Original instruction
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Overview
The test adapter from ABB Components can permanently connect the tap on the bushing to measuring equipment, for monitoring of the bushing during service.

All transformer bushings and some wall bushings that are manufactured by ABB Components, are capacitance-graded bushings that are equipped with a voltage tap or test tap.

The tap is connected to a conductive layer in the condenser core, this makes it possible to measure the capacitance and dissipation factor of an installed bushing. This can be done during service if the test adapter is installed on the tap.

With the test adapter, the tap can also be used as a power source or for the measurement of voltage. The test adapter limits the amount of power that can be passed through the tap, despite a higher capacity of the tap, refer to "Description and limitations of the tap" on page 7. The quality of the output is limited by the temperature dependence of the main insulation, and the fluctuations in the network.

Test tap
The test tap divides the total capacitance of the bushing in two sub-capacitances: C1 (central conductor – test-tap layer) and C2 (test-tap layer – grounded flange).

* The installation wall, transformer tank or reactor contributes to the capacitance C2.
### Voltage tap

The voltage tap divides the total capacitance of the bushing into two sub-capacitances:
- \( C_1 \) (central conductor – voltage-tap layer) and
- \( C_2 \) (voltage-tap layer – grounded layer).

#### Usage

Use the test adapter only as described in this installation and maintenance guide, and obey the limitations of the test adapter. Refer to "Description and limitations of the tap" on page 7.

#### Grounding

The tap is not self-grounding, and must always be grounded or connected to an external impedance. Because \( C_2 \) is usually relatively small, the test tap must never be open-circuited when the bushing is energized.

If the tap is not grounded when the bushing is energized, failure of the bushing will occur.

#### About usage with shunt reactors

It is not recommended to use the test adapter with shunt reactors. Because there is a 90° phase offset between current and voltage, the voltage will be at maximum when the current is at zero. Thus, switching at current zero will produce a large amount of voltage transients with high amplitude, because of this the impedance of the cable connected to the tap can cause problems. This effect is strengthened if the shunt-reactor switchgear is located near the bushing.

Exceptions can be made if a study is done on the actual switchgear station. But this study is complicated and expensive, thus it is generally not recommended.

#### About usage with gas insulated switchgear (GIS)

It is not recommended to use the test adapter with GIS, because switching operations will produce voltage transients that can cause problems. When used with GIS, disconnecters and grounding switches can produce strong voltage transients. These voltage transients are very fast transients (VFT), and because of this the impedance of the cable connected to the tap can cause problems.

Exceptions can be made if a study is done on the actual switchgear station. But this study is complicated and expensive, thus it is generally not recommended.

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* The installation wall, transformer tank or reactor contributes to the capacitance \( C_2 \).
Description and limitations of the tap

**Overview**

The values of impedance for the main insulation and the tap are unique to every bushing. Refer to the rating.

The value of the capacitance $C_2$ depends on the design of the bushing and on its installation, and can thus vary more or less. The capacitance $C_2$ should be measured after installation of the bushing, to get an accurate value.

The test adapter limits the amount of power that can be passed through the tap, despite a higher capacity of the tap.

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**Circuit diagram**

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**Table 1. Limitations of the connected circuit**

<table>
<thead>
<tr>
<th>Limitations of the connected circuit</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum allowed voltage, $U_2$:</td>
<td>At service voltage: 110 V</td>
</tr>
<tr>
<td></td>
<td>At lightning impulse: 200 V</td>
</tr>
<tr>
<td>Maximum inductive and/or resistive loads, $Z$:</td>
<td>$\omega L = 100 , \text{mΩ}$</td>
</tr>
<tr>
<td></td>
<td>$R = 100 , \text{mΩ}$</td>
</tr>
</tbody>
</table>

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**Table 2. Units**

<table>
<thead>
<tr>
<th>Unit</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C_1$</td>
<td>Capacitance 1 in condenser core, [F]</td>
</tr>
<tr>
<td>$C_2$</td>
<td>Capacitance 2 in condenser core, [F]</td>
</tr>
<tr>
<td>$U_2$</td>
<td>Tap voltage, [V]</td>
</tr>
<tr>
<td>$U_{2\text{max}}$</td>
<td>The maximum service voltage, [V]</td>
</tr>
<tr>
<td>$U_1$</td>
<td>Voltage between outer terminal and earth, [V]</td>
</tr>
<tr>
<td>$R$</td>
<td>Resistance, [Ω]</td>
</tr>
<tr>
<td>$Z$</td>
<td>Impedance, [Ω]</td>
</tr>
<tr>
<td>$\omega$</td>
<td>Angular velocity for AC voltage [rad/s]</td>
</tr>
<tr>
<td>$L$</td>
<td>Inductance, [H]</td>
</tr>
<tr>
<td>$\omega L$</td>
<td>Inductive reactance, [Ω]</td>
</tr>
<tr>
<td>$Z$</td>
<td>Inductive and/or resistive loads, [Ω]</td>
</tr>
</tbody>
</table>
Dimensions

Test adapter, 1ZSC003881-AAC

Test adapter, 2769522-C

04 Test adapter, 1ZSC003881-AAC.

05 Test adapter, 2769522-C.
Ordering particulars

When ordering, please state:
- Type and catalogue number of the bushing.
- Tests required, in addition to the routine tests.