TERMS OF REFERENCE FOR R&D PROJECT

Shell and tube type heat exchangers

1. Title
Study of latest technological developments and practices in the life cycle of shell and tube type heat exchangers.

2. Background
2.1 Shell and tube type heat exchangers are widely used in many branches of industry for duties such as heating, cooling, evaporation, petroleum industry and chemical industry.

2.2 IS 4503 : 1967 - Specification for shell and tube type heat exchangers has been published by BIS which covers the design, construction, inspection and testing of cylindrical shell and plain tube heat exchangers for application in the petroleum and general chemical industry. Both the requirements of the industries where the operating conditions are not severe or where costlier materials of construction are used as well as the more severe requirements of the petroleum and chemical processing industries are covered. This project is aimed at upgrading this specification by inclusion of the latest technology and practices which is currently being used in the Heat Exchangers industry. This standard can be accessed from https://standardsbis.bsbedge.com/.

3. Objective
To collect relevant data and information from primary and secondary sources for latest technological upgrades and practices covering design, construction, inspection and testing of cylindrical shell and plain tube heat exchangers.

4. Scope
4.1 Study the available literature like national and international standards such as ASME, ASTM, JIS, EN, ISO etc available on the subject, research papers, any study conducted by other organisations, companies' brochures.

4.2 Collect data of the manufacturing base of the product.

4.3 Visit the manufacturers of the equipment and get the information on the following:

a) Types of Raw material used
b) Varieties/grades manufactured
c) Terminology
d) Quality parameters
e) Design
f) Components
g) Manufacturing process
h) Fabrication and Welding
i) Safety requirements
j) In process quality checks
k) Storage and Dispatch
l) Installation
m) Test facilities and test methods used
n) Inspection

o) Marking and labelling being done
p) Packaging requirement
q) Tests being undertaken
r) Testing facilities in the manufacturing plant
s) Documentation
t) Dismantling and Disposal
u) Addressing sustainability in processes such as using energy efficient processes, using renewable energy sources, recycling and reuse.
v) Waste recycling

4.4 Identification and visit to the laboratories as per the sampling plan.

4.5 Check the applicable regulatory requirements related to the product in the country.

4.6 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.

4.7 Identify the users of the product and take data of the quantity being used by them, specification used, maintenance and inspection, periodic in-house and outsourced testing, breakdown, etc. Also understand from the user the main properties required by them in the product.

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

5. Research Methodology

5.1 Study the literature and analyse the findings.

5.2 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.

5.3 Visit laboratories and make report on
a) test equipment required
b) test method being used.

5.4 Visit the identified importers and exporters and collect data as mentioned in the scope.

5.5 Visit the users of the product and collect data as mentioned in the scope.

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

5.7 Developing and circulating questionnaires for obtaining data from stakeholders.

6. Sampling Plan

A sampling plan to be devised covering visits to manufacturers from 2 large as well as 2 MSME scale. Visit to 2 users of the product, preferably from different sectors, shall also be included in the sampling plan. Dedicated testing laboratories, one from government and one from private sector and R&D laboratories on the subject to be identified and included in the sampling plan. Visit to importers and exporters also to be included in the plan. The proposed plan to be submitted to BIS for approval.

7. Deliverables

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

7.2 Comparative Statement on parameters as mentioned in **4.3** while going through literatures as per **4.1**.

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

7.4 In case of delay in submission of the final draft report, the justification shall be given by the project proposer for consideration by the Sectional Committee.

8. Timeline

Admissible duration of the project is upto 6 months from the date of award of the project. The proposed indicative timeline stage-wise is given below:

Sl No.	Milestones	Timeline
a	Literature review and identification of manufacturing base, testing laboratories, user/user industry, and discussion with BIS for the finalisation of sampling plan	1 month
b	Visit to manufacturers, testing laboratories, users and importers and exporters and data collection	2 months
Mid-term review of the progress of the project		
c	Preparation and submission of first draft report to BIS	2 months
d	Submission of final project report	1 month
	Total	**6 months**

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

9. 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.

10. Nodal Technical Committee of BIS

Boilers and Pressure Vessels Sectional Committee, MED 01
(Email: med@bis.gov.in)

Member Secretary - Mr Naveen K, Scientist ‘D’, Mechanical Engineering Department, Bureau of Indian Standards