



A Division of Transnet SOC Limited

INFRASTRUCTURE ENGINEERING

ELECTRICAL DEPARTMENT SPECIFICATION

MULTI-TRANSFORMER TEST SET

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Transnet Freight Rail - Infrastructure

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CONTENTS

1. GENERAL REQUIREMENTS3

2. OPERATING CONDITIONS.....3

3. FUNCTIONAL REQUIREMENTS.....3

2. TECHNICAL REQUIREMENTS.....3

3. SOFTWARE FEATURES5

4. PHYSICAL AND MECHANICAL REQUIREMENTS6

5. ACCESSORIES6

6. COMPLIANCE AND CERTIFICATION7

7. SUPPORT AND TRAINING7

8. TECHNICAL EVALUATION7

1. GENERAL REQUIREMENTS

- 1.1. The multi-transformer test set shall be suitable for testing and evaluating all traction and distribution transformers within the Transnet environment which are used in electrical systems rated up to 220kV AC and on transformers with two or three or four windings rated at a maximum capacity of 40MVA.
- 1.2. The multi-transformer test set shall be a TRAX 279 or an instrument with same or better features than a TRAX.
- 1.3. It must comply with international safety standards (e.g., IEC, IEEE).

2. OPERATING CONDITIONS

- 2.1. The multi-transformer test set shall be operated in all weather conditions as well as salt laden and industrial atmosphere.

Altitudes: From sea level to 2000m above sea level.

Relative humidity: 10% to 95%

Atmospheric conditions: May vary from heavily saline to dry and dusty conditions.

Ambient air temperatures: -10° C to 50° C. (daily average +30° C)

3. FUNCTIONAL REQUIREMENTS

- 3.1. The multi-transformer test set shall be capable of performing the following tests:

- 3.1.1. Transformer insulation resistance
- 3.1.2. Power factor and dissipation factor measurements
- 3.1.3. Transformer turns ratio (TTR)
- 3.1.4. Transformer excitation current measurements
- 3.1.5. Sweep frequency response analysis.
- 3.1.6. Circuit breaker testing
- 3.1.7. Transformer power analysis
- 1.1.1. Circuit Breaker testing capabilities
- 3.1.8. VT and CT testing capabilities

2. TECHNICAL REQUIREMENTS

- 2.1. The multi-transformer set must comply with the following technical requirements:

2.2. High-Voltage Leads and Connectors must be:

- 2.2.1. The high-voltage leads must be rated for not less than 12 kV.
- 2.2.2. They must be insulated and shielded to ensure safety and accuracy.
- 2.2.3. The connectors must be of high-quality, corrosion-resistant, and compatible with industry standards.
- 2.2.4. The package must include test leads for various test configurations and transformer connections.

2.3. Low-Voltage Leads and Connectors must be:

- 2.3.1. Suitable for signal and measurement connections
- 2.3.2. They must be insulated and durable for consistent performance.
- 2.3.3. The connectors must be of industry-standard, secure, and reliable.

2.4. Current Clamps and Probes must be:

- 2.4.1. Clamps must be suitable for AC and DC with a measurement range suitable for transformer testing.
- 2.4.2. Precision probes are required for accurate current and voltage measurements.
- 2.4.3. The clamps must have adjustable jaws for different conductor sizes.
- 2.4.4. They must have high accuracy and stability in measurement.

2.5. The multi-transformer test set shall have the following minimum measuring capabilities:

2.5.1. Transformer Turns Ratio (TTR) Testing:

- 2.5.1.1. Range: 0.8:1 to 20:1
- 2.5.1.2. Accuracy: $\pm 0.1\%$ for ratios up to 1000:1, $\pm 0.5\%$ for higher ratios
- 2.5.1.3. Output Voltage: 8V, 40V, 100V selectable.

2.5.2. Winding Resistance Testing:

- 2.5.2.1. Test Current Range: 1 mA to 10 A
- 2.5.2.2. Resistance Range: 1 $\mu\Omega$ to 2 k Ω
- 2.5.2.3. Accuracy: $\pm 0.2\%$ of reading $\pm 2 \mu\Omega$

2.5.3. Excitation Current Testing:

- 2.5.3.1. Test Voltage Range: 50V to 200V.
- 2.5.3.2. Current Range: 0.1 mA to 10 A
- 2.5.3.3. Accuracy: $\pm 0.5\%$ of reading

2.5.4. Short Circuit Impedance Testing:

- 2.5.4.1. Voltage Output: Up to 200V
- 2.5.4.2. Current Output: Up to 20A

2.5.4.3. Impedance Range: 0.1 mΩ to 100 Ω

2.5.4.4. Accuracy: ±0.2% of reading

2.5.5. Power Factor/Dissipation Factor (Tan Delta) Testing:

2.5.5.1. Voltage Output: Up to 12 kV

2.5.5.2. Frequency Range: 1 Hz to 1 kHz

2.5.5.3. Accuracy: ±0.02% for PF and ±0.001 for DF

2.5.6. Sweep Frequency Response Analysis (SFRA):

2.5.6.1. Frequency Range: 10 Hz to 25 MHz

2.5.6.2. Dynamic Range: >140 dB

2.5.6.3. Accuracy: ±0.02 dB

2.5.7. Insulation Resistance Testing:

2.5.7.1. Test Voltage Range: 500V to 5kV.

2.5.7.2. Resistance Range: 0Ω to 10 TΩ

2.5.7.3. Accuracy: ±5% of reading

2.5.8. Dynamic Resistance Measurement (DRM):

2.5.8.1. Test Current: Up to 250 A

2.5.8.2. Resistance Range: 1 μΩ to 100 mΩ

2.5.8.3. Accuracy: ±1% of reading

2.5.9. Voltage Transformer (VT) Testing:

2.5.9.1. Ratio Range: 1:1 to 2000:1

2.5.9.2. Accuracy: ±0.1%

2.5.10. Current Transformer (CT) Testing:

2.5.10.1. Ratio Range: 1:1 to 2000:1

2.5.10.2. Accuracy: ±0.1%

2.6. The main instrument must have a minimum of six channels of binary inputs and output with a voltage range from 0V- 250V.

2.7. It must be equipped an LCD touch screen with intuitive graphical user interface (GUI) for easy operation.

3. SOFTWARE FEATURES

3.1. The multi-transformer test set shall have the following software features:

3.1.1. Its system must include test automation software compatible with Windows and Android platforms.

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- 3.1.2. It must have features for storing and retrieving test data, with export options to CSV, PDF, and XML formats.
 - 3.1.3. It must be capable for automated report generation with customizable templates for different tests.
 - 3.1.4. It must be operatable from a computer and have the capability for remote diagnostics and software updates, ensuring the system remains up to date with the latest features and improvements.
 - 3.1.5. It must have a built-in memory for storing test results and data, with options for exporting data via USB, ethernet or other interfaces. USB option is necessary.

4. PHYSICAL AND MECHANICAL REQUIREMENTS

- 4.1. The multi-transformer test set must be compact and lightweight design for ease of transport and use in the field. Its weight shall not exceed 30kgs excluding accessories and auxiliaries.
- 4.2. It must be rugged and durable in construction to withstand harsh field conditions.
- 4.3. It must have an effective cooling system to prevent overheating during prolonged use.
- 4.4. The system must include built-in overvoltage protection to prevent damage to the equipment and ensure user safety.
- 4.5. The main instrument should be equipped with an easily accessible emergency stop button to immediately terminate all tests in case of an emergency.
- 4.6. The multi-transformer test set should include an interlock mechanism that prevents high voltage testing unless all connections are properly secured.

5. ACCESSORIES

- 5.1. The multi-transformer test set must be supplied with all necessary auxiliaries and cables, connectors, and adapters for various test procedures. All main cables must have high voltage insulation and not less than 10m in length.
- 5.2. Its carry case and that of its auxiliaries must be durable, weather resistant (IP53) carrying case for protection during operation and transportation.
- 5.3. It must be supplied with a complete grounding kit to ensure safe operation during testing.
- 5.4. It must have an option of external power supply (230V AC @ 50Hz) for continuous operation in the field.

6. COMPLIANCE AND CERTIFICATION

- 6.1. The multi transformer test set must compliance with relevant international standards.
- 6.2. It must be supplied with calibration certificates traceable to national standards.
- 6.3. It must come with a minimum of 2 years warranty where the supplier shall take full responsibility in repairing or replacing the faulty unit and component unless it has been proven to be negligence on the side of the end user.

7. SUPPORT AND TRAINING

- 7.1. The OEM or contractor shall provide on-site training for not less than 10 operators and maintenance personnel.
- 7.2. The OEM shall be willing to provide technical support with quick response times.
- 7.3. The instrument shall be supplied with comprehensive user manual, service manual, and technical documentation.

8. TECHNICAL EVALUATION

- 8.1. All bidders shall submit data sheets with clear pictures of the instrument and its accessories.
- 8.2. Data sheets shall detail relevant technical, operational, functional, and other relevant requirements as indicated in the specification. Failure to provide detailed datasheets shall result in the disqualification of the bidder.