TERMS OF REFERENCE FOR THE R&D PROJECTS

1. **Title of the Project**: Study of performance and safety parameters of Wearable E-Textile for Heating Application

Sectional Committee: LITD 33 "Wearable Electronic Devices and Technologies"

Proposed Duration: 6 Months

2. Background

2.1 Wearable heating e-textiles are a specialized category of e-textile products designed to generate and distribute heat for various applications. The market currently offers a variety of wearable heating products like heating jackets, belts, blankets but there are no set requirements for assessing the performance and safety of these products.
The proposal aims to address the critical need for a thorough study focused on Wearable Heating E-textiles to ensure the safety, performance, interoperability and, efficiency of these products.
2.2 The objective of this project is to create a comprehensive study of evaluation of performance and safety parameters of wearable E-Textile products for heating application that are widely used in the country. This study will encompass a diverse range of heating textile products, such as heating jackets, belts, blankets, and, others that fall under the wearable e-textile group. The study is vital for ensuring the safety, efficacy, and quality and for promoting the development and widespread adoption of wearable heating e-textiles in India.
2.3 The report would eventually be utilized to formulate an Indigenous Standard on the performance and safety aspects of Wearable Heating E-Textiles.

3. Scope

3.1 The scope of this project is to conduct an in-depth evaluation of wearable heating e-textile products.
3.2 This proposal applies to heating products that incorporate heating wires within a textile fabric insulation and those that can be worn by an individual. The details of the scope of this proposal is as follows:

3.2.1 A comprehensive survey of International/National Standards related to wearable heating e-textile products.

3.2.2 Collection and reporting of the following data:

a. Raw materials used

b. Countries from where raw materials are being sourced and percentage thereof

c. Manufacturing methodology used and process control

d. Varieties manufactured

e. Test-facilities available

f. Test methods used

g. Test equipment's available for complete testing of the product

h. Frequency of testing of each parameter

i. Sampling data for testing

j. Marking & labelling requirements

k. Packaging

l. Post production quality check facilities

m. Data on sales (export and domestic consumption)

n. Collection of data sheet/ technical specification of each variety of product manufactured

o. Steps taken for ensuring energy conservation/ efficiency

p. Sustainable processes followed in the production process

q. Waste disposal management

3.3 Study of technical regulations and applicable standards of countries where the product is exported.

3.4 Specifying test methods

3.5 Assessment of test facilities available for the product in the country

3.6 Feedback from users of the product

3.7 Expert consultation

4. Expected Deliverables

The expected deliverables for this project are as follows:

4.1 Report on the data collected as mentioned at Clause 3.2 of this R&D proposal.

4.2 A clear and comprehensive categorization of various types of heating e-textile products is to be provided. Aspects considered for the purpose of categorization, to create a standardized taxonomy, is to be mentioned.

4.3 A detailed review report specifying test methods to evaluate the performance and safety parameters of the wearable heating e-textiles is to be submitted. This report shall cover various performance and safety aspects of wearable heating e-textile products, including:

4.3.1 Durability: Evaluation of the product's longevity and ability to withstand wear and tear.

4.3.2 Abrasion Resistance: Testing the product's resistance to abrasion and its ability to maintain functionality.

4.3.4 Temperature Range: Determining the range of temperatures that the product can achieve effectively.

4.3.5 Response Time: Determining how quickly the product reaches the desired temperature

4.3.6 Power Consumption: Measuring the energy efficiency and power requirements of the product

4.3.7 Interoperability: Tests to ensure that the wearable heating e-textile components from different manufacturers can work together seamlessly.

4.3.8 Fall Test: A fall test to be formulated to evaluate the product's safety in scenarios where users might trip or fall while using heating textile products. This test is to assess whether the product poses any risks in such situations.

4.3.9 Electrical Safety: An electrical safety test to be prescribed to evaluate the product's electrical safety.

4.3.10 Heat Distribution Safety/ Heating Uniformity: A test method to be prescribed ensuring that the heating is evenly distributed without any hotspots that could cause burns or discomfort to the user.

4.3.11 Overheating Protection: A test method to be prescribed to ensure that the product has safeguards against overheating, which could pose fire hazards or discomfort to the user.

4.3.12 User Guidelines: Recommendations to be prescribed for safe usage and maintenance of wearable heating e-textile products.

4.4 Report of testing of the product as per the test methods prescribed by the researcher from any Govt. laboratory/ NABL accredited laboratory

5. Research Methodology:

5.1 Study and comparative analysis of existing literature which includes international standards, research papers, any SOP/instruction/guidelines issued by the ministry/regulatory body concerned, any other study report.

5.2 Gathering data on heating textile products available in the market, including types, brands, and specifications. This will serve as a basis for product selection.

5.3 Conducting focus group discussions with potential users and experts in the field to identify key performance parameters and safety concerns.

5.4 Visits to manufacturing units to understand the production processes and quality control measures in place. Visits to 2 large scale manufacturing units, 2 small scale manufacturing units and 2 micro scale manufacturing units to be undertaken.

5.5 Selection of the number of representative samples of heating textile products for testing to be ascertained.

5.6 Defining test methods for assessing the performance and safety parameters of wearable e-textiles used for heating applications.

5.7 Testing the selected samples in a controlled laboratory environment to evaluate their performance and safety characteristics.

5.8 Seeking feedback and consultation from experts in textile engineering, electrical engineering, and product safety to ensure the accuracy and relevance of the testing procedures prescribed.

6. Timeline and Method of Progress Review:

6.1 Project Initiation, Data Collection and Testing (First 3 Months): The project officially begins with a detailed review of the existing International/National Standards and other similar literature available on the topic. This phase also focuses on collection of data from manufacturers/laboratories/users and formulating test methodologies to address the performance and safety parameters of the wearable e-textile products for heating applications. The first draft of the project report is to be submitted during this stage.

6.2 Analysis and Assessments (Last 3 Months): A mid-term review is conducted to assess progress and adjust methodologies as necessary after taking feedback from concerned stakeholders and expert consultation. In these months, testing of the collected samples is to be carried out in the laboratories and the test methods and requirements prescribed are to be analysed and assessed. The final project report is to be submitted.

This condensed timeline covers the essential phases for the completion of the project within 6 months timeframe from the date of awarding the project, ensuring efficiency in project execution. Progress reviews will be conducted as needed to track developments and to make timely adjustments.

7. Support BIS will Provide:

BIS will offer valuable guidance and access to existing ISO and IEC Standards relevant to heating products (textile or non-textile). The contact details of the concerned member secretary will be provided.