Terms of Reference for R& D Project

Title	**:**	Study for reviewing Performance requirements for Constant Speed Compression Ignition (CI) Internal combustion engines
Sectional Committee	**:**	Automotive Prime movers, Transmission Systems and Internal Combustion Engine Sectional Committee, TED 02
Proposed Duration	**:**	3 Months

1 Introductory background

1.1 The testing and performance of constant speed and variable speed internal combustion engines were originally covered by Indian Standards IS 1600:1960, IS 1601:1960, IS 1602:1960, and IS 1603:1960. These standards have been extensively revised over the years, resulting in two sets of standards: one covering methods of testing and the other covering specification and performance requirements of engines. The standards covering Performance requirements for Compression Ignition (CI) Internal combustion engines are IS 10001, IS 10002 and IS 11170.

1.2 The Indian Standards IS 10001 and IS 10002, published in 1981, provides the performance requirements for constant speed compression ignition (diesel) engines, catering to different power ranges. IS 10001 pertains to engines up to 19 kW for general applications, whereas IS 10002 encompasses engines with power capacity above 19kW generally used in electricity generating sets and other applications, excluding marine, aircraft, or traction engines. In addition, IS 11170 also exists which gives performance requirements for constant speed compression ignition (Diesel) engines for agricultural purposes. All the aforementioned standards underwent multiple amendments aimed at refining criteria like power determination, specific fuel consumption (SFC), and lubricating oil consumption. BIS Licenses have also been issued against IS 10001 and IS 11170.

1.3 Due to the dynamic landscape of engine technologies, evolving manufacturing capacities globally, increased emphasis on fuel efficiency, updated environmental rules and emission norms, there is a pressing need to study both local and global standards and regulations along with advancements in engine and component manufacturing technologies and integrating them into a revised version of these standards to ensure their alignment with the latest international practices.

2 Objectives

To collect relevant data and information from primary and secondary sources in regard to Power, Specific Fuel Consumption, lubricating oil usage, etc., for Internal Combustion engines and Analysis of emission norms for potential inclusion in the revision of IS 10001, IS 10002 and IS 11170.

3 Scope of Work

3.1 Review and evaluation of current standards for performance requirement of IC Engines (IS 10001, IS 10002 and IS 11170) in light of technological advancements, industry best practices and latest environmental guidelines, research papers, SOP/guidelines issued by concerned Ministry and any other study published on the subject.

3.2 Determination of the performance criteria for internal combustion engines such as power, specific fuel consumption (SFC), and lubricating oil usage across different engine types and speeds. This assessment will consider advancements in fuel efficiency of engines and ensure alignment with international standards. The recommendations need to be substantiated by the empirical test results.

3.3 Study of existing Emission Norms and global environmental standards and their feasibility for integration into Performance Testing as per IS 10001, IS 10002 and IS 11170.

3.4 Identification of manufacturing base (large, medium and small scale) and testing agencies, exporters and importers, for each component and systems of IC Engine.

3.5 Review the technical requirements of different countries (from where imports and where exports are made), and making comparative analysis, for each component and each system.

3.6 Undertake visits to the manufacturing facilities and NABL accredited testing labs. Minimum two Large, 2 MSME manufacturing facility and 2 NABL accredited laboratory to be visited for collection of details.

3.7 Collect of data during the visit from these industries and testing laboratories for test methods, requirements and standards that they are following.

3.8 Collection of data from other Industries and testing laboratories through questionnaire. The questionnaire to be finalized in consultation with BIS.

3.9 Carrying out comparative analysis after collection of data done as per **3.7** and **3.8.**

3.10 Collect data from industries about steps taken by them to promote sustainability in their manufacturing processes, raw materials, methods, storage, packaging and waste disposal.

3.11 Collection of feedback from users regarding issues being faced, and other related points.

3.12 Identification of gap areas on subject for standard formulation.

3.13 Preparation of detailed analytical report based on above points.

4 Methodology

4.1 Carry out thorough literature review as specified in **3.1**.

4.2 After the collection of data for manufacturing and testing units, sampling plan shall be submitted by proposer to BIS for approval for undertaking visits to manufacturing and testing units.

4.3 Collect information from stakeholders (exporter and importer) through discussion and structured questionnaire for technical requirements. Further prepare a comparative analysis as per **3.5.**

4.4 Visits to manufacturers facilities to witness the manufacturing processes and to collect the data related to its performance in detail. These data should be collected by observing processes and focused group discussions on the following (Tentative):

i.	Capacities of Engines	**vii.**	In process quality checks
ii.	Major Components/Raw materials	**viii.**	Testing facilities available
iii.	Types / Variants of Engines Manufactured by Manufacturer	**ix.**	How product is different than that of the requirement given in standards
iv.	Test methods used presently	**x.**	Measures may be taken to make the standards compatible for cross reference of various standards
v.	Test requirements for both Indian as well as Export Markets	**xi.**	Measures taken by Industry towards Sustainable development of product (please refer **3.9**)
vi.	Manufacturing processes	**xii.**	Other relevant points

4.5 Visits to testing laboratories, especially NABL accredited, and collect data for testing facilities available, test methods, test requirements and standards being followed, if any.

4.6 Collect data through questionnaire from Manufacturing units and testing laboratories as per **4.4** and **4.5** respectively.

4.7 Collect data and feedback from different users through circulation of questionnaire regarding issues being faced by them and their suggestions for improvement.

4.8 Analyse the findings and data.

5 Deliverables

An analytical report in soft and hard copy, covering all aspects mentioned in the scope, shall be submitted. Details of visits to manufacturers and testing agencies, discussions with focused group as per **4.4**, questionnaire with exporters and importers, feedbacks from users, research findings, data collected, comparative analysis, literature review and test results along with a clause wise update recommended for incorporation in standards (IS 10001, IS 10002 and IS 11170) shall be appended to the report.

An analysis report of the data collected w.r.to efficiency with gap analysis.

6 Sampling Plan

Based on identification of manufacturing and testing base, a sampling plan shall be submitted by researcher for approval from BIS, for visits to different stakeholders.

7 Support

BIS will provide the related Standards on request. Previous test reports for the products those which are under BIS licensing scheme.

8 Timelines and Method of Progress Review

A stage wise indicative timeline plan is provided below:

a) Project timeline – 3 months from the date of award of project.
b) Identification of stakeholders and initial literature review report – By end of 30 days.
c) Visit to manufacturers and laboratories and testing of collected samples – By end of 60 days.
d) Final report covering all the aspects of the ToR – By end of 90 days.