

## Pocket guide

# VLF tester and diagnostics device **viola / viola TD**



## For your safety



You may work with this pocket guide only after acquiring complete knowledge of the user manual.

## For your safety



### **DANGER**

#### **High electric voltage. Danger to life or risk of injury due to electric shock**

Working with high electric voltage demands careful attention and special safety measures:

- » Observe the safety instructions in the user manual.
- » Observe the safety and accident prevention regulations (according to the state-of-the-art).
- » Observe the national and international standards and guidelines.
- » Operate the device only in a technical perfect condition.
- » Do not operate the device in areas with risk of explosion and fire.
- » Use personal safety equipment for protection against electric shock and burning due to possible arcing faults.

### **Before commissioning:**

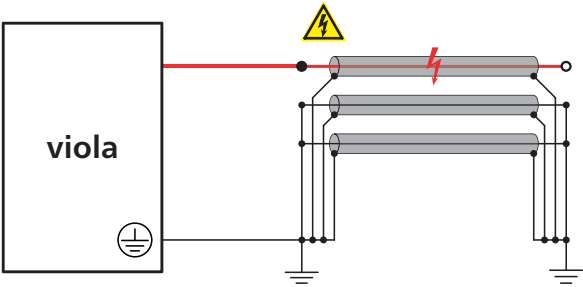
- » Ensure there is no voltage at the work place:
  1. Disconnect test object from all live parts.
  2. Secure against restart.
  3. Ascertain that there is no voltage.
  4. Earth and short all phases of the test object.
  5. Cover or close off nearby live parts.
- » Earth device.
- » Connect device correctly to the test object and delimit the connection point as well as the far end of the test object.
- » Mark the test area and end points clearly.
- » Use suitable personal protective equipment to protect yourself against arcing faults and electric shock.

### **Securing against unauthorised commissioning:**

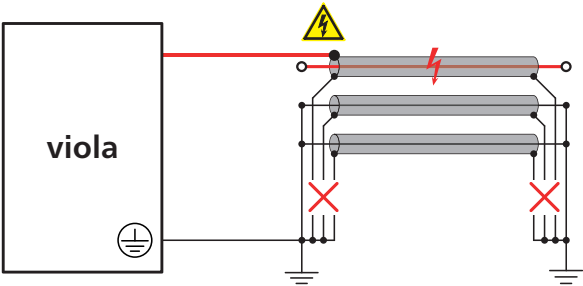
- » On leaving the device, press the emergency stop button and pull out the key.

# Connection diagrams

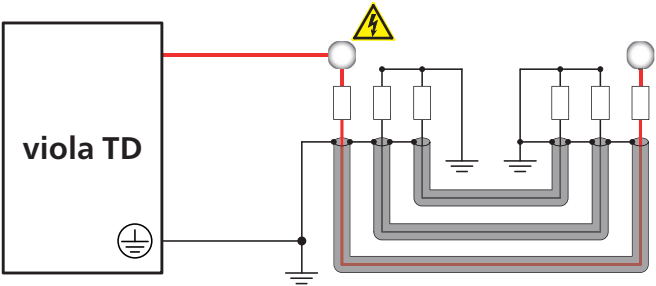
## Cable testing



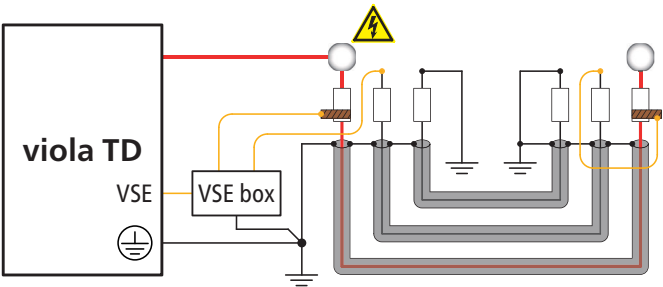
## Cable sheath testing



## tan δ Measurement / without VSE box

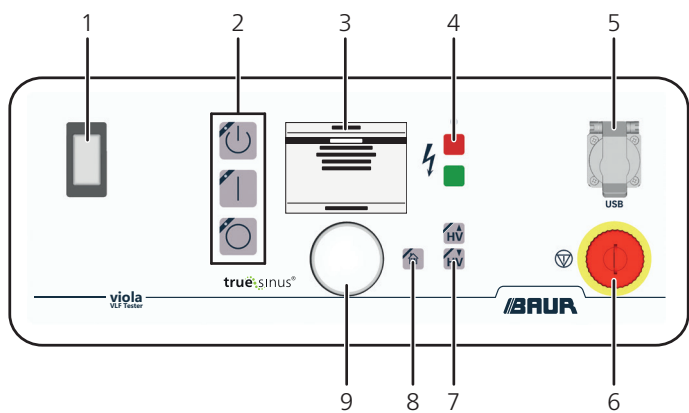


## tan δ Measurement / with VSE box



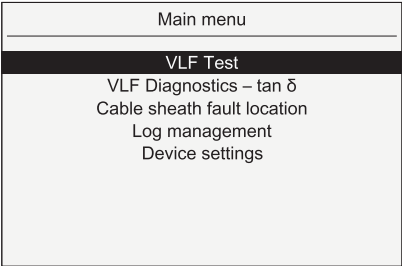
# Connection diagrams

Control panel



|   |                                                                                                                         |
|---|-------------------------------------------------------------------------------------------------------------------------|
| 1 | Main switch                                                                                                             |
| 2 | Buttons to switch on and off the high voltage:<br>⏻ "Ready to switch on"<br>⏻ "High voltage On"<br>⏻ "High voltage Off" |
| 3 | Display                                                                                                                 |
| 4 | Status display:<br>🟢 Ready for operation<br>🔴 (flashing) Ready to switch on<br>🔴 In operation                           |
| 5 | USB port                                                                                                                |
| 6 | Emergency stop button with key lock                                                                                     |
| 7 | Buttons for adjusting the high voltage                                                                                  |
| 8 | "Back" button: Go to the previous menu item                                                                             |
| 9 | Rotary knob: Menu navigation                                                                                            |

Main menu



| Menu item                          | Function                                                        |
|------------------------------------|-----------------------------------------------------------------|
| <i>VLF Test</i>                    | To perform manual and automatic cable tests                     |
| <i>VLF Diagnostics – tan δ</i>     | To perform dissipation factor measurements and MWT measurements |
| <i>Cable sheath fault location</i> | For cable sheath fault location                                 |
| <i>Log management</i>              | To export or delete all logs                                    |
| <i>Device settings</i>             | To set device parameters                                        |

Device settings

» To make the general settings for the device, select **Device settings** in the main menu.

| Menu item                          | Description                                                                                                         |
|------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| <i>Info</i>                        | View device information: Serial number, firmware version etc.                                                       |
| <i>Language</i>                    | Select menu language.                                                                                               |
| <i>Time &amp; Date</i>             | Set time and date.                                                                                                  |
| <i>Switch-on menu</i>              | Define switch-on menu.                                                                                              |
| <i>Display contrast</i>            | Adjust display contrast.                                                                                            |
| <i>Test settings</i>               | Save ambient temperature to log (yes/no), auto. voltage reduction (on/off)                                          |
| <i>Demo mode</i>                   | Activate demo mode: In demo mode, you can familiarise yourself with the menu without switching on the high voltage. |
| <i>Settings for remote control</i> | Show <b>Remote control via BAUR Software</b> menu item in the main menu (yes/no).                                   |

Display symbols

| Abbreviation | Meaning                                                         |
|--------------|-----------------------------------------------------------------|
| <i>I</i>     | Output current                                                  |
| <i>f</i>     | Frequency                                                       |
| <i>Slew</i>  | Voltage slew rate (voltage shape = square wave)                 |
| <i>Ivse</i>  | Leakage currents acquired through the VSE box                   |
| <i>Unom</i>  | Nominal voltage                                                 |
| <i>Umax</i>  | Maximum voltage                                                 |
| <i>R</i>     | Resistance                                                      |
| <i>C</i>     | Electric capacity                                               |
| <i>TD</i>    | Current dissipation factor                                      |
| <i>MTD</i>   | Mean value of dissipation factor                                |
| <i>ΔTD</i>   | Change in dissipation factor with the voltage                   |
| <i>SDTD</i>  | Dissipation factor stability: Standard deviation                |
| <i>ΔTDt</i>  | Change in dissipation factor over time (during MWT measurement) |
| <i>t</i>     | Test time                                                       |
| <i>S</i>     | Voltage step                                                    |
| <i>M</i>     | Measurement                                                     |
| <i>L</i>     | Phase                                                           |
| <i>Thv</i>   | Operating temperature of high voltage unit                      |
| 😊            | Measured values are within the permissible range.               |
| 😐            | Cable is partially damaged. Further observation is recommended. |
| 😞            | Cable is damaged. Appropriate measures are necessary.           |
| ⊗            | Measurement was cancelled.                                      |

## Manual cable testing



**DANGER!**

**The test object still carries live voltage.**

Danger to life, risk of injury due to electric shock!

10. Before touching the test object, discharge, earth and short-circuit. [ [Taking out of operation](#)]
11. To save the log, select **Finish** and answer the query with **Yes**.
12. Enter log name and select **OK**.

Manual test VLF Sine auto

42.0 kVrms

f = 0.10 Hz R = >100.0 MΩ

U<sub>nom</sub> = 42.0 kVrms C = 300 nF

I = 4.5 mA Thv = 25 °C

t: 00:18/30 min

Stop Voltage

| Settings      |               |
|---------------|---------------|
| Voltage shape | VLF Sine auto |
| Max. voltage  | 42.0 kVrms    |
| Frequency     | auto Hz       |
| Test time     | 30 min        |
| Start delay   | --- min       |
| Burn          | off           |
| Back          |               |

6. In the test mode window, select **Start**.
7. Press the  button until the  status display flashes.
8. While the status display is flashing, press the  button. The  status display is on continuously. Cable testing is started with 1 kV after the load determination.
9. Press the   buttons to change the test voltage.

## Manual cable testing

After the defined test duration, the test ends automatically, the high voltage decreases and the device discharges internally.

Danger to life, risk of injury due to electric shock!

10. Before touching the test object, discharge, earth and short-circuit. [ [Taking out of operation](#)]
11. To save the log, select **Finish** and answer the query with **Yes**.
12. Enter log name and select **OK**.

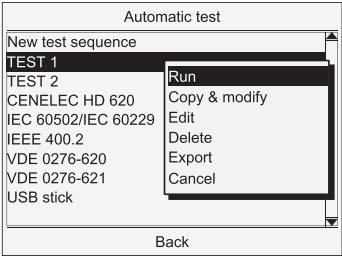
# Automatic cable testing



## Danger due to electric shock!

- » Take all necessary safety measures.  
[↪ For your safety]

1. Connect and earth device for the cable test.  
[↪ Cable testing – Connection diagram]
2. Press main switch. The device is ready for operation (status display: ).
3. In the main menu, select **VLF Test> Automatic test**.



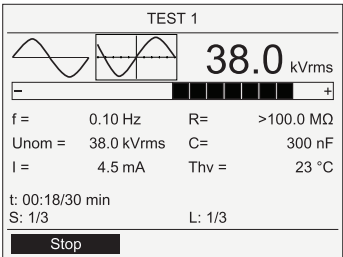
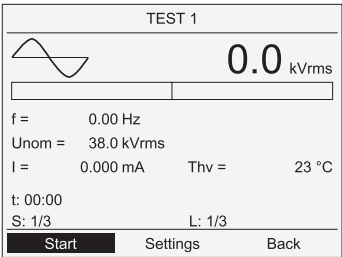
A test sequence contains all the necessary parameters of a test. You can create individual test sequences for various test tasks. An additional 5 preprogrammed standard test sequences are available (IEC 60502/IEC 60229 = Cable sheath test).

4. Select test sequence and in the context menu, select **Run**. The test mode window opens.

### Creating a new test sequence

- a. Select **New test sequence** and enter the test parameters:
  - Test sequence name
  - Number of steps and phases
  - Voltage shape
  - Max. voltage
  - Frequency
  - Burn mode (on/off)
- b. In the lower menu bar, select **Steps** and define the test duration/voltage for the individual steps.
- c. Select **Save**. The test sequence is saved.

### Performing tests



5. Select **Start** and press the button until the status display flashes.
6. While the red status display is flashing, press the button. The status display is on continuously.

The cable test starts. After the defined test duration, the test ends automatically, the high voltage decreases and the device discharges internally.

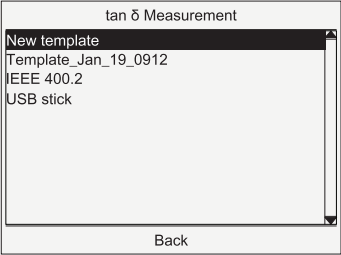


### The test object still carries live voltage.

Danger to life, risk of injury due to electric shock!

7. Before touching the test object, discharge, earth and short-circuit. [↪ Taking out of operation]
8. To save the log, select **Finish** and answer the query with **Yes**.
9. Enter log name and select **OK**.

1. In the main menu, select **VLF Diagnostics – tan δ > tan δ Measurement**. A list of available templates is displayed.



Template = Program (measurement parameters) + Evaluation (threshold values).  
You can create individual templates for various test tasks.  
A preprogrammed template in accordance with IEEE 400.2 is also available.

Editing templates

2. Select a template and in the context menu, select **Edit**. Go to step 4.

Creating new templates

3. Select **New template**.  
Or select a template and in the context menu, select **Copy & modify**.  
4. Enter a name for the template.  
5. Select input field for program.  
6. Select **New program** or an existing program.

Create new program:

- a. Enter the following parameters:

- |                                         |                                   |
|-----------------------------------------|-----------------------------------|
| • Name, nominal voltage (Phase – Earth) | • Number of measurements per step |
| • Number of steps                       | • Number of phases                |

- b. Select **Next** and define voltage for the individual steps.  
c. Select **Save** to save the program.

7. Select input field for evaluation.  
8. Select **New Evaluation** or an existing evaluation.

Create new evaluation:

- a. Enter name.  
b. Define threshold values for tan δ and tan δ change with the voltage.

| Threshold value | Information / Symbol on the display                               |
|-----------------|-------------------------------------------------------------------|
| Cancel          | Measurement is cancelled on reaching this threshold value. ⊗      |
| High risk       | Cable is damaged. Measures are necessary. ☹                       |
| Risk            | Cable is partially damaged. Further observation is recommended. 😐 |

- c. Select **Save** to save the evaluation.

9. In the next menu, select **Save** to save the template.  
10. In the **tan δ Measurement** menu, select the new or edited template and in the context menu, select **Run**.  
[➡ tan δ Measurement – Connection diagram, Performing the tan δ measurement]

# Performing the $\tan \delta$ measurement

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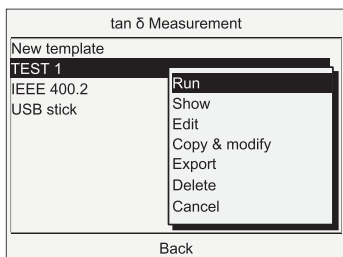


## DANGER

### Danger due to electric shock!

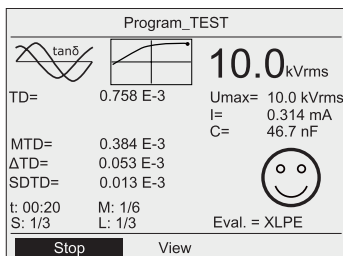
- » Take all necessary safety measures.  
[➡ For your safety]

1. Connect and earth device for the dissipation factor measurement. [➡ [tan  \$\delta\$  Measurement – Connection diagram](#)]
2. Press main switch. The device is ready for operation (status display: ■).
3. In the main menu, select **VLF Diagnostics – tan  $\delta$  > tan  $\delta$  Measurement**.



To create or edit a template, see [Configuring the tan  \$\delta\$  measurement](#).

4. Select a template and in the context menu, select **Run**.
5. In the measurement mode window, select **Start**.
6. If more than one phase is specified in the program, select a phase in the context menu.
7. Press the  button until the ■ status display flashes.
8. While the status display is flashing, press the  button. The ■ status display is on continuously. The measurement is started.

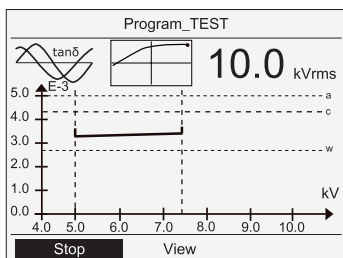


During the measurement, you can choose from 3 different views that you can select using **View**. Examples:

Top: Main view (continuous display of all measured values)

Bottom: Diagram tan  $\delta$  versus voltage

The display symbols are described under [Device settings / Symbols](#).



The measurement ends automatically, the high voltage decreases and the device discharges internally.



## DANGER!

### The test object still carries live voltage.

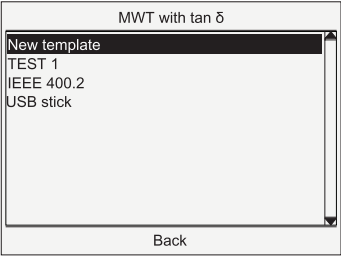
Danger to life, risk of injury due to electric shock!

9. Before touching the test object, discharge, earth and short-circuit. [➡ [Taking out of operation](#)]
10. To save the log, select **Finish** and answer the query with **Yes**.
11. Enter log name and select **OK**.

# Performing the $\tan \delta$ measurement

In the **Monitored Withstand Test (MWT)**, a VLF cable test and a dissipation factor measurement are performed in parallel.

- In the main menu, select **VLF Diagnostics –  $\tan \delta$  > MWT with  $\tan \delta$** . A list of available templates is displayed.



A template consists of a program (measurement parameters) and an evaluation (threshold values). You can create individual templates for various test tasks. A preprogrammed template in accordance with IEEE 400.2 is also available.

Editing templates

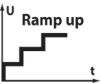
- Select a template and in the context menu, select **Edit**. Go to step 4.

Creating new templates

- Select **New template**. Or select a template and in the context menu, select **Copy & modify**.
- Enter a name for the template and select the input field for the program.
- Select **New program** or an existing program.

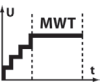
Create new program:

- Enter parameters for ramp-up phase:



- Name of program
- Nominal voltage
- Number of steps
- Number of measurements per step
- Number of phases

- Select **Next** and enter voltage and evaluation criteria for each step.
- Select **Next** and enter parameters for the MWT phase:



- Test voltage
- Extended test duration
- Standard test duration
- Reduced test duration
- Time, after which the recommended test duration must appear

- Select **Save** to save the program.

- Select input field for evaluation.
- Select **New Evaluation** or an existing evaluation.

Create new evaluation:

- Enter name.
- Enter threshold values for following measured values:
  - TD stability (SDTD)
  - TD change with voltage ( $\Delta$ TD)
  - TD mean value (MTD)
  - TD change over time ( $\Delta$ TDt)
- Select **Save** to save the evaluation.

- In the next menu, select **Save** to save the template.
- Select the new template and in the context menu, select **Run**. [[tan  \$\delta\$  measurement – Connection diagram, Performing the Monitored Withstand Test](#)]

# Performing the Monitored Withstand Test

viola TD

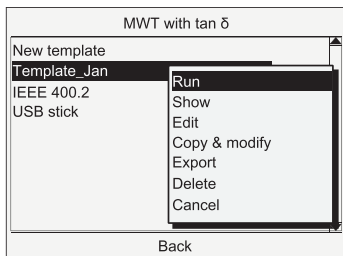


## DANGER

### Danger due to electric shock!

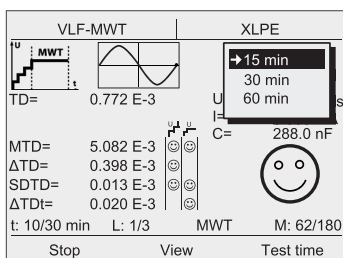
- » Take all necessary safety measures.  
[➡ For your safety]

1. Connect and earth device for the MWT.  
[➡ [tan  \$\delta\$  measurement – Connection diagram](#)]
2. Press main switch. The device is ready for operation (status display: )
3. In the main menu, select **VLF Diagnostics – tan  $\delta$  > MWT with tan  $\delta$** .



To create or edit a template, see [Configuring the Monitored Withstand Test](#).

4. Select a template and in the context menu, select **Run**.
5. In the measurement mode window, select **Start**.
6. If more than one phase is specified in the program, select a phase in the context menu.
7. Press the button until the status display flashes.
8. While the status display is flashing, press the button. The status display is on continuously. The measurement is started.



**MWT:** After the defined time, the recommended test duration based on tan  $\delta$  values is displayed.

9. Select the test duration for the MWT phase.
10. During the measurement, 4 different views are available that you can select using **View**.

The measurement ends automatically, the high voltage decreases and the device discharges internally.



## DANGER!

### The test object still carries live voltage.

Danger to life, risk of injury due to electric shock!

11. Before touching the test object, discharge, earth and short-circuit. [➡ [Taking out of operation](#)]
12. To save the log, select **Finish** and answer the query with **Yes**.
13. Enter log name and select **OK**.

# Taking out of operation

## Discharging and earthing the test object



**DANGER**

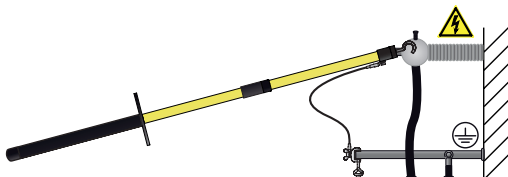
**The test object still carries live voltage.**

Danger to life, risk of injury due to electric shock!

- » Before touching the test object, discharge, earth and short-circuit.

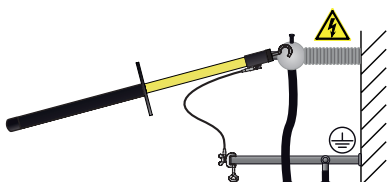
1. Connect the earthing conductor of the discharge and earth rod to the station earth.

### Discharging



2. Install the discharge rod.
3. During discharge, maintain a distance of approx. 50 cm to the earthing conductor of the discharge rod.
4. Hold the discharge rod by the black handle and touch the test object with the tip of the discharge rod.
5. Observe the minimum discharge time in accordance with the capacity of the test object.

### Earthing



6. Install the earthing rod.
7. During earthing, maintain a distance of approx. 50 cm to the earthing conductor of the earthing rod.
8. Hold the earthing rod by the black handle and touch the test object with the tip of the earthing rod.

### Removing the test setup

9. Switch off the device and disconnect it from the mains voltage.
10. Disconnect the high voltage cable.

**Note regarding the dissipation factor measurement or MWT:** Before touching the anti-corona protection, connect the tested conductor with the shorted conductor (Potential compensation cable is included in the delivery).

11. Finally, disconnect the earthing conductor.

Remove the earthing and short-circuit to the test object only if no subsequent work is required and if the test object will be operated again.

# Taking out of operation

Overview of applications for XLPE cables  
in relation to cable lengths

Voltage shape: truesinus® – 0.1 Hz  
1-core cable, ø 150 mm²:

| Nom.<br>voltage<br>U | Uo<br>(U/√3) | Load<br>(µF/km) | CENELEC<br>HD 620<br>VLF test 3xUo | IEEE 400.2<br>VLF test<br>(maintenance) | tan δ<br>2xUo          |
|----------------------|--------------|-----------------|------------------------------------|-----------------------------------------|------------------------|
| 6.6 kV               | 3.8 kV       | 0.465           | 11.4 kV <sub>rms</sub>             | 8.5 kV <sub>rms</sub>                   | 7.6 kV <sub>rms</sub>  |
|                      |              |                 | 14.8 km                            | 19.9 km                                 | 21.5 km                |
| 10.0 kV              | 5.8 kV       | 0.380           | 17.3 kV <sub>rms</sub>             | 11.5 kV <sub>rms</sub>                  | 11.5 kV <sub>rms</sub> |
|                      |              |                 | 12.0 km                            | 18.0 km                                 | 18.0 km                |
| 11.0 kV              | 6.4 kV       | 0.361           | 19.1 kV <sub>rms</sub>             | 12.5 kV <sub>rms</sub>                  | 12.7 kV <sub>rms</sub> |
|                      |              |                 | 11.5 km                            | 17.5 km                                 | 17.2 km                |
| 20.0 kV              | 11.5 kV      | 0.240           | 34.6 kV <sub>rms</sub>             | 19.5 kV <sub>rms</sub>                  | 23.1 kV <sub>rms</sub> |
|                      |              |                 | 5.5 km                             | 16.8 km                                 | 12.4 km                |

3-core cable, ø 150 mm²:

| Nom.<br>voltage<br>U | Uo<br>(U/√3) | Load<br>(µF/km) | CENELEC<br>HD 620<br>VLF test 3xUo | IEEE 400.2<br>VLF test<br>(maintenance) | tan δ<br>2xUo          |
|----------------------|--------------|-----------------|------------------------------------|-----------------------------------------|------------------------|
| 6.0 kV               | 3.5 kV       | 0.388           | 10.4 kV <sub>rms</sub>             | 8.0 kV <sub>rms</sub>                   | 6.9 kV <sub>rms</sub>  |
|                      |              |                 | 19.5 km                            | 25.4 km                                 | 25.8 km                |
| 6.6 kV               | 3.8 kV       | 0.450           | 11.4 kV <sub>rms</sub>             | 8.5 kV <sub>rms</sub>                   | 7.6 kV <sub>rms</sub>  |
|                      |              |                 | 15.3 km                            | 20.6 km                                 | 22.2 km                |
| 10.0 kV              | 5.8 kV       | 0.314           | 17.3 kV <sub>rms</sub>             | 11.5 kV <sub>rms</sub>                  | 11.5 kV <sub>rms</sub> |
|                      |              |                 | 14.5 km                            | 21.8 km                                 | 21.7 km                |
| 11.0 kV              | 6.4 kV       | 0.240           | 19.1 kV <sub>rms</sub>             | 12.5 kV <sub>rms</sub>                  | 12.7 kV <sub>rms</sub> |
|                      |              |                 | 17.2 km                            | 26.3 km                                 | 25.8 km                |
| 22.0 kV              | 12.7 kV      | 0.242           | 38.1 kV <sub>rms</sub>             | 21.0 kV <sub>rms</sub>                  | 25.4 kV <sub>rms</sub> |
|                      |              |                 | 4.5 km                             | 14.9 km                                 | 10.2 km                |



BAUR GmbH  
Raiffeisenstraße 8  
6832 Sulz / Austria  
  
headoffice@baur.eu  
www.baur.eu