TERMS OF REFERENCE FOR THE R&D PROJECT

Title :

Study of grades, chemical and mechanical properties of 'High strength steel castings for general engineering and structural purposes'.

1. Background :

1.1India is the world's third-largest casting producer after China and the U.S. India produces castings of about 11 and 12 million tonnes per year. Generally, the casting are manufactured of Cast Iron, however wherever along with strength properties such as toughness, smoother surface finish, weldabaility, dimensional accuracy is desired, steel casting are preferred.Steel casting process involves pouring molten steel into a cast to form a desired shape..High strength steel castings are casting having tensile strength more than 600 MPa and are extensively used in transportation equipment, agricultural machinery parts, and general engineering, as structural parts.

There is an Indian standard IS 2644: 1994"High strength steel castings for general engineering and structural purposes–Specification" which mentions five grades of high strength steel castings. However, this standard is very old and in last 30 years' number of new high strength grades have been developed and used by the industry which are not present in the current standard. ISO has also recently upgraded its specification and an ISO Standard ISO 9477: 2023 "High-strength cast steels for general engineering and structural purposes, has been published.

A need was felt to identify and verify the grades of high strength steel used for castings in India and this study will be basis for upgradation and revision of IS2644: 1994.

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

2.Objective:

To collect relevant data and information, from primary and secondary sources, for grades of High strength steel castings for general engineering and structural purpose and verify quality requirements (chemical and mechanical properties) of these grades.

3.Scope:

3.1 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.

3.2 Collect data of the manufacturing base of the product.

3.3 Visit the manufacturers of the product and get the information on the following:

3.3.1 Types of Raw material used

3.3.2 Types of castings manufactured

3.3.3 Grades manufactured

3.3.4 Quality parameters (chemical, and mechanical properties) of different grades

3.3.5 Manufacturing process,

3.3.6 In process quality checks

3.3.7 Test facilities and test methods used

3.3.8 Tests being undertaken

3.3.9 Requirement of weldability

3.3.10 Marking and labelling being done

3.3.11 Packaging requirement

3.3.12 Steps taken to address sustainability and 3 R, reduce, reuse and recycle.

3.3.13 Waste recycling

3.4 Identify and visit the laboratories

3.5 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.

3.6 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 physical properties mentioned in the TC. Also understand from the user the main properties required by them in the product.

3.7 Prepare a comprehensive project report incorporating the points mentioned above.

4. Methodology:

4.1 Study the literature and analyse the findings.

4.2 Visit the manufacturing unit and

a. observe the manufacturing process,
b. examine in-process control measures,
c. conduct focussed group discussion with production and quality personnel to gain insight in the
d. collect the data as mentioned in the scope through a questionnaire.
e. Test various grades manufactured and draw sample of the grades.

4.3 Visit laboratories and make report on

a. test equipment required

b. test method being used
c. testing charges
d. testing time required.

4.4 Test the samples drawn in In-house laboratory/NABL accredited laboratory/BIS recognized laboratory and verify the chemical and mechanical properties.

4.5 Visit the identified importers and exporters and collect data as mentioned in the scope through aquestionnaire

4.6 Visit the users of the product and collect data as mentioned in the scope through a questionnaire

4.7 Analyse the data and test reports from diverse sources and include the same in the project report.

5. Sampling plan:

5.1 Two manufacturers from each large/medium and small/micro scale shall be visited.

5.2 Three samples for each grade shall be tested.

5.3 Samples 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 editable 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 4 months from the date of award of the project. The proposed indicative timeline stage-wise is given below:

Sr No	**Stage**	**Time from date of award project (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	3 month
3	Preparation and submission of first draft report to BIS	3.5 month

4	Submission of final project report	4 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:

BIS will provide access to latest available editions of Indian standards and/ or international standards relevant to the project, on request.

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

Sectional committee:

MTD 14 (Foundry and Steel Castings Sectional Committee)

Nodal officer:

Mr Kunal Kumar, Scientist D/ Joint Director – Member Secretary MTD 14,

Email: mtd14@bis.gov.in