PROJECT ABSTRACT

Transformer Oil Breakdown Voltage Test Kit

A bench-scale kit for the dielectric-strength (BDV) test of transformer oil: a transparent perspex oil cell with brass spherical electrodes and a control box with a kV meter, interlock and safety lamps. Delivered built-to-order with the kit, procedure manual, report, PPT and viva kit.

01. Title

Transformer Oil Breakdown Voltage Test Kit

02. Introduction / Background

Transformer oil insulates and cools, and both functions fail when the oil is contaminated with moisture or particles. The single number certifying oil health is its breakdown voltage — the voltage at which a standard electrode gap in the sample sparks over — tested routinely to IEC 60156 by utilities. Students, however, meet this test only as a paragraph in a high-voltage engineering textbook. This project puts the test on the bench: a transparent perspex oil cell with two polished brass spherical electrodes on an adjustable 2.5 mm gap, a control box that ramps the test voltage, and a kV meter that reads each breakdown — with the standard six-breakdown sequence in the manual.

03. Problem Statement

Dielectric-strength testing is a core high-voltage-engineering skill, but few college labs own a BDV test set, so students graduate without ever running the procedure the industry uses to accept or reject insulating oil. The project addresses this with an affordable, transparent bench-scale kit where the student performs the full IEC 60156-style procedure: six breakdowns per sample, mean BDV computation, and a clean-vs-contaminated oil comparison that makes the effect of moisture unmistakable.

04. Objectives

- Provide a transparent perspex oil cell with polished brass spherical electrodes.
- Set the standard 2.5 mm electrode gap with an adjustable screw and feeler gauge.
- Ramp the AC test voltage smoothly with a control box, kV meter and test pushbutton.
- Implement the six-breakdown-per-sample procedure with settling intervals.
- Include a clean-vs-contaminated oil comparison experiment.
- Enforce safe operation with a lid interlock and READY/HV-ON lamps.

05. Proposed Methodology

The oil sample fills the cell covering the electrodes; the gap is set to 2.5 mm with the feeler gauge and the lid is closed to enable the interlock. The operator presses TEST and the control box ramps the AC voltage until the oil sparks over between the spheres; the kV reading at breakdown is recorded. After the settling interval the run repeats for six breakdowns, and the mean BDV and spread are computed in the result sheet. The cell is

cleaned, refilled with the second sample, and the sequence repeated for the comparison.

06. System Architecture / Working

The two brass spheres form a quasi-uniform field gap in the oil sample; as the ramped voltage rises, the field at the gap eventually exceeds the oil's dielectric strength and an arc bridges the spheres — the breakdown event the kV meter captures. Moisture or particles distort the field and trigger breakdown far earlier, which is why the contaminated sample's mean BDV collapses relative to the clean sample. The perspex cell lets the student observe each breakdown safely through the wall, connecting the meter reading to a visible physical event.

07. Hardware / Software Requirements

- Transparent perspex oil test cell with brass spherical electrodes
- Adjustable gap screw with 2.5 mm feeler gauge
- HV control box with smooth voltage ramp and kV panel meter
- Test pushbutton, power switch, lid safety interlock
- READY (green) and HV-ON (red) indicator lamps
- Cell-cleaning accessories and sample bottles
- BDV test procedure manual with six-breakdown result sheets

08. Expected Outcomes

- Student-run six-breakdown BDV sequences on two oil samples.
- Computed mean BDV and spread per sample, in standard result-sheet format.
- A clear clean-vs-contaminated comparison demonstrating moisture's effect.
- A complete report, PPT and viva Q&A; on dielectric strength and IEC 60156.

09. Applications

- Teaching the standard insulating-oil acceptance test in high-voltage labs.
- Demonstrating dielectric breakdown mechanisms and contamination effects.
- A base rig for follow-on oil-diagnostics studies.

10. Future Scope

- Automated six-breakdown sequencing with digital kV logging.
- Temperature-controlled cell for BDV-vs-temperature studies.
- Partial-discharge listening as a complementary diagnostic.
- Comparative tests on alternative insulating liquids.