# Final Combined Dataset Table for Transformer Health Prediction

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| Category | Parameter | Description | Data Type | Target Variable |
| Transformer Common Data | Transformer ID | Unique identifier for transformer | Categorical |  |
|  | Transformer Age (Years) | Age of the transformer | Numeric (Years) |  |
|  | Transformer Type | Type of transformer (Power, Distribution) | Categorical |  |
|  | Rated Power (MVA) | Transformer rated capacity | Numeric (MVA) |  |
|  | Rated Voltage (kV) | Transformer rated voltage level | Numeric (kV) |  |
|  | Manufacturer | Manufacturer of the transformer | Categorical |  |
|  | Installation Date | Date of transformer installation | Date (YYYY-MM-DD) |  |
|  | Last Maintenance Date | Date of last maintenance activity | Date (YYYY-MM-DD) |  |
|  | Operating Status | Current operational status (Active, Standby, Faulty) | Categorical |  |
| Dissolved Gas Analysis (DGA) | Hydrogen (H₂) Concentration (ppm) | Indicator of overheating and corona discharge | Numeric (ppm) | Transformer Fault Type (Normal, Thermal Fault, Electrical Fault, Arcing) |
|  | Methane (CH₄) Concentration (ppm) | Detects overheating faults | Numeric (ppm) |  |
|  | Ethylene (C₂H₄) Concentration (ppm) | Identifies high-temperature thermal faults | Numeric (ppm) |  |
|  | Ethane (C₂H₆) Concentration (ppm) | Indicates overheating degradation | Numeric (ppm) |  |
|  | Acetylene (C₂H₂) Concentration (ppm) | Detects arcing and severe faults | Numeric (ppm) |  |
|  | Carbon Monoxide (CO) Concentration (ppm) | Represents paper insulation degradation | Numeric (ppm) |  |
|  | Carbon Dioxide (CO₂) Concentration (ppm) | Indicator of overheating and oxidation | Numeric (ppm) |  |
| Partial Discharge Measurement | Partial Discharge Intensity (pC) | Measures magnitude of discharge activity | Numeric (pC) | Partial Discharge Severity (Low, Medium, High) |
|  | Pulse Repetition Rate (Hz) | Frequency of discharge occurrences | Numeric (Hz) |  |
|  | Discharge Energy (mJ) | Energy released per discharge event | Numeric (mJ) |  |
|  | Phase Angle (Degrees) | Phase position of discharge events | Numeric (Degrees) |  |
| Dissipation Factor & Capacitance | Dissipation Factor (Tan Delta) | Measures dielectric losses | Numeric | Insulation Health (Good, Degraded, Critical) |
|  | Capacitance (µF) | Measures insulation ability to store charge | Numeric (µF) |  |
|  | Test Voltage (kV) | Voltage applied during measurement | Numeric (kV) |  |
|  | Test Frequency (Hz) | Frequency of AC voltage applied | Numeric (Hz) |  |
| Insulation Resistance Measurement | Insulation Resistance (MΩ) | Resistance of transformer insulation | Numeric (MΩ) | Insulation Health Status (Good, Moderate, Poor) |
|  | Voltage Applied (kV) | Voltage level used during measurement | Numeric (kV) |  |
|  | Temperature (°C) | Transformer operating temperature | Numeric (°C) |  |
|  | Moisture Content in Oil (ppm) | Presence of water in transformer oil | Numeric (ppm) |  |
| Winding Resistance Measurement | Winding Resistance (Ω) | Measures resistance in transformer windings | Numeric (Ω) | Winding Condition (Normal, Degraded, Critical) |
|  | Test Current (A) | Applied current during measurement | Numeric (A) |  |
|  | Temperature at Measurement (°C) | Winding temperature during resistance test | Numeric (°C) |  |
|  | Previous Maintenance Date | Last winding resistance check | Date (YYYY-MM-DD) |  |
| Dielectric Constant Measurement | Dielectric Constant | Measures insulation material's ability to store energy | Numeric | Insulation Efficiency (High, Medium, Low) |
|  | Oil Quality Index (%) | Indicator of oil dielectric strength | Numeric (%) |  |
|  | Moisture Content (ppm) | Water content in oil affecting dielectric constant | Numeric (ppm) |  |
|  | Frequency of Measurement (Hz) | Test frequency used in measurement | Numeric (Hz) |  |
| Oil & Winding Temperature Monitoring | Oil Temperature (°C) | Transformer oil operating temperature | Numeric (°C) | Overheating Risk (Low, Moderate, High) |
|  | Winding Temperature (°C) | Temperature of transformer windings | Numeric (°C) |  |
|  | Load (% of Rated Load) | Transformer load percentage during monitoring | Numeric (%) |  |
|  | Cooling System Status | Indicates if the cooling system is active | Binary (On/Off) |  |
| Frequency Response Analysis | Resonance Frequency (Hz) | Frequency at which resonance occurs | Numeric (Hz) | Structural Integrity (Stable, Minor Deviation, Major Deviation) |
|  | Magnitude Response (dB) | Amplitude response of transformer | Numeric (dB) |  |
|  | Phase Shift (Degrees) | Phase difference between input and output signals | Numeric (Degrees) |  |
|  | Previous Fault History | Past occurrence of frequency-related failures | Categorical (Yes/No) |  |
| Degree of Polymerization Measurement | Degree of Polymerization (DP Value) | Measures aging of paper insulation | Numeric | Paper Insulation Condition (Good, Aged, Critical) |
|  | Moisture Content (ppm) | Water content affecting polymer breakdown | Numeric (ppm) |  |
|  | Oil Acid Number (mgKOH/g) | Acidity level in transformer oil | Numeric |  |
|  | Operating Temperature (°C) | Transformer temperature over time | Numeric (°C) |  |
| Moisture or Water Particle Measurement | Moisture Content (ppm) | Water content in transformer oil | Numeric (ppm) | Moisture Risk Level (Low, Medium, High) |
|  | Relative Humidity (%) | Humidity level within the transformer | Numeric (%) |  |
|  | Oil Temperature (°C) | Temperature of transformer oil | Numeric (°C) |  |
|  | Previous Drying Treatment Date | Last moisture removal process | Date (YYYY-MM-DD) |  |