

TERMS OF REFERENCE FOR THE R&D PROJECT

Title of the Project –Study of Construction, safety requirements and types of Crane- Suspended ladles for iron and steel foundries.

1. Background-

- 1.1 Ladles are used for transfer of molten metal and in Iron and steel foundry industry, various types of crane suspended ladles are used that could be categorized as foundry ladles, transfer ladles and treatment ladles according to their functions. These are of various capacity, design, size& shape.
- 1.2 Indian standard IS 4475 (Part 1 to 4) exists for crane suspended ladles with maximum capacity covered 50 Ton. The Indian standards can be accessed by link <https://standardsbis.bsbedge.com/>.
- 1.3 The ladle capacities covered in various parts of Indian standard IS 4475 is not adequate as now a day's steel foundries in India are using crane suspended ladles up to 70-ton capacity. Also the ladles used today are of various size and capacities which are not present in current standard.
- 1.4 Further, Rotary treatment ladle which uses pure magnesium for maximum magnesium recovery and offer an economic process of production of S.G. Iron is not covered in the existing standard but it is used in many foundries across India.
- 1.5 It was felt that a R&D project may be undertaken to study the Capacity, Design, Size & Shape of the various types of crane suspended ladles and rotary treatment ladles used in India along with their construction and safety requirements. This study will assist in upgradation and revision of IS 4475 (Part 1 to 4) and formulation of a new standard on Rotary treatment ladle.

2. Objective –

To collect relevant information and data, from both primary and secondary sources, for Construction, safety requirements and types of Crane- Suspended ladles for iron and steel foundries

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, and journals. Identify the various crane suspended ladles including rotary treatment ladle in regard to a) Type, Use & Capacity – Design, Size & Shape and b) Construction and safety requirement.
- 3.2 Collect data of the manufacturing base of the ladles.

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

3.3.1 Types of material used

3.3.2 Type, Use & Capacity – Design, Size & Shape of the ladle manufactured –

a) Straight Sided/ Taper sided/ cylindrical, with gear/ without gear, open top/ covered/ hand operated gear/ automatic gear,

b) Shell pate thickness, shell dimension, dimension of hand operated wheels, body holding rings, Capacity, refractory lining thickness, refractory retaining rings, minimum top allowance above liquid metal, trunnion, shaft diameter, pouring lips, safety catches, tilting gear and lip design.

3.3.3 Manufacturing process,

3.3.4 Safety requirements

3.3.5 In process quality checks –

Radiography examination of weld, radiography/ ultrasonic examination of the forgings and castings used in the ladle.

3.3.6 Test facilities in the plant

3.3.7 Tests being undertaken

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

3.4 Collect data of the Iron and Steel foundry Industry across the country.

3.5 Visit the Iron and Steel Foundry Industry to get the information on the following:

3.5.1 Type, Use & Capacity – Design, Size & Shape of the ladle -

a) Straight Sided/ Taper sided/ cylindrical, with gear/ without gear, open top/ covered/ hand operated gear/ automatic gear;

b) Capacities, Dimension- Refractory lining thickness, minimum top allowance above liquid metal, shell dimension (diameter of top/ bottom, depth).

3.5.2 Desired Quality parameters in the ladle.

3.5.3 Quality parameters checked before use of the ladle

3.5.4 Safety measures followed

3.5.5 Name of the manufacturer

3.5.6 Shelf life, Maintenance and reuse

3.6 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

4.2.1 observe the manufacturing process,

- 4.2.2 examine in-process control measures,
- 4.2.3 conduct focused group discussion with Production and quality personnel
- 4.2.4 collect the data as mentioned in the scope through a questionnaire.
- 4.2.5 Undertake dimensional and other tests specified in the standard on the ladles being manufactured and in stock. Also in-house test reports of the ladles manufactured by the firm may be collected.

4.3 Visit Iron and Steel Foundry Industry and

- 4.3.1 Observe the process Type, Use & Capacity – Design, Size & Shape of the ladle
- 4.3.2 Safety measures followed
- 4.3.3 Quality parameters checked before use of the ladle
- 4.3.4 collect the data as mentioned in the scope through a questionnaire.
- 4.3.5 Shelf life, Maintenance and reuse
- 4.3.6 Undertake dimensional and other tests specified in the standard on the ladles in use

4.4 Analysis of data collected.

5 Sampling Plan –

5.1 There are three broad categories of foundries – Steel, White & Grey cast iron, S.G. Iron - for each category 4 foundries shall be visited- one each from large, medium, small and micro scale. The foundries should be selected to ensure that one foundry from each region viz Northern, Eastern, Western and Southern region are covered.

5.2 Two manufacturers, one each from large and small scale shall be visited.

6. Deliverables:

6.1 Final project report, in hard copy format as well as in ediable 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 of award of project(cumulative)
1	Literature review and identification of manufacturing base, Iron and Steel Foundry industry, and discussion with BIS for the finalization of sampling plan	1 month

2	Visit to manufacturers, Iron and Steel Foundries 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

8. Support BIS will Provide:

8.1 Any national /international standard relevant to the project.

9. Relevant sectional committee and Nodal officer from BIS

Sectional committee :

MTD 14-Foundry and Steel Castings Sectional Committee Sectional Committee

Nodal officer :

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

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