

## **TERMS OF REFERENCE FOR THE R&D PROJECT**

### **Title:**

**Study the grades, chemical and physical properties, and various shapes and sizes of stainless steel pipe fittings**

### **1. Background:**

**1.1** Stainless steel pipe resists oxidation, making it a low-maintenance solution that is suitable for high-temperature and chemical applications. Because it can be easily cleaned and sanitized, stainless steel pipe is also desired for applications involving food, beverages, and pharmaceutical applications.

**1.2** Stainless steel pipe fittings are used to connect steel pipes. The stainless steel fittings include Tee, Cross, Elbow, Reducer, Coupling, Nipple, Plug & Cap, Adapters, Union, Connectors, Compression fittings, and Valve.

**1.3** Stainless steel pipes and fittings are widely manufactured and used for industrial applications and domestic purposes. BIS has formulated standards on Stainless steel seamless and welded pipes and tubes for general engineering applications (IS 6913, IS 17875 and IS 17876) but Indian standards are not available for stainless steel pipe fittings. In the absence of standards for stainless steel fittings, the ecosystem system of standardization is not complete as installation of stainless steel pipes cannot be done without using stainless steel fittings.

**1.4** This R&D project is thus proposed to study the grades, chemical and physical properties, and various shapes and sizes of stainless steel fittings and would be helpful in formulation of a new standard on Stainless steel pipe fittings.

**1.5** The Indian standards mentioned above can be accessed from <https://standardsbis.bsbedge.com>.

### **2. Objective:**

To collect relevant data and information from primary and secondary sources for grades, chemical and physical properties, and various shapes and sizes of stainless steel fittings.

### **3. Scope:**

**3.1** Study the available literature like national and international standards such as ASTM, JIS, EN, ISO etc available on the subject, research papers, any study conducted by other organisations, companies' brochure. Identify the grades, sizes, types, dimensions and their chemical, dimensional, and mechanical properties, and any other requirements.

**3.2** Collect data on the manufacturing base of the product in the country.

**3.3** Identify the end use of Stainless steel fittings including water application, general application, high temperature applications, and food and beverages industry applications.

**3.4** Study the end use of stainless steel fittings based on Pressure/ temperature ratings.

**3.5** Visit the manufacturers of the product and get the information on the following:

- a) Types of Raw material used,
- b) Varieties/grades manufactured,
- c) Quality parameters (chemical, dimensional, and mechanical properties) of different grades and different types,
- d) Manufacturing process,
- e) Heat treatment requirements,
- f) Safety requirements,
- g) In process quality checks,
- h) Test facilities and test methods used,
- j) Marking and labelling being done,
- k) Packaging requirement,
- l) Tests being undertaken,
- m) Testing facilities in the plant,
- p) Addressing sustainability in processes such as using energy efficient processes, using renewable energy sources, recycling, reuse, and
- q) Waste recycling.

**3.6** Identification and visit to the laboratories.

**3.7** Check the quantity of the product imported and exported and the 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 on the foreign specification as per which the product is being imported or exported.

**3.8** Identify the users including organized buyers of the product and take data of the quantity being used by them, specifications used, check for the test certificates received by them, and study the chemical and physical properties mentioned in the test certificate. Also, understand from the user the main properties required by them in the product.

**3.9** 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 quality personnel,
- d) collect the data as mentioned in the scope through a questionnaire,
- e) test samples in the factory and draw samples of the grades and shapes being manufactured and get them tested in BIS approved/ NABL accredited laboratories, and laboratories of BIS MoU Partner Institutes.
- f) collect the drawings and dimensions of various stainless steel fittings manufactured.

#### **4.3 Visit laboratories and make reports on**

- a) test equipment required,
- b) test method being used,
- c) testing charges,
- d) testing time required,
- e) the tests being conducted on the samples drawn, and
- f) findings of the tests conducted on the samples drawn.

**4.4** Visit the identified importers and exporters and collect data as mentioned in the scope through a questionnaire

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

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

#### **5. Sampling plan:**

**5.1** Two manufacturers from each large and MSME shall be visited.

**5.2** Three samples for each shape of fittings of different grades of stainless steel shall be tested.

**5.3** Samples may be drawn from manufacturers, users, importers and/or market

**5.4** All stainless steel fittings samples should be tested for dimensional, chemical, mechanical tests, and hydrostatic tests and other tests as identified in the literature survey/information gathered from manufacturers or users.

**5.5** Two users of the product shall be visited.

**5.6** Two laboratories, preferably one in the government sector and one in the 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 certificates, drawing and dimensions of various stainless steel fittings, extract of International specifications, 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:

<b>Sl No.</b>	<b>Stage</b>	<b>Time from date of award of project (cumulative)</b>
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 a test report from independent laboratories if the test is of long duration test.

### **8 Support BIS will Provide:**

- a) National /international standards relevant to the project,
- b) Details of BIS Licensees details,
- c) Product manual, and
- d) Details BIS recognized laboratories.

### **9 Relevant sectional committee and Nodal officer from BIS Sectional committee:**

MTD 19-Steel Tubes, Pipes and Fittings Sectional Committee Sectional Committee

#### **Nodal officer:**

Mr Sachin Choudhary, Scientist C/ Deputy Director – Member Secretary MTD 19,  
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