Energy efficiency at our core.
ENERGY & CARBON SAVINGS THROUGH SUPPLY TRANSFORMERS

Our Wilson e3 amorphous transformer is the industry leading ultra low loss transformer product. It avoids energy wastage through transformer losses and helps organisations reduce their operating costs and their emissions. With significant energy savings over the lifetime of a transformer, total cost of ownership considerations are almost always favourable with a Wilson e3.

BENEFITS OF CHOOSING A WILSON E3

- Guaranteed loss savings over lifetime
- Favourable total cost of ownership (TCO)
- Cost effective 2 in 1 Voltage Management solution
- Over 800 installations with proven & reliable technology
- Up to £100k lifetime savings when replacing an existing transformer
- Easy, non-invasive energy efficiency measure
- 24 month guarantee for complete peace of mind

ADD TO YOUR BOTTOM LINE WITH ONE SIMPLE INFRASTRUCTURE DECISION

Our Wilson e3 transformer range provides superior operational efficiency alongside in-built voltage management capabilities, achieving savings in both energy costs and associated CO2 emissions.

BENEFITS OF CHOOSING A WILSON E3

- Guaranteed loss savings over lifetime
- Favourable total cost of ownership (TCO)
- Cost effective 2 in 1 Voltage Management solution
- Over 800 installations with proven & reliable technology
- Up to £100k lifetime savings when replacing an existing transformer
- Easy, non-invasive energy efficiency measure
- 24 month guarantee for complete peace of mind

CUTTING TRANSFORMER LOSSES FURTHER: AMORPHOUS METAL CORE TECHNOLOGY

Core losses are continually present from the day the unit is energised; that is 24 hours a day, 365 days a year. Wilson e3 transformers combine amorphous metal cores with low current density conductor to create an ultra low loss transformer with significantly reduced losses.

The result? Providing you with guaranteed, easily quantifiable energy savings for your organisation.

FUTURE PROOF YOUR SITE:

Two types of energy losses are inherent in the running of distribution transformers:

1. LOAD LOSSES THAT VARY DEPENDING ON TRANSFORMER LOADING
2. NO-LOAD LOSSES THAT OCCUR IN THE TRANSFORMER CORE

Payback Calculation Wilson E3 - Ultra low loss amorphous
ENERGY EFFICIENCY AT OUR CORE

The Wilson e3 transformer combines amorphous core material with low current density conductors to provide a distribution transformer with the lowest combined transformer losses. As a result it not only exceeds EU Eco Design specifications due to come into force in 2021 (Tier 2) but sets ambitious new standards ahead of the curve for Tier 3.

WHAT ARE AMORPHOUS CORE TRANSFORMERS (AMT’s)?

The cores of conventional transformers consist of stacks of laminations that are made from silicon steel with an almost uniform crystalline structure (CRGO). In transformers with amorphous cores, a ribbon of steel is wound to form the core.

The big benefit of amorphous transformers is that amorphous steel has lower hysteresis losses. Simply put, this means that less energy is wasted as heat during the magnetisation and de-magnetisation of the core (see IR imagery below).

WHAT ARE AMORPHOUS METALS?

Amorphous metals are made of alloys that have no atomic order. They are made by rapid cooling of molten metals that prevents crystallisation and leaves a vitrified structure in the form of thin strips. Due to the lack of systematic structure, this type of metal has also been given the name “The Metallic Glasses”.

COMPARISON OF PROPERTIES

**Properties**

<table>
<thead>
<tr>
<th></th>
<th>Amorphous Metal</th>
<th>CRGO Steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density ((g/cm^3))</td>
<td>7.15</td>
<td>7.65</td>
</tr>
<tr>
<td>Specific resistance</td>
<td>130.00</td>
<td>45.00</td>
</tr>
<tr>
<td>Saturation flux density ((T))</td>
<td>1.56</td>
<td>2.03</td>
</tr>
<tr>
<td>Typical core loss ((Watt/kg)) at (50, Hz, 1.4, T)</td>
<td>0.205</td>
<td>0.54</td>
</tr>
<tr>
<td>Thickness ((mm))</td>
<td>0.025</td>
<td>0.23</td>
</tr>
<tr>
<td>Space factor</td>
<td>0.86</td>
<td>0.97</td>
</tr>
<tr>
<td>Britteness</td>
<td>Higher</td>
<td>Lower</td>
</tr>
<tr>
<td>Available form</td>
<td>Ribbon/foil*</td>
<td>Sheet/Roll</td>
</tr>
<tr>
<td>Annealing temperature</td>
<td>360°C</td>
<td>810°C</td>
</tr>
<tr>
<td>Annealing atmosphere</td>
<td>Inert gas</td>
<td>Inert gas</td>
</tr>
<tr>
<td>Special annealing requirement</td>
<td>Magnetic field annealing</td>
<td>-</td>
</tr>
</tbody>
</table>

*Standard sizes -142.2mm, 170.2mm & 213.4mm*

Infrared (IR) images illustrate significantly lower temperature in an amorphous metal core (right) compared with a traditional silicon steel core (left).
THE UK’s LEADING ENERGY EFFICIENT TRANSFORMER

LOWEST COMBINED TRANSFORMER LOSSES:

Since its lunch, Wilson e3 has been continually developed to achieve the highest energy efficiency levels possible. As a distribution transformer product, Wilson e3 exceeds Tier 2 Eco Design specification and sets the bar for ambitious new standards to come, Tier 3.

A HISTORICAL GUIDE TO LOSSES

When calculating the gains associated with upgrading supply transformers to modern ultra low loss equivalents, the age and construction of the existing unit will make a significant difference.

As a rule of thumb, the older your transformer, the worse its performance is likely to be.

How much energy (and money!) is your old transformer wasting away through losses? Find out from our rough guide on typical loss values for transformers manufactured in the last 65 years (based on a typical 1000kVA transformer).

Transformer loss comparison. All values are given in Watts [W] and refer to full load. Figures correct at date of the third publication, June 2019.

Transformers are categorized for this comparison as follows:

- **1950s Transformer (Hot rolled steel - typically pre 1965)**
- **1970s Transformer (Early C50 - 1965 to 1985 approx)**
- **1990s Transformer (Modern standard C50 - from approx 1985 onwards)**
- **2015 Transformer (Tier 1 EU Eco Design compliant)**

**KVA**

- 315
- 500
- 800
- 1000
- 1250
- 1500
- 1600
- 2000
- 2500

**Core Losses**

- 1950s Transformer: 2870
- 1970s Transformer: 1770
- 1990s Transformer: 1350
- 2015 Transformer: 770

**Load Losses**

- 1950s Transformer: 14000
- 1970s Transformer: 13000
- 1990s Transformer: 12500
- 2015 Transformer: 10500

**KWh Savings Wilson e3/PA**

- 1950s Transformer: £5,712
- 1970s Transformer: £4,180
- 1990s Transformer: £3,539
- 2015 Transformer: £2,036

*Based on electricity costs of £0.11/kWh

**All values based on 1MVA rating and 70% load.

Please note that the dates detailed above are approximate and an overlap of manufacturing techniques may be evident in transformers commissioned around these milestone periods.
VOLTAGE MANAGEMENT THROUGH MV SUPPLY

Many sites in the UK are supplied by a higher than optimal voltage that is responsible for significant energy losses in voltage dependent equipment.

Voltage Management is an energy saving technique that reduces these unnecessary losses by improving voltage to site. The Wilson e3 transformer comes with in-built voltage management capabilities that allow for easy adjustment to LV site voltage without the need of costly additional equipment.

TWO AREAS OF ENERGY SAVINGS

1. GUARANTEED SAVINGS THROUGH REDUCED TRANSFORMER LOSSES

Based on a 30-year transformer lifespan, a 1000kVA Wilson e3 transformer will typically save £75,000 over its lifetime when compared with a modern, Eco design Tier 1 compliant transformer.

2. SUBSTANTIAL POTENTIAL SAVINGS THROUGH VOLTAGE MANAGEMENT

The Wilson e3 is designed to deliver a reduced secondary voltage (415 instead of 433V). In addition the units feature an extended tapping range (+7.5%) designed to reduce site voltage at source without the need for costly dedicated voltage management equipment. This reduces plant footprint, avoids additional system losses and eliminates the need for additional plant maintenance.

GUIDEラインウール FOR NO LOAD VOLTAGE

<table>
<thead>
<tr>
<th>HV VOLTAGE</th>
<th>TAP SETTING</th>
<th>LV VOLTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>11,000V</td>
<td>7.5% (1)</td>
<td>384V</td>
</tr>
<tr>
<td>11,000V</td>
<td>5% (2)</td>
<td>394V</td>
</tr>
<tr>
<td>11,000V</td>
<td>2.5% (3)</td>
<td>405V</td>
</tr>
<tr>
<td>11,000V</td>
<td>0 (4)</td>
<td>415V</td>
</tr>
<tr>
<td>11,000V</td>
<td>-2.5% (5)</td>
<td>425V</td>
</tr>
<tr>
<td>11,000V</td>
<td>-5% (6)</td>
<td>436V</td>
</tr>
</tbody>
</table>

NHS CASE STUDY - VOLTAGE DATA

The following graph details the recorded RMS voltage for the supply.

"An extremely cost effective infrastructure upgrade that not only provides guaranteed energy savings through reduced transformer losses but delivers substantial additional savings through in-built voltage management capabilities."

NHS ESTATES MANAGER

GET SUBSTANTIAL ADDITIONAL SAVINGS FROM VOLTAGE MANAGEMENT AT NO ADDITIONAL COST
**DIMENSIONS & TYPICAL ASSEMBLY**

Representative assembly shown for 2000kVA Wilson e3 transformer.

<table>
<thead>
<tr>
<th>RATING KVA</th>
<th>TANK TYPE</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
<th>K</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>315</td>
<td>1</td>
<td>1377</td>
<td>1685</td>
<td>1750</td>
<td>1320</td>
<td>1405</td>
<td>720</td>
<td>745</td>
<td>1049</td>
<td>1320</td>
<td>400</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>500</td>
<td>2</td>
<td>1387</td>
<td>1998</td>
<td>1750</td>
<td>1320</td>
<td>1555</td>
<td>720</td>
<td>755</td>
<td>1049</td>
<td>1320</td>
<td>400</td>
<td>71</td>
<td>-</td>
</tr>
<tr>
<td>800</td>
<td>2</td>
<td>1585</td>
<td>2080</td>
<td>1750</td>
<td>1320</td>
<td>1800</td>
<td>720</td>
<td>840</td>
<td>1049</td>
<td>1320</td>
<td>400</td>
<td>111</td>
<td>-</td>
</tr>
<tr>
<td>1000</td>
<td>2</td>
<td>1585</td>
<td>2080</td>
<td>1750</td>
<td>1320</td>
<td>1800</td>
<td>720</td>
<td>840</td>
<td>1049</td>
<td>1320</td>
<td>400</td>
<td>151</td>
<td>-</td>
</tr>
<tr>
<td>1250</td>
<td>2</td>
<td>1730</td>
<td>2240</td>
<td>1750</td>
<td>1320</td>
<td>1960</td>
<td>720</td>
<td>870</td>
<td>1049</td>
<td>1320</td>
<td>400</td>
<td>231</td>
<td>-</td>
</tr>
<tr>
<td>1500</td>
<td>2</td>
<td>1730</td>
<td>2240</td>
<td>1750</td>
<td>1320</td>
<td>1960</td>
<td>720</td>
<td>870</td>
<td>1049</td>
<td>1320</td>
<td>400</td>
<td>271</td>
<td>-</td>
</tr>
<tr>
<td>1600</td>
<td>2</td>
<td>1730</td>
<td>2240</td>
<td>1750</td>
<td>1320</td>
<td>1960</td>
<td>720</td>
<td>870</td>
<td>1049</td>
<td>1320</td>
<td>400</td>
<td>271</td>
<td>-</td>
</tr>
<tr>
<td>2000</td>
<td>3</td>
<td>1985</td>
<td>2242</td>
<td>1750</td>
<td>1320</td>
<td>1960</td>
<td>720</td>
<td>1010</td>
<td>1049</td>
<td>1320</td>
<td>400</td>
<td>271</td>
<td>191</td>
</tr>
<tr>
<td>2500</td>
<td>4</td>
<td>2130</td>
<td>2437</td>
<td>2712</td>
<td>1500</td>
<td>2155</td>
<td>900</td>
<td>1115</td>
<td>1229</td>
<td>1500</td>
<td>500</td>
<td>311</td>
<td>311</td>
</tr>
</tbody>
</table>

Dimensions shown are subject to tolerances (10%)
**E3 RANGE, ELECTRICAL CHARACTERISTICS & TYPICAL APPLICATIONS**

**WILSON E3 DISTRIBUTION TRANSFORMER RANGE:**

- Single and three phase transformers
- 100kVA – 3000kVA
- Oil filled ONAN or synthetic ester filled KNAN with insulation class up to 36kV
- Primary voltages typically 3.3kV, 6.6kV, 11kV, 11/6.6kV dual, 33kV
- Secondary voltages typically 280V, 315V, 400V, 415V, 433V, 480V, 690V
- Off-load tap changers (on load tap changer available for Wilson e3+)
- Extended tapping range: -5% to +7.5%
- Corrugated or bolt on panel radiator tanks
- Cable box type or open bushings
- BS / IEC standards or custom specifications

**TYPICAL APPLICATIONS:**

- Step down distribution transformers
- Step up generation transformers
- Package substations
- Unit type substations
- Data centres
- Wind farm transformers
- Solar PV farm transformers
- 6 Pulse and 12 Pulse rectifier transformers
- Isolation transformers
- Voltage Management
- Battery Storage

**TYPICAL ACCESSORIES:**

- Oil temperature indicator (OTI)
- Close coupled MV switchgear
- Close coupled LV cabinets /feeder pillars
- Winding temperature indicator (WTI)
- Magnetic oil level gauge (MOG)
- Forced air cooling
- Marshalling box
- Pressure relief device (PRD)
- Bi-directional rollers
- Radiator valves
- Dehydrating breather

### ELECTRICAL CHARACTERISTICS

<table>
<thead>
<tr>
<th>RATING KVA</th>
<th>KVA/V</th>
<th>HV LI/PF</th>
<th>LV LI/PF</th>
<th>Z</th>
<th>PO NL</th>
<th>PO LL</th>
<th>THD%</th>
<th>KG</th>
</tr>
</thead>
<tbody>
<tr>
<td>315</td>
<td>4.75</td>
<td>180</td>
<td>2520</td>
<td>2700</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>500</td>
<td>4.75</td>
<td>270</td>
<td>3510</td>
<td>3300</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>800</td>
<td>4.75</td>
<td>382</td>
<td>5400</td>
<td>4350</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1000</td>
<td>11/415</td>
<td>75/28</td>
<td>-/3</td>
<td>4.75</td>
<td>450</td>
<td>6840</td>
<td>&lt;5%</td>
<td>4650</td>
</tr>
<tr>
<td>1250</td>
<td>6</td>
<td>505</td>
<td>8550</td>
<td>5250</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1500</td>
<td>5.5</td>
<td>560</td>
<td>10152</td>
<td>5900</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1600</td>
<td>5.5</td>
<td>575</td>
<td>10800</td>
<td>6100</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>6</td>
<td>750</td>
<td>13500</td>
<td>7300</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2500</td>
<td>6</td>
<td>810</td>
<td>16650</td>
<td>9810</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**EXCEEDING TIER 2 ECO DESIGN DIRECTIVE SPECIFICATIONS TODAY**
Results - £22,500 annual savings
272,949 kWh reduction annually.

I found Carl and his team on site very professional. They all got on with the job, had pride in their workmanship and attention to detail. The client was certainly impressed and is looking forward to the energy savings.

Results - £25,000 annual savings
285,000 annual kWh savings.

An extremely cost effective infrastructure upgrade that not only provides guaranteed energy savings through reduced transformer losses but delivers substantial additional savings through in-built voltage management capabilities.

NHS UNIVERSITY HOSPITAL OF SOUTH MANCHESTER

We’re happy to recommend the Wilson e2 transformer as part of an integrated approach to energy savings.

It was in reality a ‘no brainer’ to select the Wilson e2 for two recently completed substation upgrade projects.

I found Carl and his team on site very professional. They all got on with the job, had pride in their workmanship and attention to detail. The client was certainly impressed and is looking forward to the energy savings.

Wilson Power Solutions Limited
Westland Works, Westland Square. Leeds LS11 5SS UK
T: +44 (0)113 271 7588  E: info@wilsonpowersolutions.co.uk

WILSONPOWERSOLUTIONS.CO.UK