



BOWERS ENERGY SAVING TRANSFORMER (B.E.S.T.)



Since our beginnings in 1947, Bowers Electricals has become one of the UK's biggest suppliers of electrical products.

Bowers supply new and refurbished power and distribution transformers, HV and LV switchgear and all manner of associated products and services.

Our transformers provide solutions for all applications and working environments. They are designed to fit seamlessly between energy generation and the end user operating at up to 60MVA at 66kV.

Bowers Electricals offers a full turnkey solutions that includes the supply, overhaul, rewind and repair of customer property, as well as ongoing service, maintenance and expert management of all projects, regardless of size.



Table of Contents

Meet the B.E.S.T.	04
Amorphous vs CRGO	06
Benefits of Amorphous	07
Eco Design Regulation	08
Accessories	11
Standard Dimensions & Weight	12
Drawing & Datasheet Example	14

Meet the B.E.S.T.

With the increasing global demand for electrical power and the rising cost of electricity the need for more energy efficient and reliable grids is ever-growing. The reduction of CO2 emissions is a focus of energy-saving programmes and efficiency requirements driven by both local and global initiatives.

When it comes to distribution transformers, which are a crucial part of the electrical infrastructure and supply system, there is still a large total loss of energy which amounts to 3-5% of all electrical energy production. Transformers operate 24 hours a day, 7 days a week during which they are experiencing constant energy losses.

As a result, electricity utilities and industries are searching for technologies that will help to reduce operating costs and improve energy savings throughout their systems.

The Bowers Energy Saving Transformer (B.E.S.T.) is an alternative to conventional distribution transformers. It increases energy efficiency efforts by saving up to 55% on energy losses and reduces CO₂ production when compared to a transformer of the same rating but pre 2015 regulations. As a result, over its 25-30 year life span the total ownership cost is significantly reduced.

What is an Amorphous Core?

amorphous

adjective

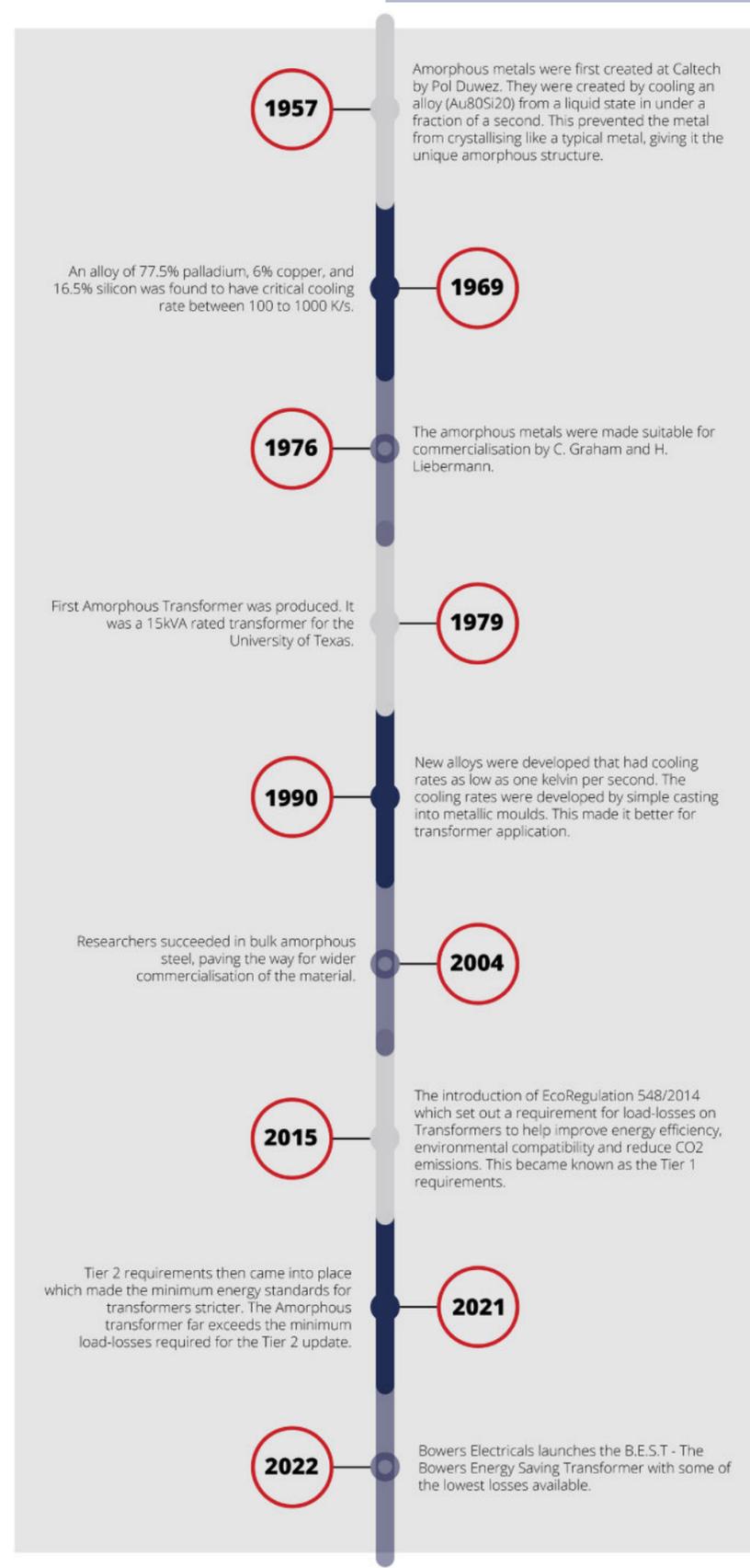
adjective: **amorphous**

without a clearly defined shape or form.
"an amorphous, characterless conurbation"

Similar: **shapeless formless unformed unshaped unstructured**

- lacking a clear structure or focus.
"an amorphous and leaderless legislature"
- **MINERALOGY • CHEMISTRY**
(of a solid) not crystalline, or not apparently crystalline.
"an amorphous polymer"

When talking about solid materials, "Amorphous" is a non-crystalline state. In electrical power transmission, this relates to core steel which is a major component of any transformer. The Amorphous materials are formed by cooling the liquid material quickly enough to prevent crystallisation, because of the fast freezing the atoms do not have time to arrange themselves into an ordered structure. The material's disordered structure makes it extremely efficient in transformer applications and more resistant to corrosion and wear.





Benefits to Amorphous Core

1. Low Eddy Current Losses.

The thickness of Amorphous Metal is 0.025mm which results in lower eddy current loss.

2. Lower No-Load losses.

Random molecular structure of amorphous metal causes less friction than CRGO when a magnetic field is applied. This allows easy magnetization and demagnetization which significantly lowers hysteresis losses, thus amorphous core significantly reduces no-load losses when compared to CRGO.

3. Environmental Benefits.

Due to the energy savings, there are significant reductions in greenhouse gas emissions of CO2.

4. Reduced Ageing of Transformer Insulation.

Lower temperature rise, slower deterioration of insulations and hence longer life.

5. Decreased Total Ownership Cost.

Although initial investment will be higher, total ownership cost over the transformers average lifespan of 25-30 years will be significantly lower than that of CRGO Transformers based on operational and maintenance costs.



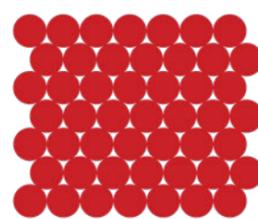
Amorphous vs CRGO Core

Traditionally distribution transformers were made with Cold Rolled Grain Oriented Steel or CRGO for short. This is widely used for manufacturing transformer cores due to its exceptionally high mechanical elasticity and magnetic properties in the rolling direction. CRGO transformers have reduced eddy current losses and increased corrosion resistance over previous grade steels.

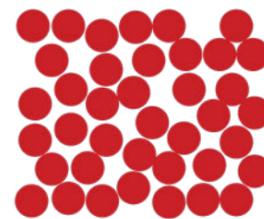
With the introduction of the UK Government's Net Zero goals and the global efforts to improve energy efficiency business are starting to turn to more environmentally friendly practises. By using Amorphous Cores instead of CRGO you can further reduce the losses from transformers.

Features	CRGO	Amorphous
Atomic Structure	Crystalline, Orderly, Repeat	Non-Crystalline, Random Arrangement
Saturation Flux Density	2.03T	1.56T
Sheet Thickness	0.23-0.3mm	0.025mm
Electrical Resistance	45ΩM	130ΩM
Available Form	Sheet, Roll	Thin Sheet, Ribbon
Lamination Factor	96%	86%
Core Losses	100%	60-75%

Right is a table of how the two materials differ and an example of the difference between crystalline and non-crystalline structure.



CRGO Crystalline Structure



Amorphous Non-Crystalline Structure



Eco Design Regulation 548/2014

**Amorphous
Core
Transformers
losses are far
better than the
current Tier 2
regulations.**

The EU Ecodesign Regulation 548/2014 limits the requirements for no-load and load losses in transformers. It is in place to improve energy efficiency, environmental compatibility and reduce CO2 emissions.

The European Commission estimates that 2.9% of all energy generated across the 27 EU countries (EU27) and the UK is wasted through transformer losses. In a survey led by the EU, they found that the EU27 transformer industry produces losses up to 93.4TWh annually. The strict new design regulation aims to reduce energy losses of distribution transformers to save on average 16TWh annually, and stops 3.7 million tonnes of CO2 from being emitted into the atmosphere.

Tier 1 Regulation Losses were introduced in 2015, but they were developed further in 2021 with the introduction of Tier 2 Regulations. The Bowers Energy Saving Transformer far succeeds the energy saving performance of the current Tier 2 regulations.

Bowers Transformer Loss comparison chart.

KVA	PRE 2015 STANDARD LOSS CRGO TRANSFORMER		BOWERS 2015 STANDARD CRGO TRANSFORMER - TIER 1		BOWERS 2021 STANDARD CRGO TRANSFORMER - TIER 2		BOWERS ENERGY SAVING TRANSFORMER (B.E.S.T.)	
	No Load Losses (NLL)	Load Losses (LL)	No Load Losses (NLL)	Load Losses (LL)	No Load Losses (NLL)	Load Losses (LL)	No Load Losses (NLL)	Load Losses (LL)
500	900 w	7400 w	510 w	5500 w	459 w	3900 w	240 w	3120 w
800	1150 w	11000 w	650 w	8400 w	585 w	6000 w	360 w	4880 w
1000	1350 w	12500 w	770 w	10500 w	693 w	7600 w	390 w	6190 w
1500	1700 w	21000 w	1129 w	13143 w	1015 w	11286 w	450 w	9960 w
2000	2300 w	24000 w	1450 w	18000 w	1305 w	15000 w	660 w	12930 w

All values are in Watts (W) and the Load Losses (LL) refer to operation at full load.

The Bowers Energy Saving Transformer (B.E.S.T.) offer significant reductions on no-load losses against pre 2015 CRGO units and are fully compliant with all current UK and EU directives, and supersedes the 2021 Tier 2 EU directive 548/2014.

Transformer Loss Chart

TYPE OF TRANSFORMER	CORE LOSSES APPROX	LOAD LOSSES APPROX	kWh SAVINGS vs B.E.S.T.	£ SAVINGS WHEN INVESTING IN B.E.S.T
PRE 2015 STANDARD CRGO	1700 w	21000 w	12,290 kWh	£25,838
OLD BOWERS 2015 STANDARD CRGO - TIER 1	1129 w	13143 w	3,862 kWh	£8,119
BOWERS 2021 STANDARD CRGO - TIER 2	1015 w	11286 w	1,891 kWh	£3,976
BOWERS ENERGY SAVING TRANSFORMER	450 w	9960 w	—	—

Based on electricity costs of £0.24 / kWh (average unit rate for electricity in the UK as of 2022) and 1500 kVA rating at full load.

The Amorphous Core transformers significantly reduce both carbon emissions and energy waste, over the course of a units typical 25 year life-span.

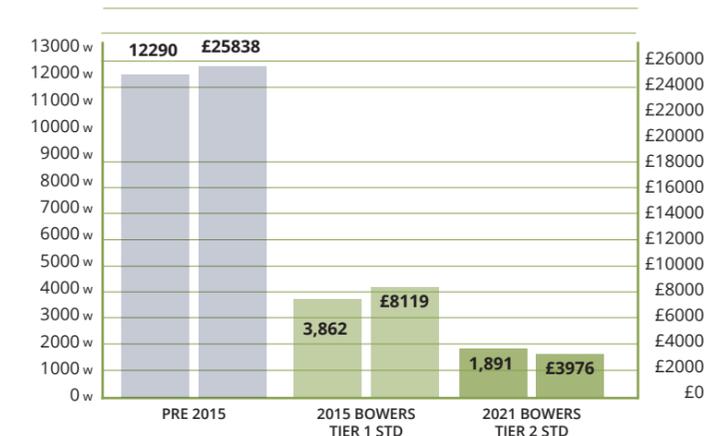
Savings can total up to £25,838 per annum, when comparing the running costs of the new B.E.S.T. to a pre 2015 standard CRGO Transformer.

Bowers 1500kVA Transformer Total Losses and Money savings*.

*When comparing them to the Bowers Energy Saving Transformer.

Upgrading older existing supply equipment to a Bowers Energy Saving Transformer will provide significant reductions in combined losses and save you money in running costs per annum.

When comparing information, the age, condition and construction should always be taken into account. Generally speaking, the older the date of manufacture the greater the potential savings you can expect, when comparing to the latest energy efficient transformers. Real energy and cost savings can be achieved by upgrading older less efficient transformers.



Based on electricity costs of £0.24 / kWh (average unit rate for electricity in the UK as of 2022) and 1500 kVA rating at full load.





Standard Dimensions & Weight

Rating (kVA)	Length (mm)	Width (mm)	Height (mm)	Weight (kg)
500	1920	1485	1660	3145
800	2235	1710	1660	3705
1000	2235	1689	1710	4200
1500	2220	1905.08	1705	5070
2000	2280.19	2085	1730	5450

All terminal heights are 1320mm.

Standard Accessories & Accessories upon request

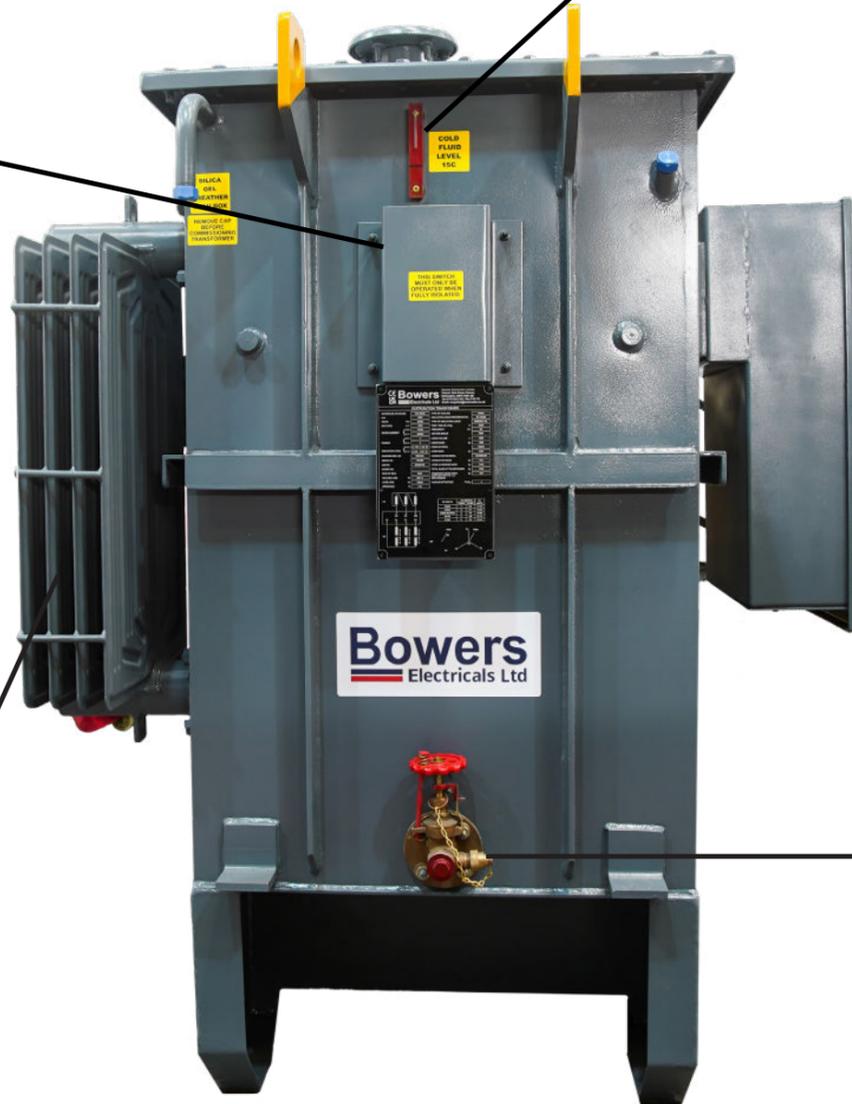
Oil Level Gauge.

The oil level gauge gives you clear visibility of the oil level inside the transformer tank.



Tap Changer.

The purpose of the off circuit tapchanger is to compensate for the different input voltages of a transformer by altering the number of turns in the input HV winding and thereby changing the turns ratio of the transformer.



Radiator.

The radiator on transformers accelerates the cooling rate of the transformer. It plays a vital role in increasing the loading capacity of an electrical transformer.

The Amorphous Transformers come as standard with the following fittings:

- Oil Filler Top Plate
- Oil level indicator
- Main lifters
- Breather pipe with Silica gel breather - supplied loose.
- Thermometer pocket
- Rating and Diagram plate with CE and UKCA Marks
- Oil drain / sampling valve
- Stainless steel earth lugs
- Jacking Points
- Skid Under Base

Accessories upon Request:

Like our standard distribution transformers all our B.E.S.T can be requested with extra fittings, such as:

- Oil Temperature Indicator (OTI)
- Winding Temperature Indicators (WTI)
- Marshalling Kiosk
- Conservator Tank
- Ring Main Units (RMUs)
- Buchholz Relay
- Bunds
- LV Cabinets

Rating Plate.

All the information regarding the transformer is recorded on the rating plate, including specification of the asset and all job details.



Oil Drain Sampling Valve.

The valve is used to release oil from the transformer tank, allowing the draining of oil as well as adding new oil. It also features a sampler valve which allows the testing of the internal oil.



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DISTRIBUTION TRANSFORMER

REFERENCE STANDARD	IEC 60076	TYPE OF COOLING	ONAN
KVA	1500	INSULATING LIQUID REFERENCE NO.	IEC 60296
VOLTS (NO LOAD)	H.V. 11000 L.V. 415	TYPE OF INSULATING LIQUID	MINERAL OIL
RATED CURRENT	H.V. 78.73	TEMP. RISE OIL/Wdg.	K 60/65
	L.V. 2086.80	FREQUENCY	Hz 50
PHASES	H.V. 3	VECTOR GROUP	Dyn11
	L.V. 3	LIQUID VOLUME	L 1230
INSULATION LEVEL	H.V. LL: 75 AC: 28	LIQUID MASS	kg 1045
	L.V. LI: - AC: 3	CORE MATERIAL	AMORPHOUS
DIAGRAM DWG. NO.	-	CORE MASS	kg 1785
SERIAL NO.	-	CONDUCTOR MATERIAL	ALUMINIUM
JOB NO.	-	CONDUCTOR MASS	kg 950
OWNER NO.	-	CORE & WINDINGS MASS	kg 3045
YEAR OF MFG.	2022	TOTAL MASS OF TRANSFORMER	kg 5070
NO LOAD LOSS	W -	TRANSPORT MASS WHEN SUPPLIED WITH HV/LV SWITCHGEAR	kg -
LOAD LOSS	W -	VACUUM WITHSTAND	P.S.I.g 4
IMPEDANCE	% -	LOSS CLASS	AK, Ac-10%

LV

HV VOLTS	HV SWITCH POSN	HV CONN	HV AMPS
11825	1	6-5	73.24
11550	2	5-7	74.98
11275	3	7-4	76.81
11000 (RATED)	4	4-8	78.73
10725	5	8-3	80.75
10450	6	3-9	82.87

HV

Bowers



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