TERMS OF REFERENCE FOR THE R&D PROJECT

Title : Study of chemical and mechanical properties of grades of aluminium alloys used in manufacturing Internal Combustion Engine Pistons

1. Background :

1.1 The universal acceptance of aluminium alloy pistons used in Internal Combustion Engine are attributed to its light weight and high thermal conductivity. The aluminium alloys used for pistons have good combination of foundry, mechanical and physical characteristics including low thermal expansion. Aluminium alloy pistons are either cast or forged.

1.2 BIS has formulated Indian Standard IS 7793:1975; Specification for Aluminium alloy for I.C engine pistons. The standard covers the technical requirements of four casting grades and three forging grades.

1.3 Annual turnover for Internal combustion engine components in India is around 15 billion USD. There are many grades manufactured and used in India which are not covered in the present standard. A need was thus felt to carry out a comprehensive study of various grades of aluminium alloys used in manufacturing Internal Combustion Engine Pistons in India. This study will be useful in revising and upgrading the standard IS 7793 to the present needs.

The standard can be accessed from https://standardsbis.bsbedge.com)

2. Objective:

To collect relevant data and information, from primary and secondary sources, for quality requirements (chemical and mechanical properties) of grades of aluminium alloys used in manufacturing Internal Combustion Engine Pistons

3. Scope:

1. Study the available literature like national and international standard such as ASTM, JIS, EN, ISO etc available on the subject, research papers, any study conducted by other organisations, companies' brochure. Identify the grades, their chemical and mechanical properties and any other requirements which can be included in the standard.
2. Collect data of the manufacturing base of the product.
3. Visit the manufacturers of the product and get the information on the following:
    i. Types of Raw material used
    ii. Varieties/grades manufactured
    iii. Quality parameters (chemical and mechanical properties) of different grades
    iv. Manufacturing process,
    v. Safety requirements
    vi. In process quality checks

vii. Test facilities and test methods used
viii. Marking and labelling being done
ix. Packaging requirement
x. Tests being undertaken
xi. Testing facilities in the plant
xii. Steps taken for addressing sustainability and address 3 R – Reduce, reuse, recycle
xiii. Waste recycling

4. Identify the laboratories testing the product and visit these laboratories
5. Check the quantity of the product imported and exported and countries with which the trade for this product is occurring. Also check if any technical regulations exist for this product in these countries. Take data of the foreign specification as per which the product is being imported or exported.
6. Identify the users of the product and take data of the quantity being used by them, specification used, check for the test certificates received by them and study the chemical and mechanical properties mentioned in the TC. Also understand from the user the main properties required by them in the product.
7. Prepare a comprehensive project report incorporating the points mentioned above.

4. Methodology:

1. Study the literature and analyse the findings.
2. Visit the manufacturing unit and
    a. observe the manufacturing process,
    b. examine in-process control measures,
    c. conduct focussed group discussion with quality personnel
    d. collect the data as mentioned in the scope through a questionnaire.
    e. draw samples of the grades and get it tested in NABL accredited laboratories
3. Visit laboratories and make report on
    a. test equipment required
    b. test method being used
    c. testing charges
    d. testing time required.
4. Visit the identified importers and exporters and collect data as mentioned in the scope through a questionnaire
5. Visit the users of the product and collect data as mentioned in the scope through a questionnaire
6. Analyse the data and test reports from diverse sources and include the same in the project report.

5. Sampling plan:

5.1 Two manufacturers of IC engine pistons from each large, small and micro scale shall be visited.

5.2 Three samples for each grade shall be tested.

5.3 Samples for testing may be drawn from manufacturer, user, importer or market.

5.4 Two users of the product shall be visited.

5.5 Two laboratories, preferably one in government sector and one in private sector shall be visited.

6. Deliverables:

6.1 Final project report, in hard copy format as well as in soft copy, covering all aspects mentioned in the scope.

6.2 Questionnaire, discussion, visit reports, test reports to be appended with the final project report

7. Timeline:

The duration of the project is 3 months from the date of award of the project. The proposed indicative timeline stage-wise is given below:

Sr No	**Stage**	**Time from date award of proje (cumulative)**
1	Literature review and identification of manufacturing base, testing laboratories, user/user industry, and discussion with BIS for the finalization of sampling plan	1 month
2	Visit to manufacturers, testing laboratories, users and importers and exporters and data collection	2 month
3	Preparation and submission of first draft report to BIS	2.5 month
4	Submission of final project report	3 month

Note: The proposer may submit the draft report to BIS without waiting for test report from independent laboratories if the test is of long duration test .

8. Support BIS will Provide:

- National /international standard relevant to the project
- Details of BIS Licensees details.
- Product manual
- Details of BIS and BIS recognized laboratories.

9.**Relevant sectional committee and Nodal officer from BIS**

Sectional committee :

MTD 7- Ores and Feed Stock for Aluminium Industry, its Metals/ Alloys and Products Sectional Committee Sectional Committee

Nodal officer :

Mr Ashish Wakle, Scientist C/ Deputy Director – Member Secretary MTD 07 ,

Email : mtd7@bis.gov.in