Wall bushings, type GSA-AA
Installation and maintenance guide
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1 Safety

1.1 Levels of safety risks

Throughout the manual, various types of safety risks are indicated. The most serious level on this scale provides a warning about serious personal injury or possible death, or major damage to a product, if the instructions are not observed.

Symbols and their meanings

The following describes the symbols that appear in the manual, along with their meaning.

DANGER!
The yellow, filled warning triangle warns that an accident will occur if the instructions are not complied with and that it will result in serious personal injury or death and/or major damage to the product.

It is used, for example, to warn of such dangers as: contact with high voltage, explosion or fire risk, risk for toxic gases, risk of crushing, impacts, falls from high places, etc.

CAUTION!
The round warning symbol warns that an accident could occur if the instructions are not observed, and that this could result in personal injury and/or damage to the product.

It is also used to warn of risks that entail burns, eye or skin injuries, impaired hearing, crushing or slipping injuries, tripping, impacts, falls from high places, etc.

In addition, it is used to warn about functional requirements when assembling or removing equipment where there is a risk of damage to the product or that it might cause downtime.

NOTE!
The comment symbol identifies important information and conditions. Also used to indicate any danger that could lead to property damage.

Torque
The torque symbol indicates the tightening torque.

1.2 Hazardous working situations

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working close to high voltage.</td>
<td>Disconnect all plant power. Then earth all objects at the workplace.</td>
</tr>
<tr>
<td></td>
<td>If work must be carried out close to live plant components, then make</td>
</tr>
<tr>
<td></td>
<td>sure that the safety distance is in compliance with the applicable</td>
</tr>
<tr>
<td></td>
<td>safety regulations.</td>
</tr>
<tr>
<td>Working on ladders and platforms.</td>
<td>Work must be done in accordance with the applicable safety</td>
</tr>
<tr>
<td></td>
<td>regulations.</td>
</tr>
<tr>
<td></td>
<td>Do not use ladders or platforms in poor weather conditions.</td>
</tr>
<tr>
<td>Working with heavy objects.</td>
<td>Do not walk under lifted objects.</td>
</tr>
<tr>
<td></td>
<td>Make sure that heavy objects are stable before starting work.</td>
</tr>
</tbody>
</table>
1.3 Safety precautions

<table>
<thead>
<tr>
<th>Precaution</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste and cleaning up</td>
<td>Clean up liquid waste with an adsorbent. Treat waste as hazardous to the environment.</td>
</tr>
<tr>
<td>Fire</td>
<td>Extinguish fire with powder, foam or carbon dioxide.</td>
</tr>
</tbody>
</table>
2 Product description

2.1 Design

Overview

The bushing is of the dry type, with a condenser core made from Resin Impregnated Paper (RIP) as main insulation. The outdoor insulator is made from Silicone Rubber (SiR). The indoor part of the bushing does not have an insulator, and the condenser core (RIP) is exposed to the atmosphere. The core is wound from crepe paper, with aluminum foil inserts for electrical stress control. The core is resin impregnated, and cured in vacuum, giving a partially discharge-free bushing with low dissipation factor (tan δ).

For a detailed description, please refer to the Technical guide, IZSE 2750-112.

General schematics

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Intermediate flange</td>
</tr>
<tr>
<td>2</td>
<td>Outdoor insulator (SiR)</td>
</tr>
<tr>
<td>3</td>
<td>Outer terminal</td>
</tr>
<tr>
<td>4</td>
<td>Test tap</td>
</tr>
<tr>
<td>5</td>
<td>Solid conductor</td>
</tr>
<tr>
<td>6</td>
<td>Condenser core (RIP)</td>
</tr>
</tbody>
</table>
Test tap

The bushing is equipped with a test tap that is connected to the outermost conductive layer of the condenser core. The test tap is used to measure the bushing insulation by capacitance and dissipation factor, when the bushing is energized. The cover connects the outermost conductive layer to ground, and must always be installed when the bushing is energized.

The maximum one minute test voltage for this test tap is 2 kV$_{\text{rms}}$. The test tap can be used as a power source, if it is connected to an external capacitance. The operating voltage is limited to 600 V.

**CAUTION!**
Do not energize the bushing without a test adapter or the cover installed. The bushing is grounded through the cover to prevent damage to the bushing.

---

**Test adapter, 1ZSC003881-AAC, optional equipment**

The test adapter 1ZSC003881-AAC is available for permanent connection to measuring circuits. Please refer to Test adapter – Installation and maintenance guide 1ZSC000563-ACD.
**Arcing horns, optional equipment**

Arcing horns are available as optional equipment, they are made of galvanised steel.

Refer to the table for the gap distances (K) of standard arcing horns, other gap distances are available on request.

![Diagram of arcing horns](image)

<table>
<thead>
<tr>
<th>Type</th>
<th>K (mm)</th>
<th>C (mm)</th>
<th>H (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSA-AA 52/4000</td>
<td>230-440</td>
<td>315</td>
<td>112</td>
</tr>
<tr>
<td>GSA-AA 73/4000</td>
<td>400-620</td>
<td>315</td>
<td>112</td>
</tr>
<tr>
<td>GSA-AA 123/2000</td>
<td>620-960</td>
<td>315</td>
<td>114</td>
</tr>
<tr>
<td>GSA-AA 123/4000</td>
<td>620-960</td>
<td>315</td>
<td>114</td>
</tr>
</tbody>
</table>
# 2.2 Technical specifications

## 2.2.1 General specifications

Refer to the table for the standard technical specifications of the bushing. For conditions exceeding the specifications, please contact ABB.

<table>
<thead>
<tr>
<th>Application:</th>
<th>Wall bushing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classification:</td>
<td>Electrical bushing.</td>
</tr>
<tr>
<td></td>
<td>• Resin impregnated paper, capacitance graded.</td>
</tr>
<tr>
<td></td>
<td>• For outdoor-indoor / indoor-only use.</td>
</tr>
<tr>
<td></td>
<td>• Temperature class E (120 °C) according to IEC 60137.</td>
</tr>
<tr>
<td>Ambient temperature limits:</td>
<td>-40 °C to +40 °C.</td>
</tr>
<tr>
<td>Maximum altitude of site:</td>
<td>1000 m (Bushings for other altitudes can be provided on request.)</td>
</tr>
<tr>
<td>Level of rain and humidity:</td>
<td>1-2 mm rain/minute horizontally and vertically, according to IEC 60060-1, and 5 mm/minute according to IEEE.</td>
</tr>
<tr>
<td>Maximum pollution level:</td>
<td>According to the specific creepage distance, and IEC 60815.</td>
</tr>
<tr>
<td>Angle of installation:</td>
<td>From horizontal to vertical.</td>
</tr>
<tr>
<td>Test tap:</td>
<td>Test tap with 4 mm male contact pin.</td>
</tr>
<tr>
<td>Capacitance $C_2$ of test tap:</td>
<td>$&lt;5000$ pF</td>
</tr>
<tr>
<td>Arcing horns:</td>
<td>Optional</td>
</tr>
<tr>
<td>Conductor:</td>
<td>Solid conductor made of copper, or low-alloy aluminium.</td>
</tr>
<tr>
<td>Markings:</td>
<td>Conforming to IEC/IEEE.</td>
</tr>
</tbody>
</table>
2.2.2 Mechanical loading

Maximum permitted static load on the inner and outer terminals

- The load must be applied at the midpoint (2) of the terminals.
- The total cantilever load must be perpendicular to the bushing axis.
- The bushing can be installed in all positions from horizontal to vertical.

<table>
<thead>
<tr>
<th>Type</th>
<th>Outdoor type test load for 1 minute (N)</th>
<th>Maximum service load (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSA-AA 52/4000</td>
<td>4000</td>
<td>2000</td>
</tr>
<tr>
<td>GSA-AA 73/4000</td>
<td>4000</td>
<td>2000</td>
</tr>
<tr>
<td>GSA-AA 123/2000</td>
<td>5000</td>
<td>2500</td>
</tr>
<tr>
<td>GSA-AA 123/4000</td>
<td>5000</td>
<td>2500</td>
</tr>
</tbody>
</table>
3 Delivery

3.1 Receiving inspection

- Make sure that all items are delivered, refer to the packing list.
- Carefully inspect the bushings for shipping damage.

3.2 Transportation

- The bushing must be transported in the transport box.
- Make sure that the bushing is wrapped in the original (or equivalent) moisture proof wrapping.
  If the drying agent inside the wrapping has been exposed to the atmosphere, replace it.
- The bushing can be transported in both the vertical, and the horizontal positions.
- Carefully inspect the bushing for damage after transportation.

3.3 Storage

Short term storage, less than 6 months

- Make sure that the bushing is wrapped in the original (or equivalent) moisture-proof wrapping.
  If the drying agent inside the wrapping has been exposed to the atmosphere, replace it.
- The bushing can be stored outdoors, if it is in the transport box.
  Keep the transport box protected from water, when the bushing is stored outdoors.
- Keep the bushing dry, clean and protected against mechanical damage.
- The bushing can be stored in both the vertical, and the horizontal positions.

Long term storage, more than 6 months

- Make sure that the bushing is wrapped in the original (or equivalent) moisture-proof wrapping.
  If the drying agent inside the wrapping has been exposed to the atmosphere, replace it.
- The bushing can be stored outdoors, if it is in the transport box.
  Keep the transport box protected from water, when the bushing is stored outdoors.
- Keep the bushing dry, clean and protected against mechanical damage.
- The bushing can be stored in both the vertical, and the horizontal positions.
- Install a metal container on the indoor part of the bushing, put drying agent in the metal container.
3.4 Lifting

3.4.1 Lifting of the transport box

Overview

![Diagram showing lifting process]

1. Center of gravity
2. Soft lifting slings

Procedure

1. Make sure that the crane and the soft lifting slings can lift the transport box with the bushing. Refer to the weight in the packing list.

2. Attach soft lifting slings (2) to the correct locations.

3. Make sure that the angle of the soft lifting sling does not exceed 20°.

4. Carefully lift the transport box.

5. Put down the transport box on flat ground.

End of instruction
3.4.2 Lifting the bushing out of the transport box

Overview

Procedure

1. Make sure that the crane can lift the bushing. Refer to the weight on the rating plate.

2. Open the transport box.

   NOTE!
   The cover is attached with bolts.

3. Attach a soft lifting sling to the bottom end housing, as close to the flange as possible, and to the crane hook.

   CAUTION!
   Do not put the soft lifting slings on the silicone insulator, damage will occur.
4. Attach a soft lifting sling to the outer terminal and to the crane hook.

5. Carefully lift the bushing.

6. Lower the bushing onto soft bedding.

End of instruction
# 4 Installation

## 4.1 Tools

<table>
<thead>
<tr>
<th>Tool</th>
<th>Part number</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lifting tool</td>
<td>2183 789-2</td>
<td>For solid rod conductor Ø 49 mm. Max load 125 kg.</td>
</tr>
<tr>
<td></td>
<td>2183 789-1</td>
<td>For solid rod conductor Ø 86 mm. Max load 160 kg.</td>
</tr>
<tr>
<td></td>
<td>2183 789-3</td>
<td>For solid rod conductor Ø 86 mm. Max load 490 kg.</td>
</tr>
<tr>
<td>Soft bedding</td>
<td>-</td>
<td>E.g. rubber mat or wood board</td>
</tr>
<tr>
<td>Soft lifting slings</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Lifting eye M12 (DIN 580)</td>
<td>2183 2001-3</td>
<td>For installation of the bushing at an angle.</td>
</tr>
<tr>
<td>Pull-through cord with M8 swivel.</td>
<td>9760 669-A,-D</td>
<td>-</td>
</tr>
<tr>
<td>Torque wrench key for hex socket screws, 16 mm (M10) and 13 mm (M8), torque 20 to 40 Nm.</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Wrench for hex socket screws 30 mm or adjustable wrench for 30 mm bolts or larger.</td>
<td>-</td>
<td>For the test tap cover.</td>
</tr>
<tr>
<td>Tackle</td>
<td>-</td>
<td>For installation of the bushing at a specific angle.</td>
</tr>
</tbody>
</table>

## 4.2 Consumables

<table>
<thead>
<tr>
<th>Item</th>
<th>Type/name</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOBIL</td>
<td>Mobilgrease 28</td>
<td>Lubricates and protects metals against corrosion. Protects rubber. Does not react with transformer oil.</td>
</tr>
<tr>
<td>Dow Corning</td>
<td>Molykote 1000</td>
<td>For the sealing and lubrication of the contact on the outer terminal.</td>
</tr>
</tbody>
</table>
4.3 Preparations

Overview

The bushing is usually delivered with the solid rod conductor and outer terminal installed.

- Do this procedure if the solid rod conductor and outer terminal are not already installed.

Procedure

1. Attach the pull-through cord (10) to the solid rod conductor (7).

2. Put the solid rod conductor (7) into the bushing.

   **CAUTION!**
   Make sure that the solid rod conductor (7) does not fall through the bushing. Without the divided ring (6) installed, the solid rod conductor (7) will fall through the bushing.

3. Install the divided ring (6).

4. Remove the pull-through cord (10).
5. Carefully clean the contact and gasket surfaces on the outer contact (5) and the tightening ring (4).
   - Clean tin/zinc coated surfaces with soft cloth.
   - Clean un-coated aluminum with a wire brush.

   ! CAUTION!
   Do not use a wire brush on coated surfaces, the wire brush will cause damage to the coating.

6. Apply Mobilgrease 28 to the contact surfaces and the O-ring (3).

   ! NOTE!
   Or use a grease with equal properties to Mobilgrease 28.

7. Assemble the tightening ring (4), the O-ring (3), and the outer terminal (5).

8. Install the M8 bolts (1), conical spring washers (11), and the plain washers (2), but do not tighten the bolts (1).

9. Put the outer terminal (5) assembly on the solid rod conductor.

   ! CAUTION!
   Make sure that the divided ring (6) is in the correct position.
10. Apply Molykote 1000 to the threads and under the heads of the bolts M10 bolts (2).

**NOTE!**
Or use a grease with equal properties to Molykote 1000.

11. Install the M10 bolts (2), with plain washers. Tighten the bolts (2) in a crosswise sequence.

   **Torque**
   M10: 40 Nm

12. Tighten the M8 bolts (1) in a crosswise sequence.

   **Torque**
   M8: 20 Nm

**End of instruction**

### 4.4 Installation

**Procedure**

1. Attach soft lifting slings to the bushing.

   **CAUTION!**
   Do not apply force to the silicone insulator, deformation will occur.

2. Carefully lift the bushing to its position in front of the wall mount.

3. Make sure that the bushing aligns with the wall-mount.
4. Carefully insert the bushing into the wall-mount.

**CAUTION!**
Make sure that the wall is made of non-magnetic material.

**CAUTION!**
Make sure that the condenser core (1) does not come in contact with the wall mount, damage will occur.

**NOTE!**
The test tap should point downwards.

5. Install the bolts. Tighten the bolts in a crosswise sequence.

**NOTE!**
The bolts are not provided by ABB Components.

**Torque**
M12: 50 Nm
1/2" UNC: 55 Nm

6. Remove the soft lifting slings.

End of instruction
4.5 Grounding of the bushing flange

Overview

The bushing flange must be grounded to the wall. This prevents electrical discharge between the bushing flange and the wall under normal service conditions.

Procedure with a cone point set screw

1. Apply a large quantity of Mobilgrease 28 to the cone point set screw (13).
   
   **CAUTION!**
   The quality of the cone point set screw is important, stainless steel of A4-80 quality is recommended.

   **NOTE!**
   Or use a lubricant similar to Mobilgrease 28.

2. Install the cone point set screw (13).
   
   **NOTE!**
   The cone point of the set screw penetrates the paint. This makes an electrical connection between the bushing and the wall, keeping them at the same potential.

   Torque
   M12: 40 Nm

End of instruction

Procedure with a flexible cable

1. Put a flexible cable (14) between the grounding hole in the bushing flange and a grounding point in the wall.

2. Apply a large quantity of Mobilgrease 28 to the bolt (13).
   
   **CAUTION!**
   The quality of the bolt is important, stainless steel of A4-80 quality is recommended.

   **NOTE!**
   Or use a lubricant similar to Mobilgrease 28.
3. Install the bolt (13).

4. Connect the other end of the flexible cable (14) to the grounding point on the wall.

**NOTE!**
This makes an electrical connection between the bushing and the wall, keeping them at the same potential.

**End of instruction**

### 4.6 Flashover distance

The distance to external objects from the top of the bushing is very important for the safe operation of the bushing.

A clear area around the high voltage end of the bushing must be maintained, to prevent flashover or other disturbances. The radius of the area corresponds to the arcing distance of the bushing insulator.

If the wall thickness (1) is more than the value in the table, then the rating of the bushing is reduced.

**CAUTION!**
Objects in the flashover distance can cause a spontaneous electrical discharge.

<table>
<thead>
<tr>
<th>Type</th>
<th>Article number</th>
<th>L1 (mm)</th>
<th>L7 (mm)</th>
<th>Maximum wall thickness (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSA-AA 52/4000</td>
<td>LF130052-CA</td>
<td>710</td>
<td>467</td>
<td>335</td>
</tr>
<tr>
<td>GSA-AA 73/4000</td>
<td>LF130073-CD</td>
<td>910</td>
<td>647</td>
<td>230</td>
</tr>
<tr>
<td>GSA-AA 123/2000</td>
<td>LF130213-BD</td>
<td>1320</td>
<td>1067</td>
<td>230</td>
</tr>
<tr>
<td>GSA-AA 123/4000</td>
<td>LF138123-CE</td>
<td>1643</td>
<td>1083</td>
<td>650</td>
</tr>
</tbody>
</table>
5 Commissioning

5.1 Recommended tests before energization

5.1.1 Overview

The tests should be done to check the insulation, sealing and current path of the bushing.

**NOTE!**
The tests should be done after installation, but before connecting the outer terminal of the bushing to the power circuit.

5.1.2 Measurement of capacitance and dissipation factor

Overview

After installation of the bushing, it is recommended to measure the capacitance values for future reference, such as repairs, service etc. Connect a measuring bridge between the outer terminal and the test tap, or use ABB’s test adapter (1ZSC003881-AAC). This can be done without removing the bushing because the bushing has an insulated test tap. Refer to 2750 515-142, “Bushing diagnostics and conditioning”.

Nominal capacitance

The capacitance ($C_2$) depends on the environment in which the bushing is installed, and it is not possible to give a nominal value that is valid for all service conditions. Thus, it is important to measure and record the capacitance ($C_2$) for future reference, such as repairs, service etc.

<table>
<thead>
<tr>
<th>Type</th>
<th>Article number</th>
<th>$C_1$ (pF)</th>
<th>$C_2$ test tap (pF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSA-AA 52/4000</td>
<td>LF130052-CA</td>
<td>675</td>
<td>&lt;5000</td>
</tr>
<tr>
<td>GSA-AA 73/4000</td>
<td>LF130073-CD</td>
<td>756</td>
<td>&lt;5000</td>
</tr>
<tr>
<td>GSA-AA 123/2000</td>
<td>LF130123-BD</td>
<td>426</td>
<td>&lt;5000</td>
</tr>
<tr>
<td>GSA-AA 123/4000</td>
<td>LF138123-CE</td>
<td>725</td>
<td>&lt;5000</td>
</tr>
</tbody>
</table>

Procedure

1. Disconnect the external connections from the terminals of the bushing.
2. Remove the cover (2).

<table>
<thead>
<tr>
<th>Part</th>
<th>Article number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cover</td>
<td>2749 528-B</td>
</tr>
<tr>
<td>O-ring</td>
<td>1ZSC001606-AAW</td>
</tr>
</tbody>
</table>

3. Connect the measuring equipment.
   1. Connect the low voltage cable to the stud (1).
   2. Connect the high voltage cable to the outer terminal.
   3. Connect the ground cable to the bushing flange.

4. Measure the capacitance ($C_1$) between the outer terminal and the stud (1).

   **NOTE!**
   Refer to the table for the nominal capacitance ($C_1$), Nominal capacitance, page 25.

5. Measure the capacitance ($C_2$) between the stud (1) and the flange.

   **NOTE!**
   Record the capacitance ($C_2$) for future reference.

6. Install the cover (2).

   **CAUTION!**
   The test tap is not self-grounding!
   The bushing can be destroyed if the test tap is not grounded. Because the capacitance ($C_2$) is usually relatively small, the test tap must never be open-circuited when applying a current to the bushing. It must always be grounded or connected to an external impedance.

   **CAUTION!**
   Do not energize the bushing without the cover or a test adapter installed. The cover connects the outermost conductive foil to ground and will prevent damage to the bushing.

   **CAUTION!**
   Make sure that the cover is correctly installed with the O-ring in place, when the bushing is not in use. The purpose is to prevent dust and water from entering the tap.

7. Connect the terminals of the bushing to the external connections.

End of instruction
5.1.3 Measurement of through-resistance

Overview

The through-resistance is measured by applying a current to the bushing, and measuring the voltage drop between the indoor and outdoor terminals. The resistance is calculated with Ohm's law, $U = R \times I$. (U: Measured voltage drop; I: Through-current; R: Total circuit resistance).

Small faults in the current path can only be detected by making sensitive measurements across each connection point, or by measuring the temperature increase during operation with an infrared sensitive camera (thermovision).

Do the measurement of through-resistance before connecting any of the external circuits.

Procedure

1. Connect the power source to the bushing.
2. Measure the voltage drop between the indoor and outdoor terminals.
3. Calculate the resistance with Ohm's law.

End of instruction
6 Maintenance

6.1 Recommended maintenance

General

The bushings are maintenance free, no regular maintenance is necessary.

⚠️ DANGER!
No work at all may be performed on the bushing while it is energized or ungrounded.

Cleaning of the insulator surface

If the insulator shed is exposed to very high pollution, it can be necessary to clean the surface. Remove the pollution with a moist cloth. If necessary, put isopropyl alcohol on the cloth.

⚠️ DANGER!
1,1,1-Trichloroethane or Methyl-chloride are not recommended as detergents, because they are dangerous to persons and the environment.

⚠️ CAUTION!
Do not wash the insulator sheds with a high pressure water jet. This can cause damage to the insulator sheds.

Measurement of capacitance and dissipation factor

Please refer to Measurement of capacitance and dissipation factor, page 25.

Thermovision (infrared camera) check for local overheating on connectors

At the maximum rated current, the bushing outer terminal normally operates at a temperature of about +35 °C to +45 °C above the ambient temperature. Significantly higher temperatures can be a sign of bad connections, especially at lower current loading.
7 Re-packning

7.1 Re-packing of the bushing

Overview

Procedure

1. Lift the bushing. Refer to "Lifting the bushing out of the transport box, page 15.

2. Lower the bushing into the transport box.

   CAUTION!
   Do not apply force to the polymeric insulator, deformation will occur.

   CAUTION!
   Make sure that there is soft bedding in the transport box.

   CAUTION!
   Make sure that the test tap does not make contact with the transport box, or other objects.

3. Attach the bushing to the transport box in the same way as when it was delivered.

   CAUTION!
   Make sure that the bushing cannot move or rotate in the transport box.
4. Close the transport box.

**NOTE!**
Refer to *Lifting of the transport box, page 14* and *Transportation, page 13*.

End of instruction
8 Spare parts

8.1 Summary

If the bushing is damaged, we recommend that it is returned to ABB for repairs and re-testing. Some parts that are damaged or lost during transportation or installation, can be ordered from ABB.
9 Disposal and environmental information

9.1 Overview

This chapter specifies the materials used in the bushing. Obey local environmental regulations on disposal of this product, the materials used are specified for this purpose.

9.2 Disposal and recycling

ABB strives to minimize the product's impact on the environment throughout its entire life cycle. Technical and product development focuses on environmental aspects. The ecocycle approach is striven for, and consideration is taken to the materials' environmental impact and recycling alternatives. The manufacturing processes are selected to be as safe for the environment as possible.

Disposal of worn-out equipment

Worn-out equipment must be disposed of in an environmentally sound manner.

Much of the material, or energy content in the material, can be recycled if it is sorted and cleaned. The amount of material that can be recycled varies depending on the technical resources and experience in each country. Non-recyclable components should be sent to an approved environmental waste treatment plant for destruction or disposal.

The bushing has these parts and materials

- The conductor is made of copper or low-alloy aluminum.
- The terminals are made of copper, brass, or low-alloy aluminum.
  - The terminals can be plated with silver, tin, gold or nickel, with a thickness up to 20 μm.
- The bushing flange is made of cast aluminum (AlMgSi7).
- The outdoor housing is made of wrought aluminum (AlMgSi1).
- The insulator shed is made of silicone rubber.
- The condenser core is made of paper, 1 % aluminum foil (by weight), 2 g of carbon and 1 g of lead.
- The moisture proof wrapping is made of polyethylene, polyester and approximately 11 % aluminum (by weight).

Electronics

Electronics equipment should be sent to an approved recycling company, or sorted into different component materials for correct treatment.

Metals

Metals should be sorted according to type and surface coating, and sent to an approved recycling company. Following the removal of any paint or other surface coating, clean metal can usually be melted down and used in new products. Many metal components of iron, steel and aluminum are large and easy to identify, e.g. support structures. ABB strives to reduce the use of precious metals and the release of environmentally hazardous metals.

The recycling of precious metals is particularly important. Metals such as copper and silver are expensive, and are only present in small amounts in the Earth's crust. Copper is primarily used in current paths, contacts and cables. Some contacts are silver-plated. Fumes from some metals may cause environmental damage, this applies to copper, zinc and nickel, which are used sparingly as surface coatings.
Plastics

The different types of plastic should be separated and sent to an approved environmental waste treatment plant or recycling company. The energy content in thermoplastics and thermosetting plastics can often be recovered through combustion at a plant built for the purpose. Thermoplastics can usually be melted down and reused without significant loss of quality. Composites can be fractioned and used as filling materials in other materials, or be disposed of.

Oils and greases

Before disposal of the bushing, oil, grease and similar products must be removed and sent to an approved environmental waste treatment plant or recycling company. By utilizing gravimetric forces, oil waste can be separated into oil, water and a range of contaminants. In many cases, the oil can then be reused. As an alternative, the energy content in oil can be recovered through combustion at a plant designed for the purpose.

Rubber

Send rubber to an approved environmental waste treatment plant, either for disposal or reuse for different purposes.

Rubber is used in seals and gaskets.

Other materials

Sort other materials and send them to an approved environmental waste treatment plant.
10 References

10.1 Summary

- Markings: Conforming to IEC/IEEE.
- Bushing diagnostics and conditioning, 2750 515-142.
- Test adapter, Installation and maintenance guide, 1ZSC000563-ACD.
- Handling and Cleaning of Composite Insulators, SEPTPT/ PL/T/MB 2193.