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Safety Instruction for Tests with High Voltage

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Agenda

- > **Safety in different countries**
- > **Standards for Electrical Safety**
- > **Five Safety Rules for HV testing**
- > **OMICRON's effort for safety**

Helmets and Safety Shoes

- > In most utilities you have to wear helmets and safety shoes, if you are working in a substation.



Safety in different countries



Safety in different countries



Safety in different countries



Safety in different countries



Safety in different countries



Safety in different countries



Safety Standards

- > European Standards
 - > EN 50110-1
 - > EN 50191

Operation of electrical installations
Erection and operation of electrical test equipment



- > American Standard
 - > IEEE 510 – 1983

Recommended practices for safety
in High-Voltage and High-Power testing



- > National Standards



Personnel Definition in EN50110-1

- > Nominated person in control of an **electrical installation**

Person, who has been nominated to be the person with direct management responsibility for the electrical installation.

- > Nominated person in control of a **work activity**

Person, who has been nominated to be the person with direct management responsibility for the work activity.

Additional Requirements (OMICRON)

- > **One person** should be **responsible** for the work activity
- > When tests are done with voltages $>1\text{kV}$, a second person should be available who checks the test circuit (**4 – eyes principle**) and who can operate the emergency off button in case of danger
- > **Don't do HV tests** when you feel **not safe** with the test situation or if you are **tired**

Safety related parts of EN 50110-1 and EN 50191

> Five safety rules!!!!!!!

1. Disconnect completely
2. Secure against reconnection
3. Verify that the installation is dead
4. Earthing and short circuiting
5. Provide protection against near live parts



Disconnect completely(1) (open circuit breakers)



Disconnect completely(2) (open disconnectors)



closed



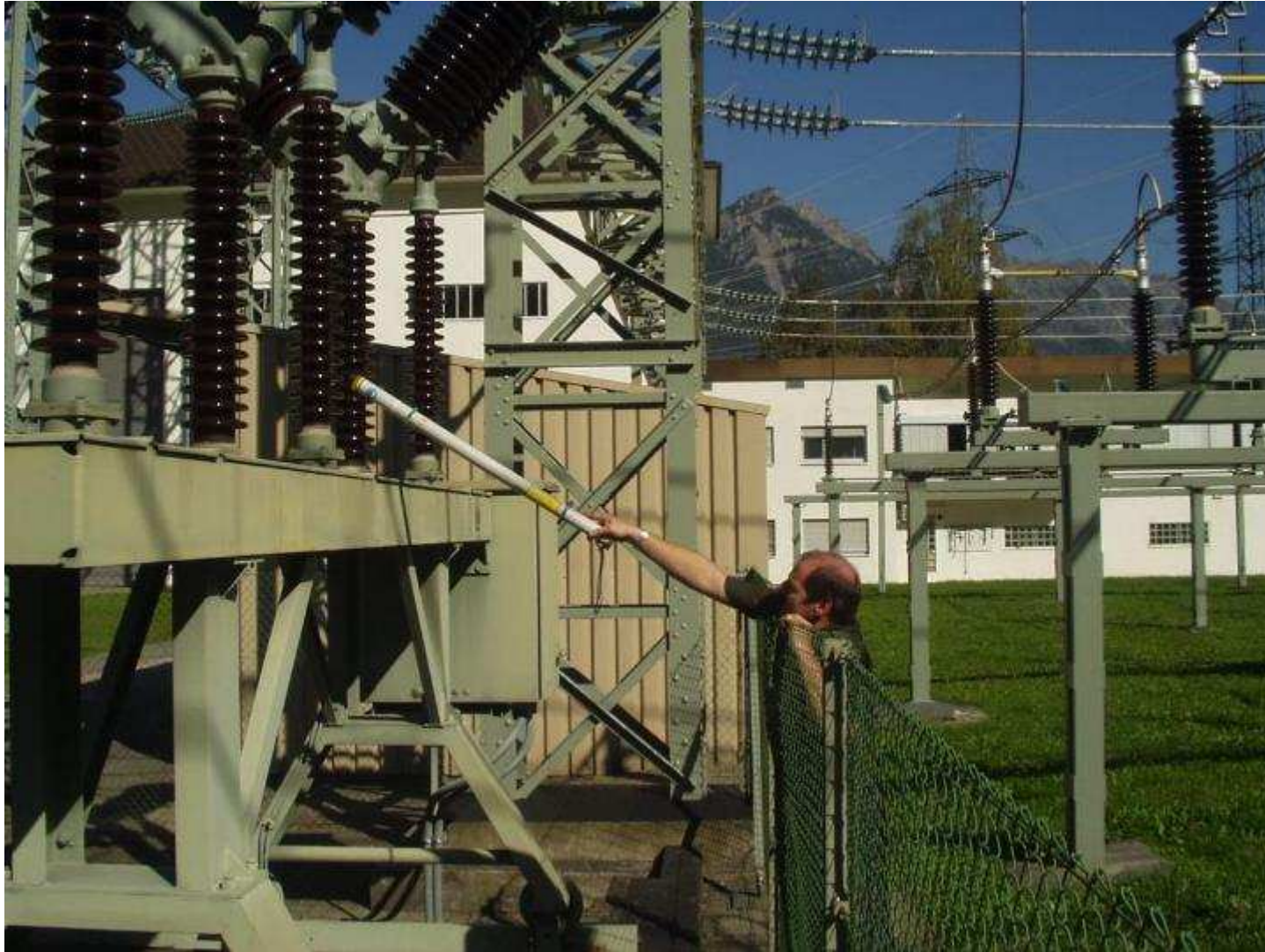
opened



Secure against Reconnecting



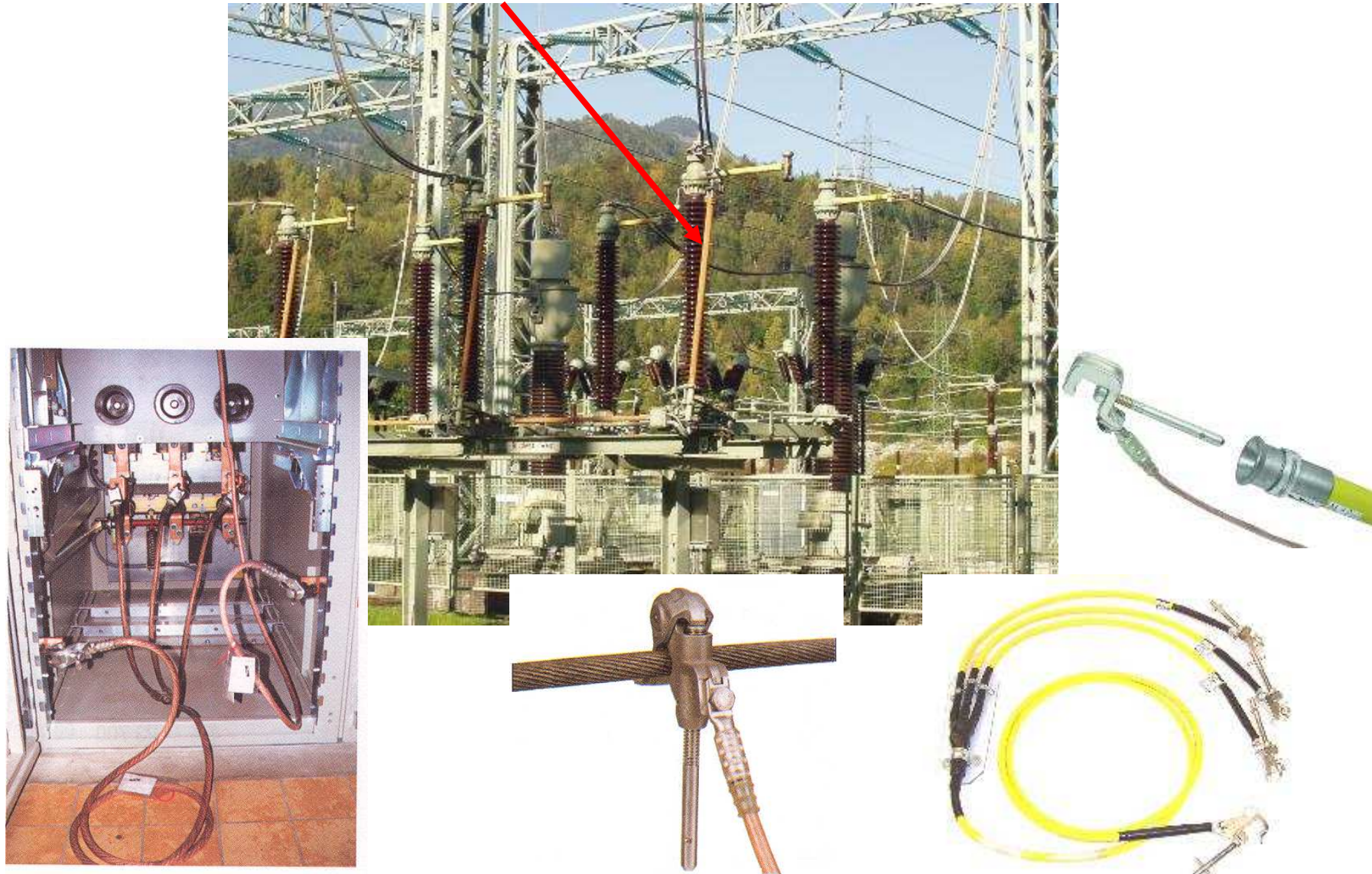
Verify that the Installation is Dead



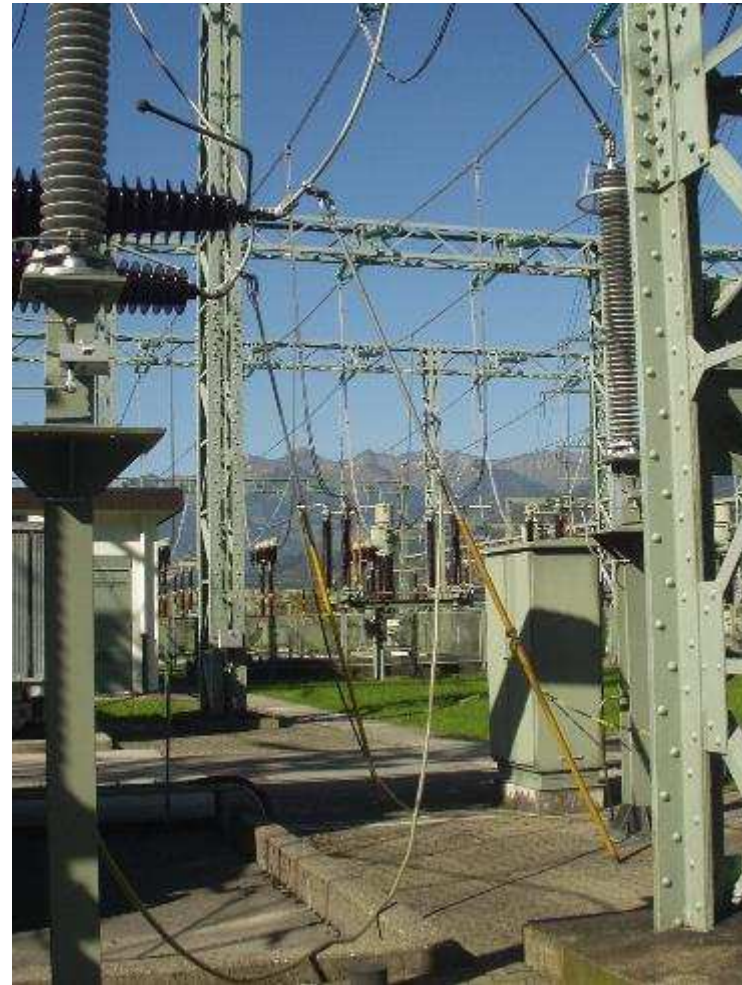
Earth and Short Circuit (1)



Earth and Short Circuit (2)



Earth and Short Circuit (3)



Provide protection against near live parts



Safety related parts of EN 50110-1 and EN 50191

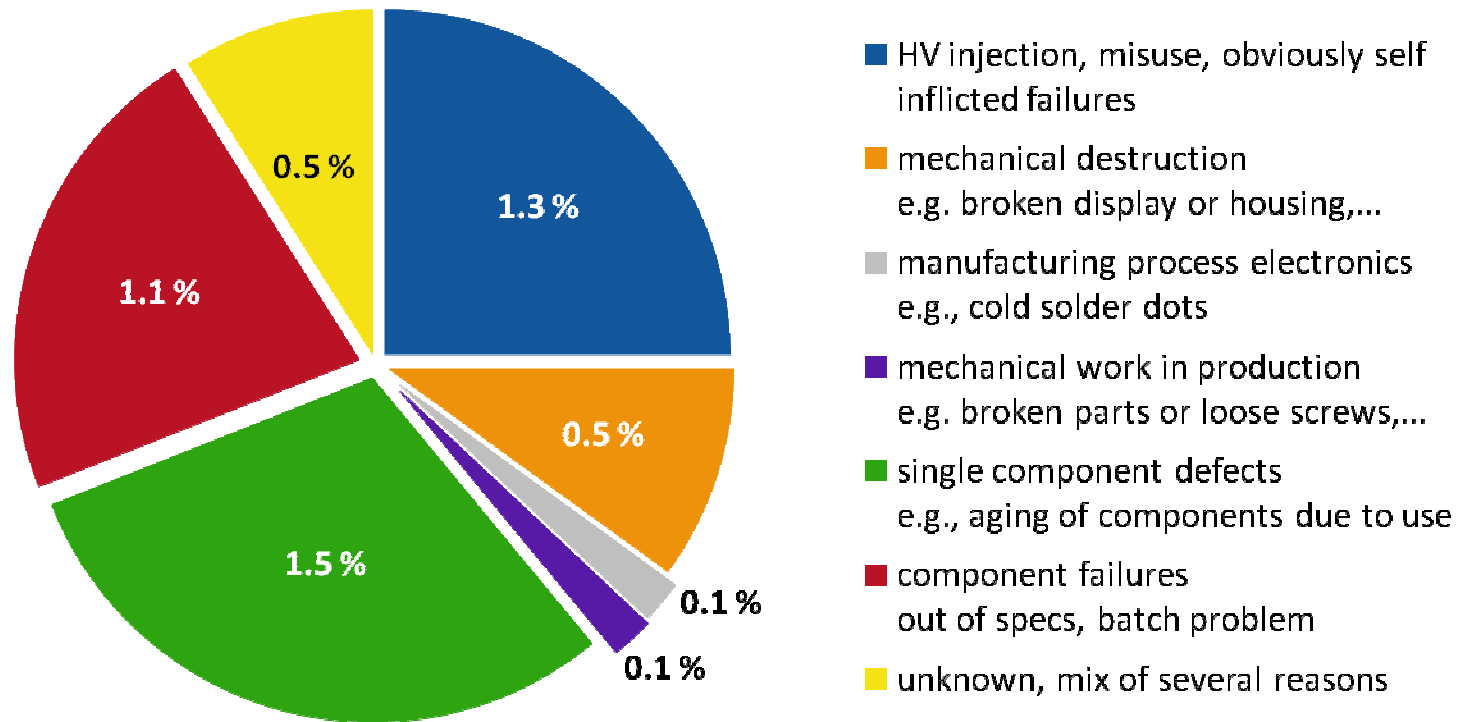
- > Before touching test objects which have been switched off - five safety rules!!!!!!!
- > Don't touch any terminal without visible ground connection!
- > Emergency routes and exits shall always be kept clear



Efforts from OMICRON(1)

Products of the highest quality

>Average failure rate: less than 5 % per year (including self-inflicted cases)



Efforts from OMICRON(2)

Safety function and Accessories

- >Automated stop features on unexpected situations
- >Various accessories for safety



Efforts from OMICRON(3)

Safety Instruction in User Manual

Winding Resistance

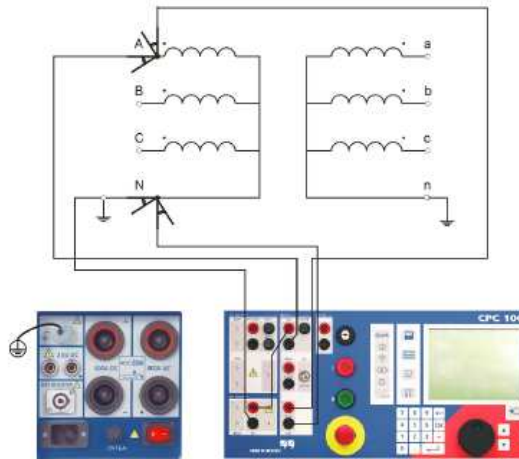
Note: Some test cards are available in more than one test mode. For the test card **RWinding** can be selected in CT, Resistance and Trans. This is solely related to usability. With regard to functionality, the test **RWinding** is identical in all test modes.



DANGER
Death or severe injury caused by high voltage or current

- ▶ After a measurement, wait until the discharge procedure is completed.
- ▶ Never open a measuring circuit while current flows.
- ▶ If you have to change the wiring after a test, use a grounding or discharge rod.

winding test.



Use the **RWinding** test card to measure the resistance of a power transformer winding. To do so, loop the I DC current signal from the **CPC 100 6A DC** via **IAC/DC** as shown in Figure 12 and inject it into the transformer's IAC/DC. **IAC/DC** measures the injected current, and **V DC** input measures the voltage generated at the transformer's winding. From these values the winding resistance is calculated.

Alternatively, inject the current directly from the 400A DC output (see Figure 12).

CT Analyzer User Manual

CIBANO 500 PTM User Manual

8.1 Safety Notes and Notes for Using Quick Test



Warning: For VT ratio measurement, the **CT Analyzer** connected to the primary side of the VT. Connecting the secondary side of the VT by mistake will cause hazard on the primary side!



Warning: Using the DC current mode of the Advanced mode can be very dangerous! It is not possible to interrupt the circuit with a relay or a standard circuit breaker. Due to the arc, contact separation distances of 10mm are required to switch off the current.



Warning: Feeding an inductance with DC current will be very dangerous! The **CT Analyzer** does not perform automatic discharge measurements with **Quick Test**. Risk of electric shock! Inductance has discharged completely before touching or disconnecting the measurement leads of the **CT Analyzer**.



Caution: When using **Quick Test**, input "Sec" of the **CT Analyzer** measure voltages up to 150V_{RMS}. Do not connect voltage or even mains voltages to the **CT Analyzer** inputs! This will damage the **CT Analyzer**!



Caution: When performing measurements on CTs use the **CT Analyzer** does not perform automatic demagnetization. Therefore, it may be necessary to additionally run a non-automatic demagnetizing cycle following **Quick Test** measurements.

17.2.4 Contact Resistance test

The Contact Resistance test measures the static resistance of the circuit breaker's main contacts.

Connection



WARNING
Death or severe injury caused by high voltage or current possible

- ▶ Do not use external power sources for the circuit breaker's main contacts.
- ▶ During the test, supply the circuit breaker's main contacts only with **CIBANO 500**.



WARNING
Death or severe injury caused by high voltage or current possible

- ▶ Do not connect anything to the circuit breaker under test without grounding the circuit breaker.
- ▶ Always ground the circuit breaker on both ends on all phases and close the circuit breaker to have proper grounding between the interrupters.

To connect the test object to **CIBANO 500**:



WARNING
Death or severe injury caused by high voltage or current possible

- ▶ Do not connect the EtherCAT® cables to the **CB MC2** module before they are connected to **CIBANO 500**.
- ▶ Connect the EtherCAT® cables first to **CIBANO 500** and then to the **CB MC2** module.

1. Make sure that all cable connectors are clean and dry before being tightly connected.
2. Connect the **CB MC2** to **CIBANO 500** with the EtherCAT® cable.
3. Hook up the **CB MC2** to the first or the first two interrupter(s) of the circuit breaker.

Efforts from OMICRON(4)

Products considering user safety



THANK YOU

