



# **Distribution Transformer Testing as per IS 1180-1: 2014**

**Electrical Research and Development Association**

# ERDA: Milestones



**Established first  
Short Circuit Lab  
1998**



**Established  
largest On Line  
SC Lab in Savli  
2007**



**Established EMI-  
EMC specialty  
center  
2012**



**Established COE  
for Rotating  
machines  
2013**



**Grown over 45  
years with 24  
centers spread  
over 5 locations  
2019**



**Started with 1  
center & 2  
Product testing  
1983**

# ERDA's Facility for IS 1180-2014



- ISI marking is mandatory for transformers up to 2.5 MVA according to IS 1180-Part-1-2014
- ERDA laboratories have been carrying out transformer testing since the last 40 years.
- BIS accredited DT Testing (as per IS:1180-2014) Laboratory at :
  - ERDA Makarpura, Vadodara (upto 2.5 MVA, 33 KV)
  - ERDA (West), Rabale , Navi Mumbai (upto 200 KVA, 33 KV)
- Testing Capacity at
  - ERDA Makarpura, Vadodara - 140 nos. Transformers per month
  - ERDA (West) , Rabale – 10 nos. Transformers per month
- The facilities have been accredited by NABL, BIS, BEE (Vadodara)

# Temperature rise, Routine and Special Test Facilities for Transformers



ERDA has six test beds to carry out temperature rise and routine tests.

Maximum rating of transformers which can be tested at ERDA, Makarpura are up to and including 33 kV, 2500 kVA.

- ERDA has facility to carry out Special tests:
  - Pressure test (Type & Routine)
  - Magnetic balance test
  - Zero sequence impedance
  - Over fluxing & flux density
  - Oil Leakage test
  - Paint adhesion test
  - Determination of sound level
  - BDV & Moisture content in oil



# Temperature Rise Test



# Short Circuit Test Facility at ERDA



ERDA has three short circuit test laboratories.

Maximum rating of transformers which can be tested at ERDA, Makarpura are:

- 11/0.433 kV, 1600 kVA
- 22/0.433 kV, 500 kVA
- 33/0.433 kV, 500 kVA

Maximum rating of transformer can be tested at ERDA, Savli are:

- 11/0.433 kV, 1000 kVA
- 22/0.433 kV, 1000 kVA
- 33/0.433 kV, 4000 kVA

# Short Circuit Test Laboratory



# Impulse Tests on Transformers



- ERDA has three Impulse Laboratories
- 2 nos. of 1600 kVp and one of 800kVp
- ERDA can test up to 160 MVA, 400 kV class transformers.





# Impulse Laboratory



# Routine & type testing of transformers up to 100 MVA, 220kV at site



- Tests carried out ERDA's calibrated instruments.
  - Measurement of winding resistance
  - Measurement of voltage ratio and phase displacement
  - Measurement of load loss and impedance voltage
  - Measurement of no load loss and no load current
  - Measurement of insulation resistance
  - Temperature rise

# Transformer Component Evaluation Services



- Paper covered copper and aluminium conductors
- High voltage bushing and insulators up to 245 kV
- CRGO Steel Laminations (both at Vadodara and Gurugram)
- Solid insulating materials (paper / pressboard / laminated wood and boards / cork sheets)
- Transformer oil (New and In service) and Dissolved Gas Analysis (DGA)
- Natural and synthetic ester oil

# Diagnostics Services of Transformers



- Condition monitoring by Capacitance & Tan delta measurements
- Online condition monitoring by acoustic emission method
- Furan analysis and Degree of Polymerisation (DP) of cellulosic (paper & pressboards) materials in transformer

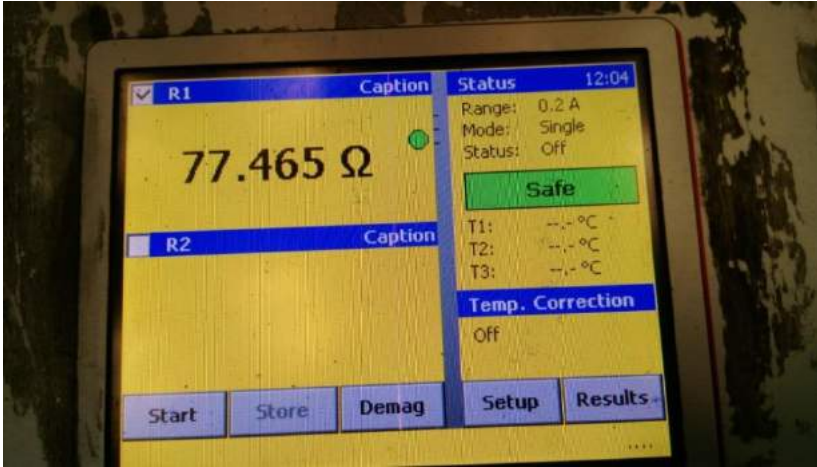
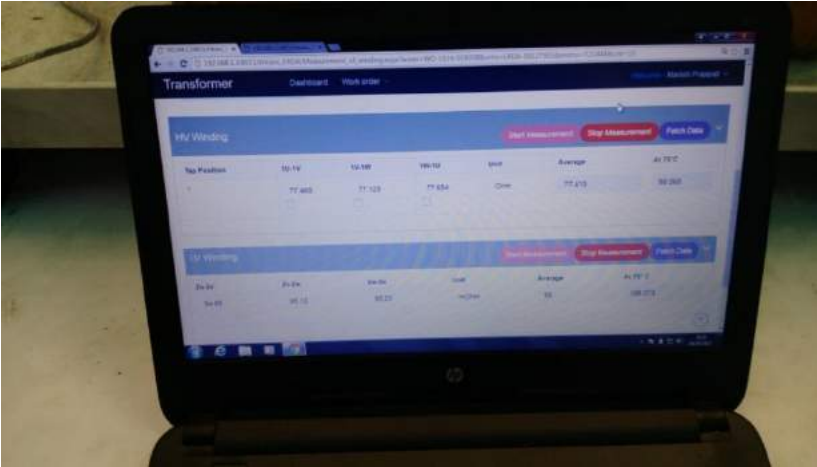
# Automatic Transformer Test System



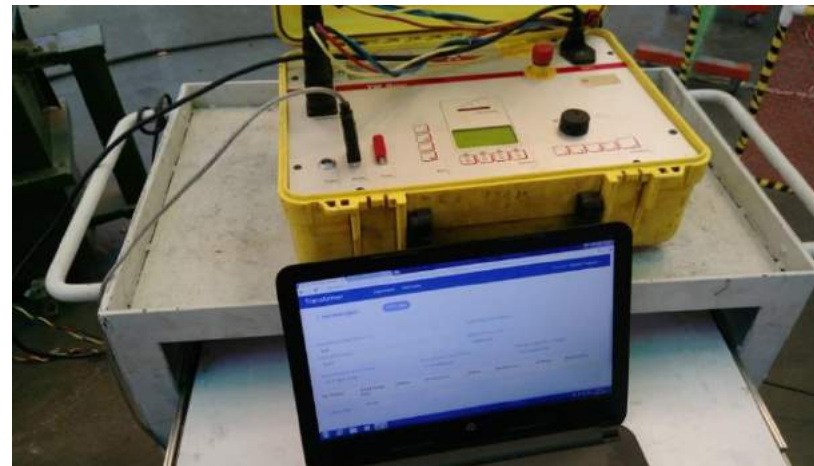
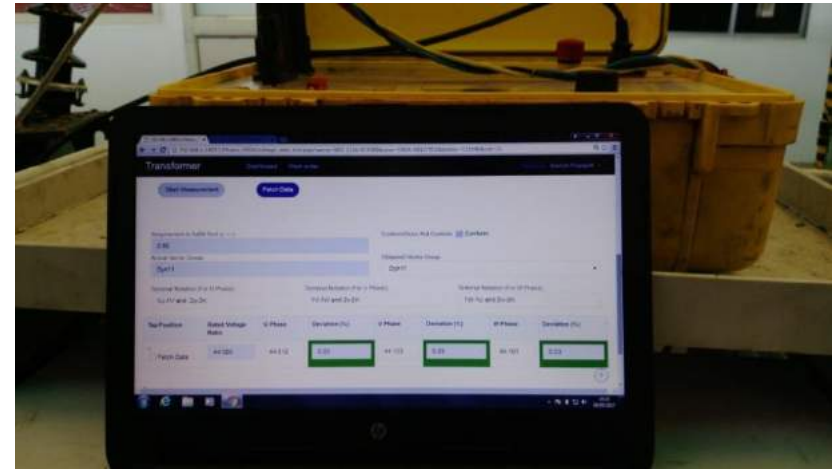
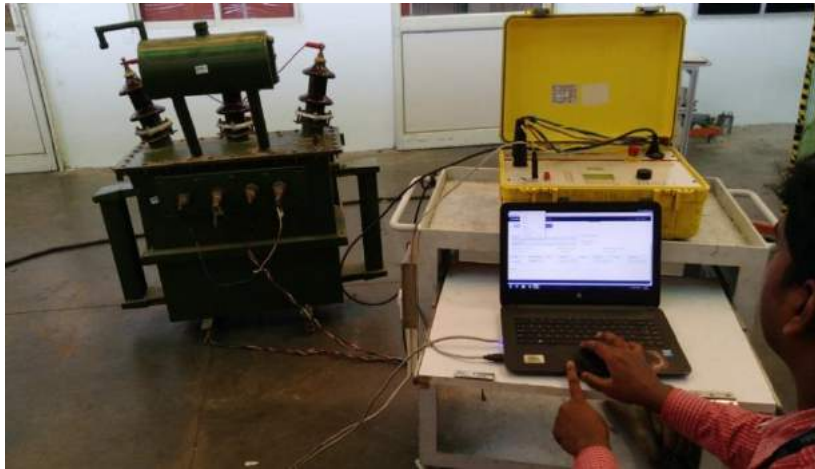
The testing of transformers is carried out by using an automatic data capturing and reporting system developed by ERDA. The benefits of the system are:

- Testing Quality Assurance
- No Manual Recording. All data are automatically transferred to computer. It is not possible to edit or change the test data.
- Better accuracy of measuring system
- Automatic test report generation after testing
- Enhanced reliability of test report
- Reduction in turnaround time
- Build Customer trust and credibility
- Easily programmable test routines
- System covers full in-house testing range up to 2.5 MVA, 33 kV Transformer

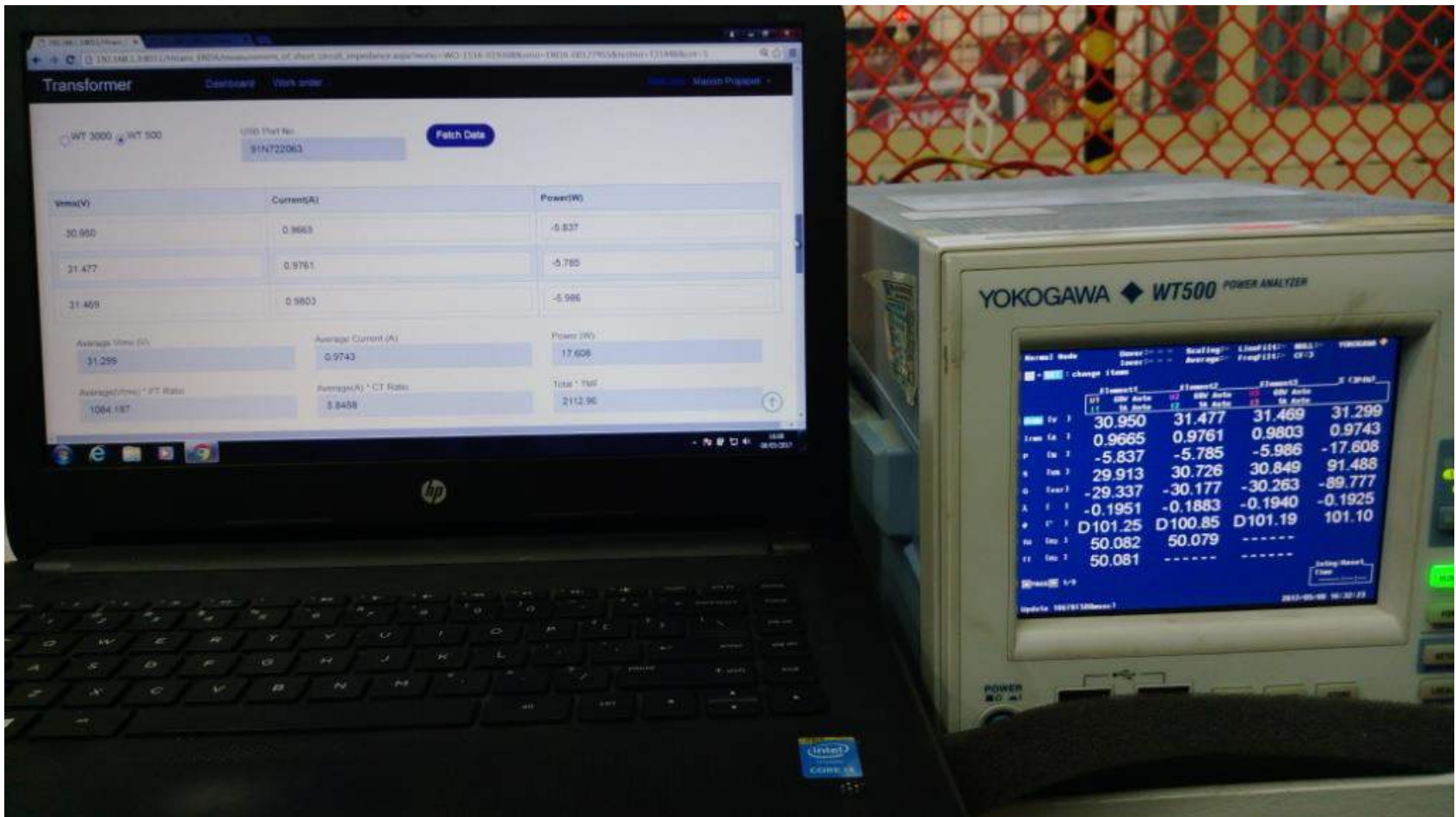
# Automatic Transformer Test System (Winding Resistance Measurement)



# Automatic Transformer Test System (Voltage Ratio Measurement)



# Automatic Transformer Test System (Load Loss & Impedance Voltage Measurement)





# BIS Testing Summary as per IS:1180-1-2014 (up to 31/08/2019)



Sr. No.	Year	Quantity
1	2014-15	4
2	2015-16	125
3	2016-17	234
4	2017-18	183
5	2018-19	133
6	2019-20	56
	Report issued	727
	Under progress	8
	Total samples	735



## Case Study – Dist. Transformer Testing as per IS: 1180-1-2014 Quality Control Order of BIS



### Dist. Transformers tested by ERDA as per IS : 1180-1-2014

Sr. No.	Year	Direct from BIS	From Manufacturers
1	2014-15	4	56
2	2015-16	125	993
3	2016-17	234	1511
4	2017-18	183	2827
5	2018-19	133	1560
6	2019-20	48	498
	Samples tested	727	7445

- ❑ ERDA had tested 727 transformers received from BIS and out of these 582 approx. manufacturers had got BIS License till date out of total licensee of 625 nos. as per IS : 1180
- ❑ On an average ERDA tests more than 80% of total Distribution Transformers tested in India as per IS : 1180-2014

# BIS Testing Pass / Fail Summary as per IS:1180-2014 (up to 31/08/2019)



Sr. No.	Year	Quantity	Pass	Fail
1	2014-15	4	3	1
2	2015-16	125	102	23
3	2016-17	234	191	43
4	2017-18	183	158	25
5	2018-19	133	115	18
6	2019-20	48	39	9
	Total	727	608	119
	8 nos. samples are under testing in 2019-20			

# Average Time taken for Testing for BIS samples



Sr.	Year	Time from Receipt of all Clarifications to Dispatch of Test Report (Days)	Time from Receipt of Sample to Dispatch of Test Report (Days)
1	2015-16	20	28
2	2016-17	15	23
3	2017-18	15	23
4	2018-19	16	30
5	2019-20	20	22

NOTE: 2019-20 data based on only 48 test report for BIS

# Average Time for Testing



Sr.	Activity	Duration
1	Time taken to allot test dates	2-3 days
2	Time taken to start testing for samples from BIS	2-3 days
3	Time taken to start testing for samples from manufacturers	2-3 weeks
4	Average number of samples tested per month at Vadodara	140 nos.
5	Average number of samples tested per month at Rabale	10 nos.

# Testing Time for IS: 1180-1-2014



Day	Tests
Day 1, 2	Routine tests, Short circuit test, Post routine tests
Day 3	Impulse test
Day 4	Temperature rise test
Day 5	Oil leakage test
Day 6	Air pressure test (Routine & Type test),
Day 7	Flux density test, Physical verification
Day 8-12	Reporting



# ERDA's Experience: IS 1180

- Majority non conformances observed in following tests:
  - Temperature Rise
  - Short Circuit
  - Impulse tests
  - Polarity and voltage ratio
  - Induced over-voltage test
  - Minimum clearances in air
  - Constructional requirements and fittings
    - Rating and terminal marking plates not provided
    - Air release plugs
    - Base channels etc

# Factors attributing to delay in testing



- Specifications are incomplete or wrongly filled to carry out the tests.
- Specifications are not meeting the requirements mention in standard
- Mismatching of transformer sr. no in drawing, technical form and on actual transformer.
- Basic Insulation level (kVp) in test request, drawing & nameplate is different.
- Accessories are not provided or do not meet requirements of the standard.



# Factors attributing to delay in testing



- Specifications are at variance from the requirements of the standard.
- Energy Level, temperature rise limits etc.
- Name plates are not as per IS: 1180 2014.
- Name plates, drawings and sample do not match.
- Drawings are not legible, without drawing numbers
- Requirement of Stacking factor for flux density measurement not specified
- Polarity of Single Phase Transformer is not given.
- Thermometer pocket not provided to measure the oil temperature.



# Thank You



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