Integrated Winding Test System

WTS-05

Surge/Impulse Test with high Precision, Resistance Measurement, AC High Voltage and Insulation Resistance Testing

- **All typical Insulation Test Methods for E-Motors, Stators, Transformers and other Coils unified in one Instrument**
- **Built-in 10 channel HV Multiplexer in 4 Wire Kelvin Technique and Tri-State Logic (High, Low, Open) with flexible Lead Assignment**
- **Ground Lead with Contact Check Function**
- **Partial Discharge Detection with Micro Wave Sensor**
- **Optional Inductance- and Rotation Direction Tests**

RM Prüftechnik

Prüfsysteme für elektrische Maschinen und Wicklungen

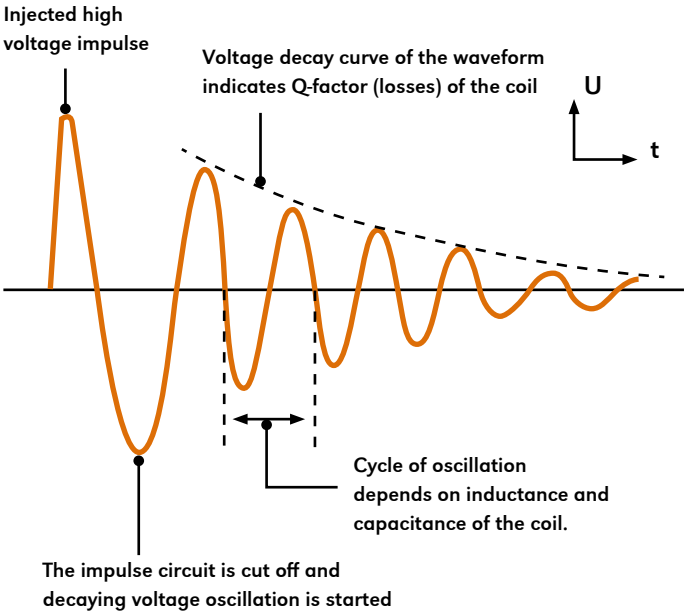
WTS-05 Features

The „one unit solution“ for all Electric windings

The WTS-05 integrates all mainly applied quality tests into one compact instrument, with the surge/impulse test as the core feature. With up to 100 test steps in one program, all test parameters can be examined quickly in one routine. This will save a complex work bench or test rack with several connect instruments and guarantees for efficient and reliable testing processes.

Surge Impulse Testing

Fast high voltage impulses with fixed rise time and same magnitude are discharged into a reference winding. The attenuated response oscillation is stored into the tester's memory as a "master" file together with certain tolerance parameters, and serves as the reference for evaluation of the DUT. Through the microprocessor control, this evaluation becomes fully automatic for pass/fail testing.

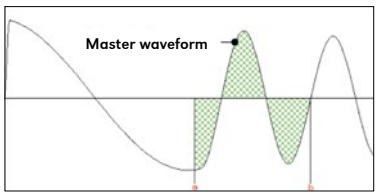


Voltage surge and response waveform contain the information about the properties of the winding under test. The characteristic of the waveform pattern is determined by the impedance and Q-factor (losses) of the DUT. Thus all defects and incorrectness's, which affect these characteristics, become evaluated.
These are in particular turn and layer shorts, wrong turn counts, wire and size errors as well as defects in the iron/ferrite core or lamination stack.

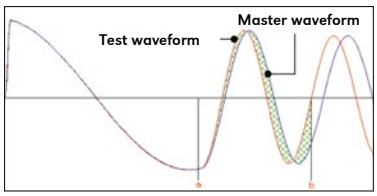
However the most important effect of this test method is the real turn/turn voltage stress, since the high frequent voltage pulse "travels" across the coil layers as a wave and generates brief dV/dt potential differences across the turns. At damaged turn, layer or coil to coil insulation, sparks or arcs of very low energy will occur. Through the high scan speed of the A/D converter, even smallest weaknesses in the insulation, which generate corona or partial discharges, will become recognized, captured and evaluated.

The Surge Evaluation Methods of the WTS-05

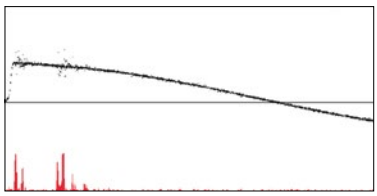
The master waveform is completed by more or less strict evaluation criteria which allow the automatic pass/fail indication. Since the different winding defects or incorrectness's result in different effect to the wave shape, various mathematic methods are applied which act differently to certain changes and allow to distinguish typical groups of defects. An error code, which is transferred to the host controller, can be used for parts selection and statistical process control.



Area Size Comparison



Differential Area Comparison



Partial Discharge with Laplacian Filter

These evaluation methods can be programmed individually or all together.
The sensitivity and selectivity can be increased by setting of test zones (evaluation windows).

Test Function	Specification	
Surge test	Peak Voltage	0.5 kV - 5.9 kV; 0.1 kV Increments
	Evaluation Methods	Area, Diff.-Area, Laplacian Filter
	Min. Winding Inductance	10 µH
	Impulse Rise Time	0.1 - 0.3 µs (depends on load impedance)
	Sampling Rate, Storage Depth	8 bit, 10 ns (100 MS/s), optional 10 bit (200 MS/s) 8 kByte
	Impulse Cycle Rate	20 - 200 ms; 52 ms Standard
	Impulse Energy	0.2 Joule max; optional 0.4 Joule

Resistance Measurement

The resistance measurement tests mainly for faults in wire gauge and for connection errors as well as weak wire contact bonding. A balance calculation for 3-phase windings is included. Auto ranging is standard as well as compensation to room/reference temperature with PT-100 (for copper and NTC). The 4-lead-Kelvin-Method allows highly precise measurements also for very low impedance windings.

Test Function	Specification	
DC Resistance Measurement	Connection System	4 lead Kelvin Technique
	Measurement Range	Up to 300 Ω; max. 1A test current
	Resolution/Accuracy	1 µΩ ; 0.2 % + 8 digit accuracy

AC High Voltage Test

With AC hipot tests, the rigidity of the insulation system is tested by application of a steady high potential between the separated components of the DUT under assessment of the leakage current, according EN 60034-1.

The test voltage, duration and leakage current limits can be programmed for each step individually and separately.
The tester hardware allows detection of short break down impulses. A ramp-up and ramp-down function is available as well.

Test Function	Specification	
AC High Voltage	Test Voltage	AC 0.2 kV - 5.0 kV_{rms} (50 Hz / 60 Hz)
	Output power	100 VA (5.0 kV, 20 mA)
	Current Ranges	High Limit: 0.01 - 20.00 mA Low Limit: 0.01 - 19.99 mA (or OFF)

Insulation Resistance Test (IR)

The Insulation Resistance is measured between separated components of the DUT. With the WTS-05, several steps can be programmed individually in one test routine with voltage, min. IR limit and duration.

Exact values between 0.1 and 9990 MOhm can be obtained. A ramp function is available as well as a measurement delay and masking of the instantaneous charging current.

Test Function	Specification	
Insulation Resistance Test	Test Voltage	DC 25 V / 50 V / 100 V / 250 V /500 V /1000 V
	Measurement Range	0.1 - 9990 MΩ

Efficient application-oriented Test Programming and User Interface

The WTS-05 is easy to use, since it is specially designed for the testing of electric motors and windings. The on-screen menus are reduced for the essential functionality of the application.
Features can be selected quickly and intuitively with function keys and the Jog Dial.

The test steps can be programmed in any order with all parameters. The pass/fail result of each step is displayed immediately while the exact result values can be scrolled through after the test sequence.

	Specification	
Test Programming	Test Lead Multiplexer	10 Channels High/ Low/ Open; arbitrary setting
	Test Programs	max. 100 Steps (250 Program files + 250 on USB drive)
General	Ext. Communication	RS-232C, Digital I/O, USB (Data backup), opt. Ethernet
	Accessories	power cord, 10x test cable 1.5 m, double ground cable
	Dimensions/ Weight	430 (W) x 245 (H) x 485 (D) mm, 27 kg
	Power	100 V to 240 V, 50 - 60 Hz

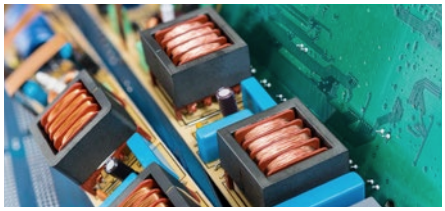
Application Ranges

The WTS-05 is designed for all types of electric windings and can be applied (among others) for these products:

E-Mobility,
Automotive Parts

AC Induction Motors,
BLDC

Chokes,
Filters of Power Supplies



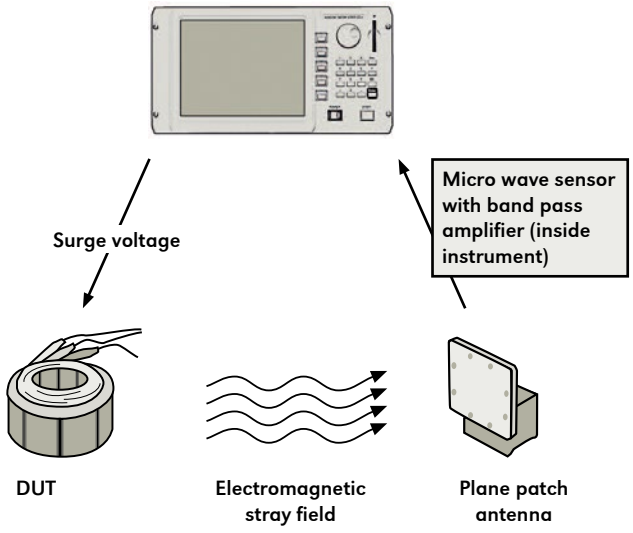
Print Transformers,
RF Transformers

Stepper Motors,
Pole Pieces

Solenoids, Relays,
Contactor coils

Impulse -Partial Discharge Test with Micro Wave Sensor (Option)

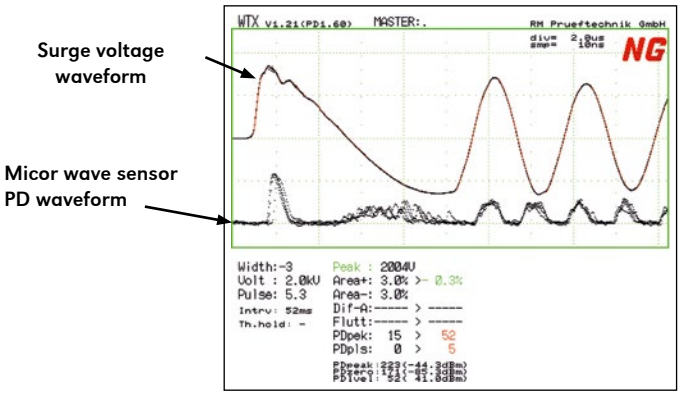
PD - examination of a sensitivity previously unknown in the coil winding industry (according IEC 61934 and IEC 60034 -18 - 41)



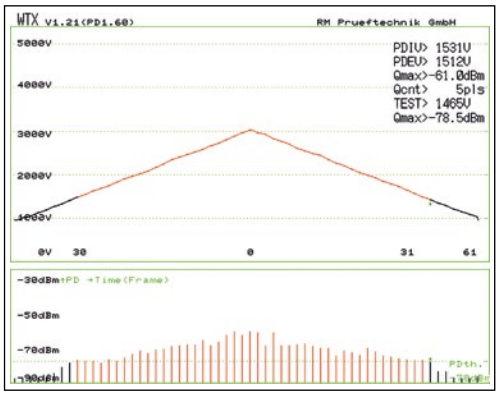
A narrowband microwave sensor detects the electromagnetic waves of partial discharges, which are generated in coils through injection of surge impulses with a fast rising front (dv/dt). Thus an excellent simulation of the transient stresses of windings at highly dynamic control systems like PWM converters is given.

In addition to the known test of latent or galvanic turn and layer shorts in windings, it allows easy and fully automatic partial discharge evaluation within a coil for applications in production, QC and research/lab as well as predictive diagnostics.

This includes the recording of PD inception and extinction voltages (PDIV-PDEV) with a new developed algorithm. Through the special filter method with a narrow band filter in the 1.6 GHz band, disturbing frequencies and noises are completely eliminated at persisting high signal sensitivity. This enables the equipment to be used in complex automatic systems or under production conditions without affecting the signal quality.



Winding wit occurring PD



Example PDIV-PDEV graph

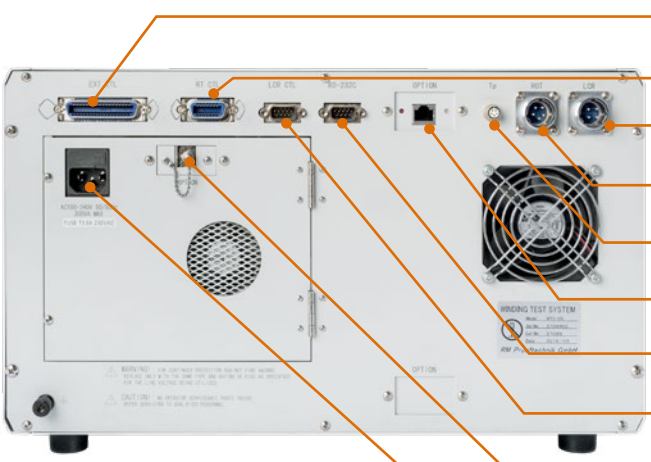
Partial discharge circuit specifications	
Micro wave sensor	Sensing the electromagnetic waves in the stray field by a narrow band plane patch antenna in 1.6 GHz band
Signal sensitivity	-90 dB ~ -30 dB within 30 cm distance from DUT
Antenna size	80 (W) x 80 (H) x 10 (D) mm, cable length = 2 m
Judgment methods	PD inception and extinction voltages (PDIV-PDEV), PD impulse counter (for RPDIV/RPDEV tests), relative PD level

Options and Accessories

The WTS-05 is prepared for extensions, in order to enhance your test capabilities perfectly.

Extensions (Connection of external devices and integration into automatic test routines)		
Inductance Test	Connected Instrument	IM 3533 or 3511 by Hioki (with RS232-C)
Rotation Direction Test	Connected Instrument	RDT-308 (with Hardware I/O)

- Optional remote control via Ethernet adapter (TCP/IP-serial-convert-protocol)
- Windows Application "WTSpc" for control of tester and saving of master files, results and waveforms in lab mode
- Several test jigs and fixtures with safety circuits, light curtain etc. are available and customizable



Contact us now and put the WTS-05 into service!

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