



## T4-41

TRACKING TEST APPARATUS

## KEYWORDS

T4-41 TRACKING TEST APPARATUS, CTI PTI TESTER, IEC TEST EQUIPMENT, IEC 60112, IEC 112, IEC 60335-1, IEC 61058-1, IEC 60065, IEC 60669-1, IEC 60884-1, IEC 60950-1, IEC 61010-1, BS 1363, IEC 60598-1, IEC 60320-1, IEC 60898-1, IEC 60400, IEC 60238, IEC 60730-1, GB4207, GB7000.1, UL746A, DIN53480, ASTM D 3638, VDE 030, DIN 53480, GB/T 4207, GB4706.1,.

## COMPLIANCE

It is constructed in compliance with IEC 60112, IEC 112, IEC 60335-1, IEC 61058-1, IEC 60065, IEC 60669-1, IEC 60884-1, IEC 60950-1, IEC 61010-1, BS 1363, IEC 60598-1, IEC 60320-1, IEC 60898-1, IEC 60400, IEC 60238, IEC 60730-1, GB4207, GB7000.1, UL746A, DIN53480, ASTM D 3638, VDE 0303, DIN 53480, GB/T 4207,...

<http://domino.iec.ch/webstore/webstore.nsf/artnum/029647?opendocument>

## INTRODUCTION

T4-41 TRACKING TEST APPARATUS is intended for determining the degree of protection against formation of conducting paths in solid insulating materials, due to the electric stress and electrolytic contamination of the surface.

This test is complex and the person performing it should be accurate and maintain good cleanliness of test equipment. The repeatability and comparability of test results depend on many different factors. Therefore we designed TRACKING TEST APPARATUS with the following goals:

- Reliability
- Maximum repeatability of test results
- Maximum comparability of test results
- Ease of operation
- Ergonomical design

The **BOLD** features below are some of advantages that were introduced to reach these goals.

## MAIN FEATURES

- **Ergonomically designed:** Two-unit apparatus

## ELECTRODE UNIT

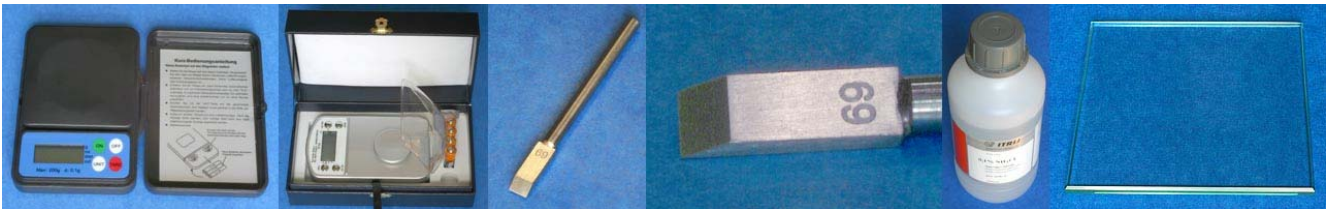
- 2 Platinum electrodes, **easily removable for cleaning, grinding purposes or replacement** by thumb screws. Each electrode is **engraved** with its serial number to enable its traceability/calibration. Platinum purity certificate included.
- **Easy removable** dripping unit enables **easy cleaning**. Dripping unit with electromagnetic valve is made of three main components that can be **simple dismantled**: electromagnet, solution cylinder and drip nozzle. Height of dripping unit is adjustable.
- Drip nozzle can be unscrewed for cleaning or replaced if damaged.
- Solution cylinder is transparent, so that the contents is clearly visible. It has level markings and adequate volume for 30 tests without refilling. It can be **dismantled** for cleaning.
- **Internal light** enables easier precise adjustments of mechanical parameters (16 different adjustments can be made inside electrode unit)
- Solid anodized aluminum framework with adjustable screw-legs for leveling
- **Transparent polycarbonate** door and **side panels** enable side view – electrodes alignment
- Electrode pivot point is **in the same level** as the height of electrode/sample contact
- **Alignment markings** behind the nozzle/electrodes enable easier and more precise centering of nozzle and electrodes.
- **Jointed electrode holders** enable adjustment of all relevant parameters
- 2 adjustable weights for adjusting force of electrodes exerted on the sample (1N)
- Table for sample positioning is **free-standing** and enables precise height leveling by thumb screw. It is **removable** to enable easy cleaning.
- Easy removable sample support glass
- With apparatus are enclosed many different **accessories** that enable easier testing (see accessories section below)
- **Ventilator** for fume extraction after the test
- Removable bottom lining for easier cleaning
- Door safety protection switch - test voltage can only be applied when doors are closed

## CONTROL UNIT

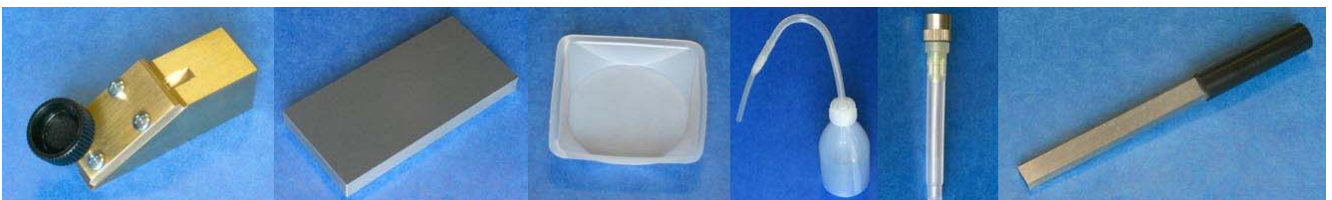
- **Siemens LOGO programmable microcontroller** for adjustment of interval between drops, volume of each drop and requested number of drops.
- **Fully automatic** test execution
- Push buttons for switching the voltage ON and OFF
- Voltage indicator light
- Transformer and variable ratio transformer for voltage adjustment 0-650V (in two ranges)
- Voltage range selection switch
- Knob for voltage adjustment
- V meter digital 650 V AC  $\pm 0,2\%$  +1digit
- Push button for enabling test current adjustment (short-circuiting the electrodes)
- Test current adjustment knob for adjusting 1A current
- Current limiting resistor, adjustable for current adjustment (1A)
- A meter digital 5 A AC  $\pm 0,2\%$  +1digit
- Adjustable over-current/time relay (trips after 0,5 A/ 2 s)
- Tripping current/time test knob
- Push-button for **manual triggering** of dripping mechanism – used for adjustment
- START/STOP push-button
- Mains switch
- Signal lamp - failure indication
- Anodized aluminum front plate, with inscriptions that clearly explain the function of **each** component on the front plate
- Push button for starting the automatic dripping
- Light switch
- Ventilator switch

## ACCESSORIES (Included in price)

- 1 pcs. **Scale 0-20 g**, resolution 0,001g up to 10 g and 0,002 g 10-20 g,  $\pm 0,2\% + \text{LSD}$ , for checking the volume of drops.
- 1 pcs. **Scale 0-200 g**, resolution 0,1g, for checking and adjusting the force of the electrodes on the tested sample
- 2 pcs. Platinum electrodes (mounted on apparatus), each **engraved** with its serial number, that enables its traceability and certification
- 1 pcs. 1 l of **test solution A**
- 1 pcs. Glass test platform



- 1 pcs. **Grinding fixture** for grinding of electrodes (they must be grinded every couple of tests to keep requested dimensions)
- 1 pcs. **Grinding platform** for forming the electrodes
- 10 pcs. **Weighing container** for 20-50 drops
- 1 pcs. **Filling cylinder** (dosing container) - for filling and draining the dripping unit with test solution
- 1 pcs. Nozzle for tracking test apparatus (mounted on apparatus)
- 1 pcs. **Distance gauge** - for adjusting the distance between electrodes equipped with its serial number that enables its traceability and certification



## DESCRIPTION

Apparatus consists of control unit and mechanical unit. Both units are connected with cable and connector that enables their separation and easier setting and transportation.

### CONTROL UNIT

Control unit is built in metal sheet housing and consists of all elements needed to control and monitor the electrical parameters of the test.

On the front plate all elements are divided in four logical sectors:

In first sector are located: mains switch with fuse, appliance inlet and voltage range selector switch.

In the second, **voltage sector** are: push buttons for switching the voltage ON and OFF (it is only possible to turn on the voltage when the doors of electrode unit are closed), voltage adjustment knob, voltage indication light and voltmeter.

In the third, **current sector** are located: current adjustment knob that works in combination with push-button for resistor adjustment, A-meter, failure light that turns on if the current over 0,5A has been existing more than 2 s, and CURRENT TEST knob, that is used for calibration.

In the fourth section are: SIEMENS microcontroller, for adjustment of interval between drops, precise volume of each drop and requested number of drops, START/STOP push-button for test sequence activation, DRIP MANUAL push-button for triggering dripping manually (mostly used in adjustment process) and switches for light and ventilation.

## ELECTRODE UNIT

This unit has a solid aluminum framework, on adjustable screw-legs that enable leveling, front doors and two side panels are made of transparent polycarbonate, other panels are made of non-transparent laminate. All materials used and construction of complete unit is such that it enables good cleaning. It is equipped with safety door switch, light, ventilator and magnet. Inside this unit are three sub-units.

**Dripping mechanism** is made of three main components that can be simple dismantled: electromagnet, solution cylinder and drip nozzle. Height of dripping unit is adjustable. Electromagnet is connected via gold plated connector. Solution cylinder has a volume adequate for more than 30 tests. It can be easily taken to pieces for cleaning and has markings which enable estimation of the quantity of solution in the vessel. On the top cover is small hole, for filling and emptying the cylinder, by help of enclosed dosing container. The solution can be also quick drained from the cylinder by suction with enclosed dosing container. On the bottom side, the drip nozzle is screwed on the cylinder.

**Electrode mechanism** is mounted on the vertical base plate. The complete assembly can be easily taken to pieces for cleaning purposes by enclosed Allen key (Hex wrench). Electrode assembly enables 11 different adjustments that can be preformed to meet standard requests. All settings are simple and are done either by thumb-screws or by Allen head screws.

Each platinum electrode is 15 mm long, and has engraved serial number that enables its traceability and certification. It is made of platinum with purity of 99,99% and comes with the purity certificate. Each electrode is hard soldered on its carrying rod. The clamping mechanism of electrodes is so designed that by releasing its thumb screw the electrode can be inserted/removed from it or its position adjusted in a sense of height and alignment of electrode edges to parallel position.

Each electrode is loaded by adjustable loading weight, to exert a force of 1 N to the tested sample. We enclose scale (balance) so that this force can be checked/adjusted after every grinding or electrode adjustment procedure.

Platinum electrodes are fixed in jointed holders that enable adjustment of 30° angle and height leveling. These holders are revolveable so that they enable correct position of electrodes even if the surface of sample is not absolute flush (straight). The Distance between electrodes can be adjusted by thumb-screw and by help of enclosed distance gauge. Distance gauge is equipped with its catalogue number and serial number that enable its traceability and certification. It is made of stainless steel, handle made of Plastic POM material.

**Sample support table** is made of anodized aluminum. On top of it is 5 mm sample support glass plate. Table is equipped by two thumb-screws. One is for precise height adjustment and the other one for arresting adjusted position. Both, table and glass plate are completely removable for cleaning purposes.

## DESIGN

Table top apparatus, two units:

**CONTROL UNIT:** solid case, Non-sensitive, scratch-resistant surfaces through powder-coating, side panels, Al extrusion, RAL 7016, Frame, Al die-cast, RAL 7016, Base and cover, Al, 1.5 mm, RAL 9006, with GND/earthing connection, case feet with anti-slip protection, front plate and rear panel anodized aluminum 2,5 mm.

Internal and external dimensions in accordance with: IEC 60297-3. Type of protection IP 20 in accordance with IEC 60529, Protective GND/earthing connections in accordance with: IEC 61010, DIN EN 50178 / VDE 0160, DIN EN 60950 / VDE 0805, DIN EN 61010-1 / VDE 0411 part 1, DIN EN 61010-1A2 / VDE 0411 part 1/A1.

**ELECTRODE UNIT:** The framework of the draught-free chamber is made of aluminum profiles, equipped by four adjustable leveling screw-legs. Aluminum extruded profiles (<http://www.item.info/en/>), Al Mg Si 0.5 F 25, material number 3.3206.72, Tolerances (straightness and flatness) according to DIN EN 12020 Part 2. The aluminium profiles are natural (C0) anodized and are therefore permanently resistant to scratching and corrosion. Surface with matt finish (E 6), anodized and compressed oxidation. Minimum layer thickness 10 µm, layer hardness 250 - 350 HV.

Doors and left and right side panels are made of transparent Polycarbonate. This material provides high impact resistance and toughness which makes Polycarbonate panels elastic and virtually unbreakable, combined with an excellent flammability rating unlike acrylic glass. It has very good visual properties and a smooth, glossy surface.

Other sides and base plate are made of laminated plastic material. This is a thermosetting material which is permanently laminated at high pressure and temperature. This gives it exceptional abrasion and impact resistance, making it suitable for panelling, table surfaces and partitions subject to high stresses. It has antistatic or ESD surfaces. Thanks to their hygienic melamine resin surface, Plastic panels have exceptional mechanical properties and high temperature resistance and are also particularly resistant to a large number of chemicals.

On the ceiling of electrode unit is mounted compact industrial aluminium light supplied by safety low voltage. It is equipped with an electronic Lamp-Control Unit for low voltage (24 V DC) and a Compact Lamp (power 11 W, corresponds to a conventional 75 W filament lamp).

Doors are equipped by safety switch that disconnect the voltage if the doors are opened. On the back panel is mounted ventilator/fan for fume extraction.

All parts of mechanism are nickel plated, anodized aluminum or made of stainless steel (AISI 304, DIN W. No. 1.4301 X5CrNi18-10) or (AISI 316, DIN W. No. 1.4401 X5CrNiMo17-12-2) [http://en.wikipedia.org/wiki/Stainless\\_steel](http://en.wikipedia.org/wiki/Stainless_steel).



## ADVANTAGES

Apparatus is made in two units for the best ergonomics. Both units are placed side by side in front of **sitting** operator, so he can operate all commands and make all the adjustments from close vicinity and in eye height. Front door and left and right side panels are made of transparent polycarbonate. Ergonomics, internal light and transparency are very important, because they enable precise adjustments and control of all parameters of dripping/electrode mechanism (Nozzle centre alignment, electrode angle adjustment, filling and draining of dripping mechanism, dripping height, height of both electrodes, rotation of both electrodes, alignment of electrodes (depth), parallelism of both electrodes, distance between electrodes, force of each electrode, height of sample). Transparency of side panels and internal light enable very exact, precise side view on the electrodes, to check their alignment.

Due to the energy released during the test through the electrodes, their edges do wear out or require cleaning after certain number of tests. For this reason, we enclose grinding fixture and grinding platform that enable the user to restore the surface of the electrodes to the original condition maintaining original angle of 30 degrees. After grinding the electrodes shall be inserted in the clamping mechanism and precisely readjusted, and this is best done by the internal light turned on, so that operator can precisely see and carry out all necessary alignments and adjustments. After every such adjustment it is recommendable to recheck the force of electrode (1 N) on the sample by enclosed scale.

Antistatic materials have been selected for panels of electrode unit, to minimize the need for cleaning the interior of electrode unit. Unlike acrylic glass that attracts soot flakes because of static electricity, polycarbonate and melamine do not have this problem.

The pivot points of both electrodes are so designed that they are at the same height as the sample surface, exactly as per standard requirement.

We use vertical markings on the base panel behind nozzle and electrodes that simplify centering and alignment of nozzle and both electrodes.

There is another problem that needs to be addressed, which we have observed through many years with some designs of dripping units. Standard IEC 60112 precisely defines the size of drop. Different equipment manufacturers have different mechanisms for solution dosage to meet this requirement. Most units dose the required amount of solution into the nozzle. But the problem is in defining the moment when the drop departs from the nozzle. This moment is defined by the surface tension of solution and the surface and surface condition of the cross-section where hypodermic needle (nozzle) has been cut. Two things can happen if this moment is left to be defined only by gravity and surface tension: either prescribed quantity is not sufficient to cause drop departure at all, or drop departs too soon which results in small quantity of solution staying on the end of the nozzle. In both cases sooner or later **double drop** falls in one prescribed interval, which causes unacceptable test results.

To solve this problem we designed diamond cut nozzle with highly polished dripping surface, which can hold larger-than-required drop. Dripping mechanism is so designed that the moment of drop departure is exactly defined. When triggered it sends a shockwave which releases the complete drop from the end of the nozzle. This means that there is no possibility of double drops (of course only within and around required range), which is the case with some other designs.

On the top cover of solution cylinder is small hole, for filling and emptying the cylinder, by help of enclosed dosing container. The solution can be also quickly drained from the cylinder by suction with enclosed dosing container.

Adequate volume of solution cylinder, enclosed scale with resolution 0,001g, weighing container (for 50 drops) and precisely controlled volume of drops (by SIEMENS microcontroller) enable you to do a test run before actual test, so you can be exactly sure about the drop volume.

On the front plate is also located push-button for over-current/time relay test. It enables you to check proper operation of over-current/time relay. The over-current/time relay shall operate when a current with an r.m.s. value of 0,50 A, has persisted for 2,00 s. If this is not the case (which can happen after a couple of recalibration periods or a couple of years), both the time (2 s) and the current (0,50 A) can be readjusted.

After finishing the test it is recommended that you drain test solution out of the dripping unit, replace it with distilled water and start another test sequence or two, to flush the solution to avoid formation of crystals on the inner wall of the nozzle. After that the nozzle shall be removed and dried. Also before each test it is recommended that one sequence is triggered so that eventual crystals are dissolved. Our design enables these tasks to be preformed fast and simple.

All components of the electrode unit can be removed and put to pieces, for cleaning procedures. Nozzle, complete dripping unit, solution cylinder, electromagnet, electrode mechanism, electrodes, table and glass plate can be removed by means of thumb-screws, enclosed Allen key and connector, very fast and simple.

## TECHNICAL SPECIFICATION

Supplying voltage	220-230V, 50Hz / other optional
Power consumption	650 VA
Test voltage:	steplessly adjustable 300 V range max. 325 V 600 V range max. 650 V
Test current:	current limiting 1A steplessly adjustable limiting resistors, wire-wound resistor 0-390 Ohm, 250 W 50 Ohm (range 325 V) 285 Ohm (range 650 V)
Time relay	tripping time: 0-3 s
Overcurrent relay	500 mA (2%), adjustable; range: 0,2A - 2A
V-meter	digital, 650 V max., accuracy $\pm 0,2\% + 1$ digit
A-meter	digital, 5 A max., accuracy $\pm 0,2\% + 1$ digit
Dripping unit	voltage: 24 V DC volume of solution cylinder approx. 40 cm <sup>3</sup>
Microcontroller	Siemens LOGO
Ventilator	dia. 80, 24 V DC
Light	fluorescent 11 W, 24 VDC
Exhaust tube connection	dia. 80 mm
Electrodes	platinum, purity 99,99%, 2x5x15 mm
Dimensions	
Control unit	WxDxH: 470 x 490 x 285 mm Weight: 23 kg
Electrode unit	WxDxH: 420 x 315 x 470 mm Weight: 12 kg

**SPARE PARTS** (can be ordered additionally)

T4-41A	PLATINUM ELECTRODES FOR TRACKING TEST APPARATUS (PAIR)
T4-41C	NOZZLE FOR TRACKING TEST APPARATUS
T4-41D	DISTANCE GAUGE FOR TRACKING TEST APPARATUS
T4-41E	AMMONIUM CHLORIDE SOLUTION 1 l
T4-41F	CALIBRATED WEIGHTS M1 IN WOODEN BOXES, 1 g and 100 g with certificates for checking the accuracy of both scales

**CALIBRATION CERTIFICATES**

Certificates for force, dimensions of electrodes, dimensions of distance gauge and voltage, are available on request, but are not included in the price.

**OTHER CONDITIONS**

Warranty: 2 years

Support by E-mail: [support@testing.si](mailto:support@testing.si)

On line Skype VIDEO Support: Testing\_support, matejsimonic

We will be glad to help you solve your problems and to hear any feedback from you.

The equipment described here is subject to redesign without notice. The change will not impair the function of apparatus its characteristics or the price.

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