Arrangement for measuring calorific value of fuel

4.2 Standard Reference Conditions:

The standard reference conditions for the purpose of determining the fuel consumption for constant speed Engines is as under (as per Section 1 of IS 10000 (Part II) 1980) shall be as under:-

- Mean Barometric Pressure = 100 kPa
- Atmospheric Temperature = 300 K
- Relative Humidity = 60 % at 300 K
- Charge Air Coolant Temperature = 300 K
- Intake Air depression and exhaust back pressure = Equal to that obtained with intake and exhaust systems normally fitted with the engine. It shall not exceed 50mm of water unless the manufacturer has accepted higher back pressure prior to the test.

4.3 Correction Factors considered:

The following correction factors based on ambient conditions need to be considered: -

- Power adjustment factor “ α ” – The net output in power at the site conditions shall be corrected to the standard reference conditions specified in section I of IS :10000 (Part II) – 1980 using correction factor “ α ” as determined from the IS: 10000 (Part IV), in item 2.2.2 and Appendix A.

$$P_x/P_r = \alpha$$

Where P_x = Power under ambient conditions &

P_a = Power under standard reference conditions

$$\alpha = k - 0.07(1-k) (1/\eta - 1)$$

$$k = (T_r/T_x)^n \times (p_x - a \cdot \Phi_x \cdot p_{sx})^m / (p_x - a \cdot \Phi_x \cdot P_{sx})^m$$

Where,

P = Power in kW

α = power adjustment factor

K = ratio of indicated powers

P = barometric pressure (kPa)

P_s = saturation vapour pressure (kPa)

Φ = Relative humidity

T = absolute air intake temperature (K)

η = mechanical efficiency

Values of a , m , n are taken from table 1 of IS 10000 (Part IV) - 1980

- Specific fuel consumption adjustment factor “ β ” – The specific fuel consumption at the site conditions shall be corrected to the standard reference conditions specified in section I of IS :10000 (Part II) – 1980 using specific fuel consumption correction factor “ β ” as determined from the IS: 10000 (Part IV) item 3.2.3 and Appendix F.

β = SFC (ambient site condition) / SFC (standard reference conditions)

Also $\beta = k / \alpha$

- Adjustment for calorific value of fuel – in case the fuel used is different from the fuel with calorific value of 42000kJ/Kg , a correction for the difference in calorific value to be applied as under

$$\beta_{cv} = CV / 42000$$

And adjusted SFC = β_{cv} x calculated SFC

Where β_{cv} = SFC adjustment factor for calorific value of fuel

CV = net lower calorific value of fuel used in kJ/kg

4.4 Testing Procedure:

The testing procedure for specific fuel consumption norms under standard and labeling program for DG sets with Diesel engines conforming to IS 10001 (< 19 kW) and alternator conforming to IS 4889 is proposed as under: -

- The DG set will be set up as per the standard procedure of the manufacturer and connected to the standard electrical load. Earthing shall be provided as per IS 3043: 1987.
- DG set shall run on 100% loading for 15 minutes after reaching thermal stability (as defined clause 8.7 of IS/IEC 60034 part 1: 2004). Then DG set load shall be gradually reduced to 75% load. After reaching 75% loading, 0.8 Power Factor and normal ambient conditions, fuel consumption and other parameters shall be recorded for 4 hours at an interval of 30 minutes each. Average SFC of 4 hours will be considered for test result.
- The data will be recorded as per the parameters given in Annexure I. The kWh will be taken from power analyzer / Energy meter.

4.5 Test Parameters

SFC: Specific Fuel Consumption in g/kWh shall be recorded.

4.6 Test report: The results of tests shall be furnished to Bureau in form of test report. The same results shall also be reported as per **Annexure I** of this Schedule.

4.7 Tolerance:

There is no tolerance for Star Rating Bands (as mentioned in Table 1). The average of products tested must be at par with type generating set or better than the Label threshold.

A tolerance of +/- 5% in specific fuel consumption shall be allowed.

5. Sampling

The samples for check testing picked up randomly by the Bureau or its designated agency for testing as per the sampling plan from the retail outlet or manufacturing facility or warehouse and as mentioned in the check testing scheme.

6. Energy Labeling Plan

The Star Rating plan for a generating set shall be based on the Specific Fuel Consumption (SFC) in g/kWh declared by the participant. Declared value of SFC shall not be less than the test result. Energy labeling star rating plan is as indicated below:

Star Level	Specific Fuel Consumption (SFC) in g/kWh
1 star	> 302 & ≤ 336
2 star	> 272 & ≤ 302
3 star	> 245 & ≤ 272
4 star	> 220 & ≤ 245
5 star	≤ 220

6. Manner of Display

The label shall be affixed on the alternator where DG set is not sold with canopy or on canopy where DG sets is sold with canopy. The participant should ensure that the label appears on every registered Unit on display for identification purpose, at point of sale or hire. The label shall also be printed or pasted on the packaging.

6.1 Color scheme of Sample label

The color scheme of the label shall be as given in Figure 1

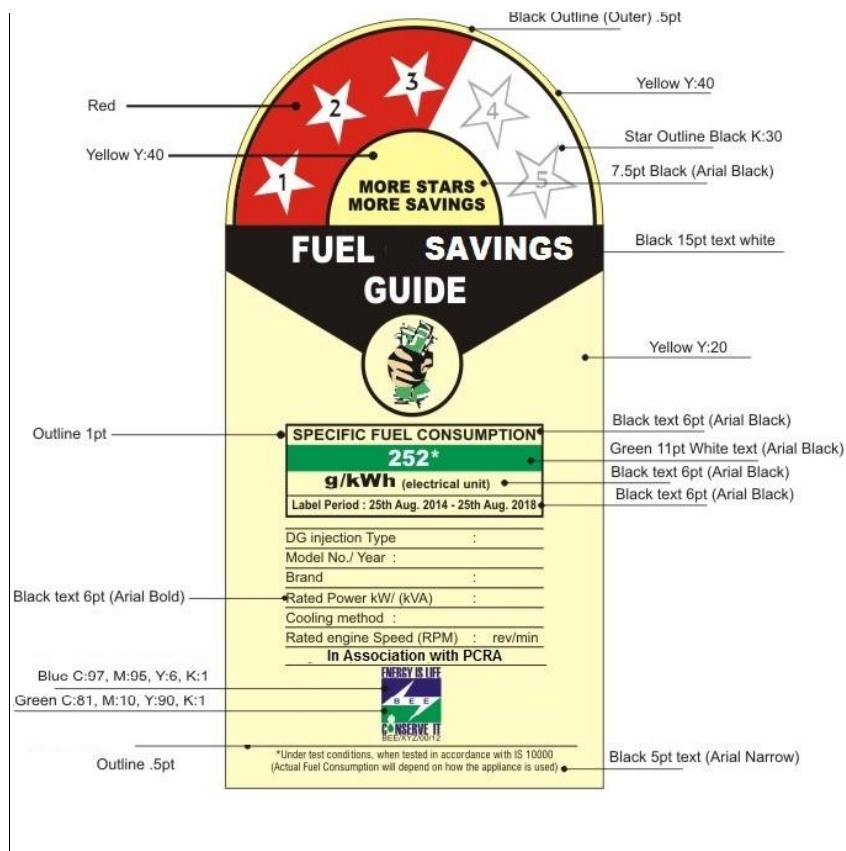


Figure 1

The following colour scheme for Bureau's logo, namely:-

BLUE –

Hue (H)-239o Saturation(S):64% Brightness (B):59%
 Luminance or lightness (L):28, chromatic components -a:24 b:54
 Red(R):54 Green (G):55 Blue (B):151
 Cyan(C):97% Magenta (M):95% Yellow(Y):6% Black (K):1%
 Web colour code - #363797

GREEN –

Hue (H)-150o Saturation(S):10% Brightness (B):67%
 Luminance or lightness (L):61, chromatic components -a:-53 b:32
 Red(R):0 Green (G):170 Blue (B):87
 Cyan(C):81% Magenta (M):10% Yellow(Y):90% Black (K):1%
 Web colour code - #00AA56;

6.2 Design of label

The design of the label shall be as given in Figure 2

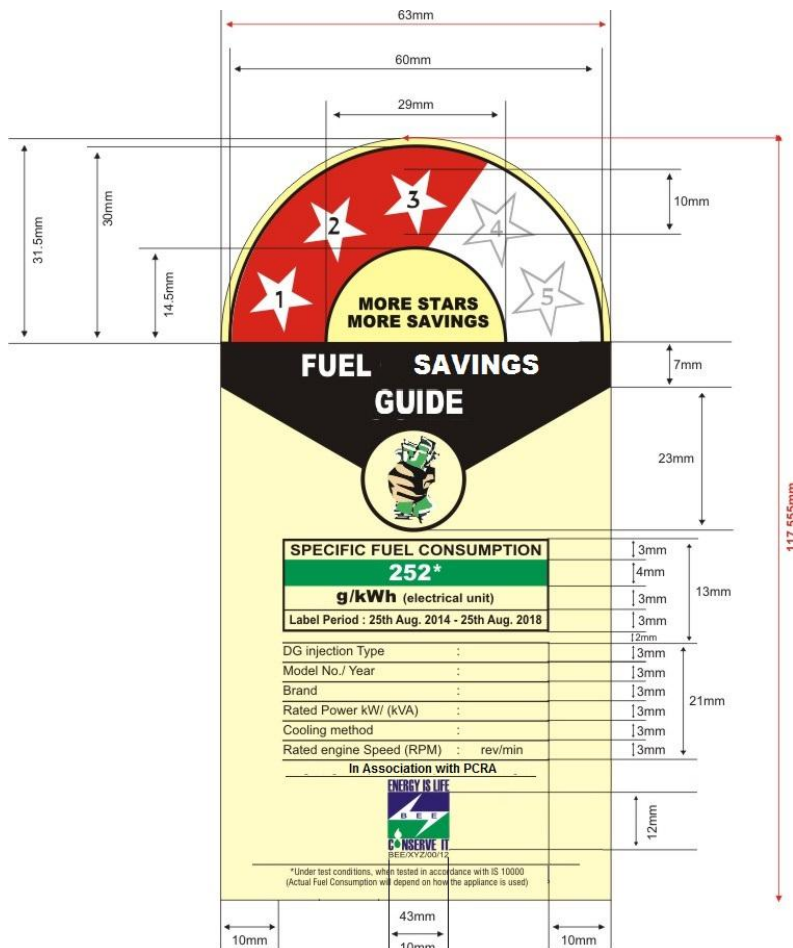


Figure 2

6.3 Material of Label

The label shall be durable and possess good wear and tear characteristics and self adhesive type. It should stick tightly on the equipment surface.

7. Fees

7.1 Security deposit for Company Registration:

An amount of INR 25,000 shall be deposited to Bureau by the small scale manufacturers holding SSI certificate.

An amount of INR 1,00,000 shall be deposited by other manufacturers

7.2 Application processing fee:

To avail the grant of permission to affix the star label on the model, a registration fee of INR 1000 /- (One thousand only) per model shall be paid to Bureau.

7.3 Labeling fee:

Labeling fee for each star label of DG sets covered under this schedule is INR 10 (Ten) only.

7.4 Fee for renewal of label registration:

To avail the grant of permission for renewal of affixing the star label on the existing model, a renewal fee of INR 500 /- (five hundred only) per model shall be paid to the Bureau.

8. Review of the product schedule

BEE reserves the right to revise this schedule, should technological and/or market changes affect its usefulness to consumers or industry or its impact on the environment. In keeping with current BEE policy, whenever there is any changes in the schedule particularly with regard to changes in the test procedure or the and/or the energy efficiency norms/values, the manufactures/user of the label shall ensure that their product meets the requirements of the revised schedule for which they should submit fresh application for fresh registration. To qualify as Star labeled product, a model shall meet the revised schedule of BEE, in respect of the products and models dispatched or shipped from the manufacturer's premises immediately after the effective date of implementation of the revised schedule.

9. Abeyance of the product schedule

The product may be put on abeyance in special circumstances with approval of DG, BEE.

TEST REPORT FORMAT

This annexure shall provide the template of the test report to be used by manufacturers to present the test results to the Bureau. This must include (minimum requirement)

Specification	Value
DG Set complete unit	
KVA Rating @ 0.8 Power Factor	
Control Panel (Manual/Automatic)	
Size - Length × Width × Height (mm)	
Fuel Tank Capacity (Itrs)	
Weight (Kg)	
Radiator capacity	
Specific Fuel Consumption (SFC) in g/kWh	
Ambient Temperature	
Engine	
Engine Model	
Gross Power 100% (100%) hp	
Type (Stroke)	
Rated Output (HP)	
Rated RPM	
Cooling (Water cooled/Air cooled)	
Cylinders- Bore × Stroke	
Governing System (Mechanical or any other type shall be mentioned by Manufacturer)	
Turbocharger (type)	
Altitude	
Air Temperature	
Exciting/Starting system (Applicable only if DG set includes a battery starter)	
Battery Capacity (AH)	
Battery Rated DC Voltage	
Alternator	
Make	
Type (Synchronous or any other type shall be mentioned by Manufacturer)	
No. of Phases (Electrical)	
Rated kVA	
Rated Frequency (HZ)	
Rated Voltage (V)	
Rated Current (Amp)	