TERMS OF REFERENCE FOR R&D PROJECT

Title: Study of methods of test for phosphate coatings for determination of characteristics of phosphate coatings on metallic substrate.

1. **Background:**
   1.1. Phosphate coatings serve as crucial surface treatments to enhance the durability and corrosion resistance of metals, particularly steel and aluminium. Ensuring the quality and reliability of these coatings is imperative across industries such as automotive, aerospace, construction, and manufacturing.
   1.2. Phosphate coatings are applied using various methods (e.g., immersion, spray) and can vary in thickness, composition, and structure based on the intended application. Generally, there are three types of phosphate coating used by the industry: zinc phosphate, iron phosphate and manganese phosphate. The need to understand and verify testing methods is critical due to the diverse nature and application of these coatings.
   1.3. Indian Standard 'IS 14503 Testing of phosphate coatings methods' is available for this subject. This standard is very old and besides the test methods defined in the standard, there are other test methods which are more fast, accurate and reliable and are widely used by the industry.
   1.4. A need was thus felt that a research project may be taken up for updating testing methods based on analytical data to improve speed, accuracy, reliability, and alignment with modern industry practices. This will be useful in upgradation and revision of IS 14503.
   1.5. Indian standards can be accessed by link https://standardsbis.bsbedge.com/

2. **Objective:** To collect relevant data and information, from both primary and secondary sources to comprehensively evaluate and update methods of test for phosphate coatings.
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. Details of test method used for determination of mass, corrosive residues, resistance to corrosion and composition of phosphate coatings and any other tests to be collected.
   3.2. Identify phosphate coating units, testing labs and users.
   3.3. Visit phosphate coating units and collect the following information:
      3.3.1. Phosphate coating process (process flow)
      3.3.2. Base materials of articles and composition of phosphating coating that is used
      3.3.3. Variety and grades of phosphate coating if any
      3.3.4. Designation/nomenclature of phosphate coatings if any
      3.3.5. Pre and post treatments
      3.3.6. Test facilities and test methods used to check the quality of coating
      3.3.7. Tests being undertaken
      3.3.8. Packaging requirement
      3.3.9. Marking requirement
      3.3.10. Sampling plans

   3.4. Visit the laboratory and collect the following information:
      3.4.1. Quality parameters and their safe limits
      3.4.2. Types of tests to check the quality of coating
      3.4.3. Test specimen for each test (size, shape, finish, conditioning, etc.)
      3.4.4. Tests to determine mass of coating

3.4.5. Tests to determine corrosive residues
3.4.6. Tests to determine resistance to corrosion
3.4.7. Tests to determine composition of phosphate coatings
3.4.8. Any other test undertaken on phosphate coating

3.5. Identify exporters/importer/users of the product. Take data of the foreign specification as per which the phosphate coated product is being imported or exported. From the users of the product, take data of the tests conducted and test method by them on the products for phosphate coating and test certificate received.

3.6. Review of Existing Methods: Analyse current methodologies employed in industries for determination of characteristics such as mass, corrosive residues, resistance to corrosion and composition of phosphate coatings.

3.7. Comparative Analysis: Evaluate the strengths, limitations, and applicability of different methods

3.8. Analysis and consolidation of data and preparation of a comprehensive analytical report of the data collected above.

4. Methodology:

4.1. Literature Review: Gather information on existing methods, their principles, advantages, and limitations from scientific papers, industry standards, and publications.

4.2. Visit he phosphate coating unit and

4.2.1. Observe the coating process,
4.2.2. Examine in-process control measures,
4.2.3. conduct focussed group discussion with quality personnel
4.2.4. collect the data as mentioned in the scope through a questionnaire.
4.2.5. Test the samples drawn in in-house labs/ BIS recognized labs/NABL accredited laboratory/Any Govt. laboratories.

4.3. Sample Preparation: Obtain samples covering all the types of phosphate coating for testing purposes.

4.4. Perform measurements using different methods on the prepared samples in NABL accredited labs, for the tests mentioned in the relevant standard/any other test as derived from literature survey.

4.5. Visit laboratories and make report on

4.5.1. test equipment and reagents/chemicals required
4.5.2. test method being used
4.5.3. test parameters to be reported
4.5.4. testing charges
4.5.5. testing time required.

4.6. Visit the importer/ exporter/user industry and obtain information as mentioned in scope through a questionnaire.

4.7. Data Analysis: Analyse the results obtained from each method, comparing accuracy, precision, and reliability.

5. Sampling Plan:

5.1. Test 3 samples of each type of coating.
5.2. Samples may be drawn from coating unit, user, trader or market.
5.3. Two phosphate coating unit from each large/medium and small/micro scale shall be visited
5.4. Four laboratories, preferably two in government sector and two in private sector shall be visited.
5.5. Two user industry 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 4 months from the date of award of the project. The proposed indicative timeline stage-wise is given below:

Sl No	**Stage**	**Time from date award of proje (cumulative)**
1	Literature review and identification of phosphate coating unit, testing laboratories, user industry, and discussion with BIS for the finalization of sampling plan	1 month
2	Visit to coating unit, testing laboratories, users 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:

8.1. 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

9.1. Sectional committee: MTD 24 (Corrosion Protection and Finishes Sectional Committee)

9.2. Nodal officer: Mr Dushyant Hawelikar, Scientist B/ Assistant Director – Member Secretary MTD 24,

9.3. Email: mtd24@bis.gov.in