

TERMS OF REFERENCE FOR THE R&D PROJECT

1. Title of the Project: Collection and analysis of Dissolved Gas Analysis (DGA) Data for Ester based Transformer fluids and conclude method for interpretation of DGA for fault identifications of ester fluid filled transformers.

2. Background:

- India Standard. IS 10593: 2023/IEC 60599:2022 covers Guidance on the interpretation of dissolved and free gases analysis of Mineral oil-filled electrical equipment in service.
- Dissolved Gas Analysis (DGA) is one of the most important method for transformer condition assessment. DGA is already a proven and widely used method for transformers with mineral insulating oil. Now-a-days most of the utility prefer ester oil rather than mineral oil in transformers because of fire safety and environmental concerns and also indigenous availability. The gases generated in ester liquids under fault conditions are the same as mineral oil, but depending upon the base oil, ratios or proportions of gases vary. Hence, a new DGA interpretation method is required to be developed for fault identifications of ester fluid filled transformers.
- Experience based data on DGA of transformers filled with ester oil are not available in open domain in sufficient quantum usually required for development of standards. Hence, more DGA data on transformers with ester oil is required to be collected from various stake holders.

3. Objective: To collect data and analyse the same to conclude regarding method of interpretation of DGA data for fault identification of ester oil filled transformers.

4. Scope: Scope of this research project includes –

- Literature review that may involve:
 - a. Study of the role and relevance of the proposed project vis-a-vis current scenario.
 - b. Available standards that may be relevant to DGA of insulating fluids.
- Identification and collection of transformer details which use the Natural and Synthetic ester oil in India, in all ranges of power ratings.
- Collection of details of type of ester oil with different base oil used in these transformers.
- Collection of DGA data of transformers with ester oil monitored over a sufficiently longer period of time.
- Collection of physical, chemical and electrical property data of these transformer oil analysed before the time of installation and at the time of fault identification.
- Details of fault diagnosed/ failures in transformers with ester oil.
- Correlating DGA data with type of fault, type of base oil, and physical & electro-chemical properties of oil.

5. Research Methodology:

- Literature review
- Identification and collection of transformer details which use the Natural and Synthetic ester oil in India, in all available ratings.
- Data collection (DGA history record, Transformer fault / failure details, oil properties before commissioning and at the time of fault/failure)
- Preparation of first draft report including analysis of data and recommendations.
- Final Report preparation.

6. Deliverables:

1. Report on Literature review including relevance of the proposed project vis-a-vis current scenario.
2. Final project report including data collected and analysis of the same to conclude regarding method of interpretation of DGA data for fault identification of ester oil filled transformers.

7. Timeline and Method of Progress Review:

7.1 Timeline:

Sr. No.	ACTIVITY	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6
1	Literature review (Milestone 1)						
2	Identification and collection of transformer details which use the Natural and Synthetic ester oil in India, in all available ratings.						
3	Data collection (DGA history record, Transformer fault / failure details, oil properties before commissioning and at the time of fault/failure)						
4	Preparation of first draft report including analysis of data and recommendations (Milestone 2)						
5	Final Report preparation (Milestone 3)						

7.2 Monthly progress Review

The review will be carried out in each month along with consultation of other experts if required. The literature review after 1 month, the first draft after 5 months and the final draft along-with report at the end of 6 months.

8. Support BIS will provide:

- BIS will provide access to latest editions of standards, required for the project.

9. Nodal Person:

Shri Nitish Kr Jain, Scientist-B/Assistant Director and Member Secretary of ETD 03,
Email: eedd@bis.gov.in