



Cambridge Instruments
& Engg. Co.

EST. 1963 · HOWRAH, INDIA

TEST REPORT FORM

Transformer Oil BDV Test

Dielectric breakdown voltage of insulating oil · six breakdowns per sample, mean and spread

01 Job and sample details

Customer / substation		Test date	Sample drawn by
Transformer ID / tag	Rating (kVA) and voltage class (kV)	Oil type / grade	Year of commissioning
Sample taken from ☐ Bottom drain valve ☐ Top ☐ Conservator ☐ Drum		Oil temperature at sampling (°C)	Sample ID(s)
Tester model, serial no.		Electrode gap (mm), normally 2.5	Voltage rise rate (kV/s), normally 2

02 Breakdown voltage readings

kV at each breakdown. Rest the filled cell, then stir gently between breakdowns

Breakdown in order	Sample 1 kV	Sample 2 kV	Sample 3 kV	Sample 4 kV
1				
2				
3				
4				
5				
6				
Mean (kV)				
Lowest (kV)				
Highest (kV)				
Standard deviation (kV)				
Spread: SD / mean (%)				
Limit for this oil (kV)				
Result	☐ Pass ☐ Fail	☐ Pass ☐ Fail	☐ Pass ☐ Fail	☐ Pass ☐ Fail

Write the limit from your utility specification, the transformer manufacturer or IEC 60422 / IS 1866 for the voltage class. The guide table on page 2 shows commonly quoted values. A very large spread between the six values suggests moisture, particles or a poor sample: refill the cell and repeat before judging the oil.

03 Visual check and conclusion

Oil appearance ☐ Clear ☐ Cloudy ☐ Dark / particles	Free water or sediment seen ☐ No ☐ Yes
Oil condition ☐ Good ☐ Dry out / filter ☐ Replace	Retest due
Remarks and recommended action	

Signature and date: tester	Signature and date: reviewer
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Procedure and guide values

Sampling, the test sequence, how to work out mean and spread, and commonly quoted limits

01 Calculations

Mean of six breakdowns

$$\text{mean} = (V_1 + V_2 + \dots + V_6) / 6$$

Standard deviation (sample)

$$SD = \sqrt{(\Sigma(V_i - \text{mean})^2 / 5)}$$

Relative spread

$$\text{spread} = SD / \text{mean} \times 100 \%$$

Worked example (made-up readings): 38.5, 41, 36, 44.5, 40, 39 kV gives mean 39.83 kV, SD 2.84 kV, spread 7.1 %.

02 Test sequence

in the spirit of IEC 60156. Follow your tester manual and the standard you work to

- **Sample.** Use a clean, dry, sealed glass or approved container. Rinse it with the oil, draw from the bottom drain after flushing the valve, and keep air and moisture out. Test soon after sampling.
- **Cell.** Clean the cell and electrodes, set the gap (2.5 mm is the usual figure for the standard electrodes), and check it with a gauge. Rinse the cell with the sample, then fill it gently to avoid bubbles.
- **Rest.** Let the filled cell stand for about 5 minutes before the first voltage is applied, so air bubbles can rise out.
- **Apply.** Raise the voltage steadily at about 2 kV per second until breakdown. Record the kV at the trip. Stir gently without making bubbles, rest about 1 minute and repeat for six breakdowns on the same filling.
- **Judge.** Take the mean of the six values. If the spread is large or the mean is below the limit, refill with fresh oil from the same sample and repeat.

03 Guide values

commonly quoted for in-service oil, 2.5 mm gap. Not from one standard: use your specification

Transformer voltage class	Acceptable (kV, mean)
Up to 72.5 kV	30 or more
Above 72.5 kV up to 170 kV	40 or more
Above 170 kV	50 or more

What lowers BDV

- Dissolved and free water, even at tens of ppm
- Cellulose fibres and dust particles
- Ageing by-products and sludge
- Air bubbles, an unrested or dirty cell

Guide values. The thresholds above are common field practice, written as guides for filling the limit box on page 1. Take the binding limit from your own specification. BDV alone does not show oil quality: use it together with water content and acidity tests where the equipment is important.

04 Safety

- The tester produces lethal voltage. Close the lid and interlock before applying voltage, and discharge and earth the electrodes before opening.
- Take oil samples from a de-energised transformer or follow your permit for sampling a live one.

CIE INSTRUMENTS FOR THIS TEST

CIE/7000 Series

8 models from 0–50 kV to 0–120 kV for transformer oil dielectric strength

Manual or motorised

Voltage rise by hand or by motor, per model

Options

Digital metering, 2-unit housing and magnetic stirrer available



See the BDV testers

Scan for CIE transformer oil BDV testers.
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