### About the loss of transformers

There are two types of losses generated during operation: No load loss and Load loss.

- **No load loss** includes hysteresis loss and eddy current loss, which can be significantly reduced with amorphous transformer technology.
- **Load loss** is generally lower with amorphous transformers compared to silicon steel transformers.

### Characteristics of Amorphous Transformer

- **Advantage in Reducing No Load Loss:** Amorphous material has great advantage in reducing No load loss. By applying this material to the transformer core with Hitachi IES’s advanced technologies, it is possible to achieve high efficiency and save huge amounts of energy in many years.

### Material Characteristics Comparison

**Amorphous Transformer vs. Silicon Steel**

- **Amorphous (Non-crystalline):**
  - No load loss can be decreased to about 1/5 of silicon steel.
  - Thickness is approximately 0.03 mm, which is about 1/10 compared to silicon steel.

- **Silicon Steel (Crystalline):**
  - Load loss and no load loss occur at the same time when the transformer is operated, the loss is a useless output chiefly converted into heat.

### Key Points to Save Energy with Transformers

- **Reduction of Load Loss**
- **Reduction of No Load Loss**

### Technical Specifications

**3P 1000kVA 6kV/210V 60Hz**

- **Electrical energy**
  - Load (W)
  - No load (W)
  - CO2 Emission (rate: 0.555kg/kWh)

- **Efficiency (%)**
  - 100% Loaded Total Loss
  - 50% Loaded Total Loss

**Characteristic Table**

<table>
<thead>
<tr>
<th>Item</th>
<th>SIT</th>
<th>AMT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimension (mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X</td>
<td>1,420(100)</td>
<td>1,620(114)</td>
</tr>
<tr>
<td>Y</td>
<td>1,075(100)</td>
<td>1,125(105)</td>
</tr>
<tr>
<td>Z</td>
<td>1,510(100)</td>
<td>1,510(100)</td>
</tr>
<tr>
<td>Mass (kg)</td>
<td>2,445(100)</td>
<td>3,120(128)</td>
</tr>
</tbody>
</table>

**SiT=Silicon Steel Core Transformer**

**AMT=Amorphous Steel Core Transformer**

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**Oil-Immersed Type**

- **Phase:** 3P
- **Core Type:** Amorphous Steel
- **Voltage:** 6.6kV/210V
- **Frequency:** 50Hz, 60Hz

- **Capacity (kVA):**
  - 100, 500, 1,000

- **No Load Loss (W):**
  - 85, 200, 315

- **Load Loss (W):**
  - 1,640, 6,300, 10,600

- **Efficiency (%):**
  - 98.30, 98.71, 98.92

- **50% Load Factor (%):**
  - 70%

<table>
<thead>
<tr>
<th>Item</th>
<th>SIT</th>
<th>AMT</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 % Loaded Loss (W)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No-Load Loss</td>
<td>1,152(100)</td>
<td>350(30)</td>
</tr>
<tr>
<td>Load Loss</td>
<td>8,095(100)</td>
<td>9,750(120)</td>
</tr>
<tr>
<td>Total Loss</td>
<td>9,247(100)</td>
<td>10,100(109)</td>
</tr>
<tr>
<td>50% Loaded Total Loss (W)</td>
<td>3,176(100)</td>
<td>2,788(88)</td>
</tr>
</tbody>
</table>

---

**Silicon Steel (Crystalline) vs. Amorphous Alloy (Non-crystalline):**

- **Silicon Steel:**
  - Higher electrical resistance, almost triple of amorphous alloy.
  - Thickness: 0.23 mm (1/10 compared to amorphous alloy: 0.025 mm)

- **Amorphous Alloy:**
  - Non-crystalline, created by rapidly freezing liquids of high temperature.
  - No rule of atomic arrangement, hysteresis loss can be decreased to about 1/5 of silicon steel.

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**Check for Reduction of Losses:**

- **Load Loss:**
  - Loading: 100%, 50%
  - Efficiency (%): 99.00, 99.08

- **No Load Loss:**
  - Efficiency (%): 99.01, 99.02

**CO2 Emission (t/year):**

- **SiT:** 2,965 (88)
- **AMT:** 1,174 (114)

**AMT=Amorphous Steel Core Transformer**

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**Conclusion:**

By utilizing amorphous transformer technology, significant energy savings can be achieved compared to traditional silicon steel transformers, leading to reduced CO2 emissions and improved efficiency.