

# Dry Transformer Problems: Overheating, Noise, Vibration and Solutions

---

## Introduction

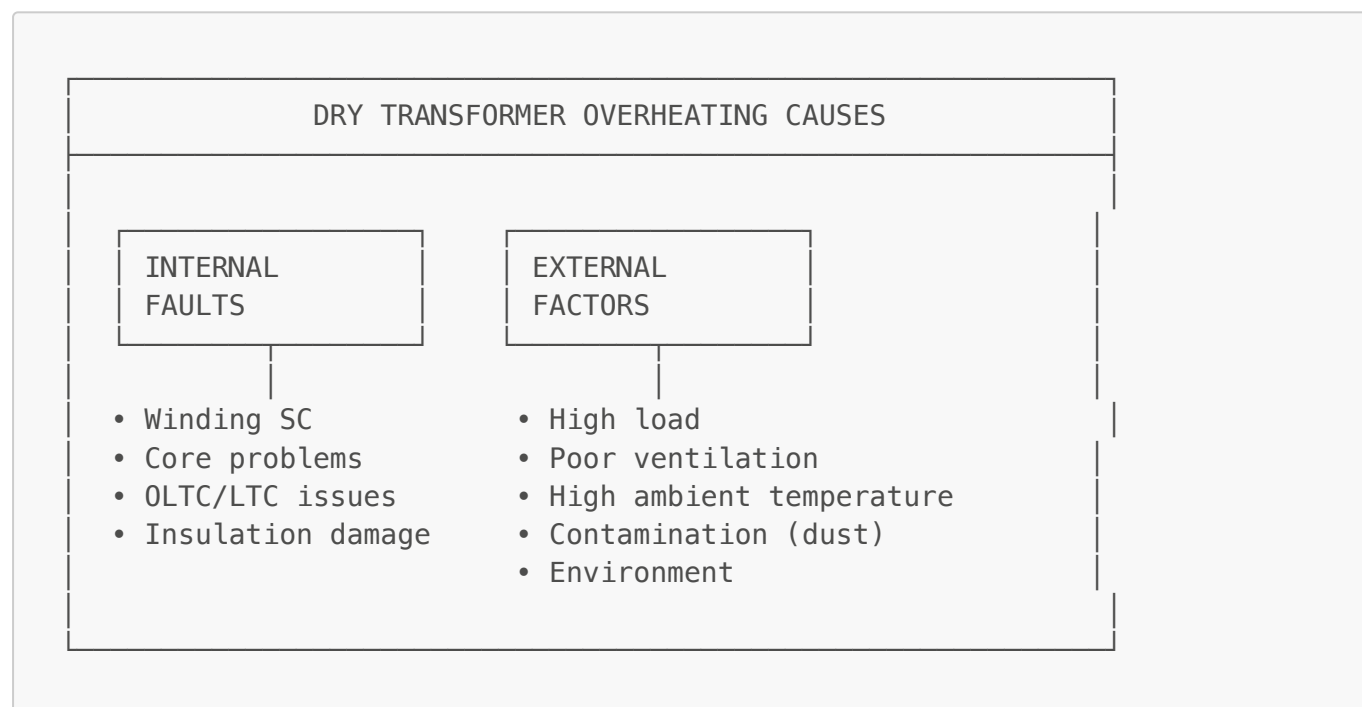
Dry-type transformers, despite their advantages in fire safety and environmental friendliness, have several **specific operational problems**. Understanding these problems and their timely resolution is critical for ensuring reliable equipment operation.

[Engineering audit for transformer diagnostics](#)

---

## Problem 1: Dry Transformer Overheating

### Causes of Overheating



### Internal Faults

#### 1.1 Winding Short Circuit

##### Mechanism:

- Short circuits between turns, layers and strands
- Short-circuit loop formation
- High temperatures at SC point

##### Causes:

- Rough manufacturing processes → mechanical insulation damage
- High temperature → insulation aging

- Overvoltage → insulation breakdown
- Current overload → thermal destruction

**Consequences:**

- Local overheating (hot spots)
- Insulation destruction
- Transformer failure

**Solution:**

- Regular winding resistance measurements
- Temperature mode control
- Timely repair or replacement

**1.2 Magnetic Core Problems****Eddy Currents in Core:**

- Insulation damage between silicon steel laminations
- Increased eddy currents
- Local core overheating

**Causes:**

- Mechanical damage during assembly
- Lamination insulation aging
- Through-bolt insulation damage

**Solution:**

- Visual core inspection
- No-load loss measurement
- Replacement if significantly increased

**1.3 Tap Changer Fault (OLTC/LTC)****Signs:**

- Uneven contact heating
- Increased contact resistance
- Sparking during switching

**Causes:**

- Insufficient contact pressure
- Contact contamination
- Improper operation

**Solution:**

- Contact pressure adjustment

- Contact cleaning
- Worn part replacement

## External Overheating Factors

### 1.4 Overload

#### Continuous Overload Operation:

- Increased copper losses ( $I^2R$ )
- Increased iron losses
- Additional losses
- Excess heat accumulation

#### Permissible Dry Transformer Overloads:

Overload	Permissible Time	Conditions
120%	2 hours	Every 24 hours
130%	30 minutes	Every 6 hours
150%	10 minutes	Emergency mode
200%	1 minute	Emergency mode

#### Solution:

- Accurate load calculation during selection
- Monitoring system installation
- Timely load reduction

### 1.5 Poor Heat Dissipation

#### Cooling System Malfunction:

- Fan failure
- Air duct clogging
- Poor sealing

#### Heat Dissipation Deterioration:

- Dust accumulation on surface
- Narrow room, poor ventilation
- Insufficient room height

#### Solution:

- Regular dust cleaning
- Fan operation check
- Ensuring free air circulation

### 1.6 Environmental Factors

### High Ambient Temperature:

- Reduced temperature difference
- Decreased heat dissipation capability
- Heat removal difficulties

### Recommended Conditions:

- Temperature: +1°C to +35°C (optimal)
- Temperature: -40°C to +60°C (limit)
- Humidity: up to 80%

### Quality control NDT

---

## Problem 2: Noise and Vibration

### Normal Noise Level

All transformers emit **normal audible hum** due to magnetostriction — expansion and compression of the core as the magnetic field changes.

### Standard Dry Transformer Noise Levels:

Power (kVA)	Noise Level (dB)
100	55
160	56
250	58
400	60
630	62
1000	65
1600	68
2500	70

### Excessive Noise Causes

#### 2.1 Loose Core or Windings

##### Mechanism:

- Core mounting bolts loosened
- Winding support elements loosened
- Vibration intensifies during operation

##### Solution:

- Transformer de-energization

- All fastener tightening
- Torque check per specifications

## 2.2 Vibration Transmission

### Mechanism:

- Natural transformer vibration
- Amplification by mounting structure
- Resonance phenomena

### Solution:

- Anti-vibration pad installation
- Vibration isolator use
- Structural decoupling

## 2.3 Overload or DC Offset

### Mechanism:

- Core saturation
- Increased magnetostriction
- Loud noise

### Solution:

- Load check
- DC source investigation
- Faulty equipment elimination

## Noise Reduction Step-Lap Technology

### Principle:

- Core laminations cut at 45° angle
- Sheet joint offset
- Vibration reduction

### Effect:

- Noise reduction by 5-10 dB
  - No-load loss reduction by 15-25%
- 

## Problem 3: Incorrect Secondary Voltage

### Voltage Deviation Causes

#### 3.1 Incorrect Tap Setting

##### Situation:

- Voltage taps set incorrectly
- Mismatch with actual primary voltage

**Solution:**

- Input voltage measurement
- OLTC position correction
- Output voltage verification

**3.2 High or Low Primary Voltage****Cause:**

- Supply network problems
- Deviations from nominal

**Solution:**

- Contact power supplier
- Voltage stabilizer installation
- LTC use

**3.3 Heavy Overload****Mechanism:**

- Significant voltage drop
- Normal mode violation

**Solution:**

- Load measurement
- Load reduction to nominal
- Higher power transformer calculation and installation

---

## Problem 4: Insulation Deterioration

### Insulation Degradation Causes

**4.1 Thermal Aging****Mechanism:**

- Long-term operation at elevated temperatures
- Polymer chain destruction
- Dielectric strength reduction

**Solution:**

- Temperature mode control
- Avoid prolonged overloads

- Timely replacement

## 4.2 Humidity

### Mechanism:

- Moisture penetration into insulation
- Insulation resistance reduction
- Breakdown risk

### Solution:

- Room humidity control
- Use transformers with appropriate protection degree
- Regular insulation resistance measurements

## 4.3 Contamination

### Mechanism:

- Dust accumulation on surface
- Conductivity increase
- Insulation properties reduction

### Solution:

- Regular cleaning
- Filter installation
- Room cleanliness maintenance

## Problem 5: Sensitivity to Operating Conditions

### Room Requirements for Dry Transformers

Parameter	Optimal Value	Permissible Value
Temperature	+1°C to +35°C	-40°C to +60°C
Humidity	up to 60%	up to 80%
Dust	< 0.1 mg/m <sup>3</sup>	< 0.2 mg/m <sup>3</sup>
Altitude	up to 1000 m	up to 4000 m

### Condition Violation Consequences

#### High Temperature:

- Accelerated insulation aging
- Service life reduction
- Overheating risk

### High Humidity:

- Insulation resistance reduction
- Metal part corrosion
- Breakdown risk

### Dust and Contamination:

- Heat dissipation deterioration
- Insulation properties reduction
- Ventilation channel clogging

[Equipment selection by operating conditions](#)

---

## Dry Transformer Maintenance

### Daily Maintenance

- Visual inspection
- Thermostat indicator check
- Foreign sound absence control
- Room temperature check

### Monthly Maintenance

- Dust cleaning (external surface)
- Fan operation check (if installed)
- Fastener check
- Grounding check

### Annual Maintenance

- Insulation resistance measurement
- Winding resistance measurement
- Bolted connection tightening check
- Thermal imaging inspection
- Cooling system operation check
- Internal surface cleaning

### Every 3-5 Years

- Major inspection
  - Transformation ratio measurement
  - Connection group check
  - Insulation tests
- 

## Dry Transformer Diagnostics

### Thermal Imaging Inspection

**Detects:**

- Hot spots in windings
- Uneven heating
- Contact problems

**Normal Picture:**

- Uniform heating of all phases
- Temperature within normal range
- No local overheating

**Insulation Resistance Measurement****Standard Values:**

- At 20°C: not less than 100 MΩ
- At 60°C: not less than 10 MΩ

**Frequency:** annually**Winding Resistance Measurement****Purpose:**

- Break detection
- Short circuit detection
- Contact condition control

**Faults and Solutions Table**

<b>Problem</b>	<b>Signs</b>	<b>Causes</b>	<b>Solution</b>
<b>Overheating</b>	Temperature >130°C	Overload, poor ventilation, SC	Reduce load, clean, check windings
<b>Excessive Noise</b>	Loud hum >70 dB	Loose core, vibration	Tighten fasteners, install anti-vibration pads
<b>Voltage Deviation</b>	Uout ≠ 380V	Incorrect tap, overload	Adjust OLTC, reduce load
<b>Current Leakage</b>	RCD tripping	Insulation damage, moisture	Check insulation, dry
<b>Short Circuit</b>	Protection tripping	Winding damage	Repair or replacement

**Why Professional Approach Matters**

- ✔ **Regular maintenance** extends service life by 30-50%
- ✔ **Timely diagnostics** prevents emergencies
- ✔ **Proper operation** saves repair costs

[Engineering selection and procurement](#)

---

## Useful Links

- [Power transformers](#)
  - [Electrical equipment](#)
  - [B2B supply services](#)
  - [Customs and logistics](#)
  - [Contacts](#)
- 

*Document prepared based on dry transformer operating experience and manufacturer recommendations.*