

# Technical & production gains using Miles Platts engineering plastic coil bobbins for transformers up to 15kVA.

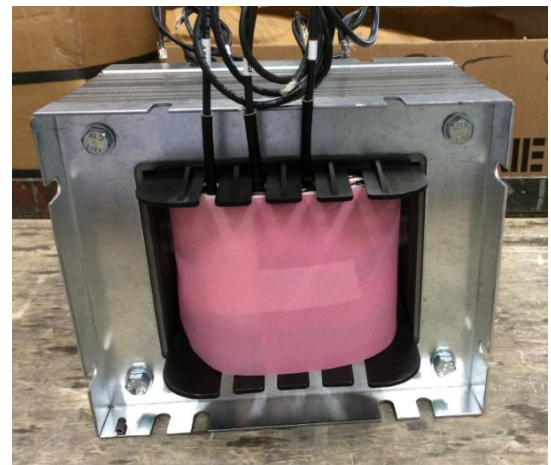


Brian Hatley- Technical Sales Manager, Miles Platts

Designers of larger transformers now have a choice when it comes to winding their laminated transformers, they can choose to use paper core tubes or plastic coil bobbins.

Historically, manufacturers winding smaller cores (EI150 and below) used plastic coil bobbins, as they are mass produced in various stacks, easily available, and meet most, if not all insulation & electrical insulation system requirements. Larger transformer manufacturers (EI150 and larger) typically have used core tubes, as plastic bobbin availability has become more custom due various stack heights, tooling of larger bobbins becomes cost prohibitive and larger transformers have a tendency to need higher temperature ratings.

Miles Platts, a manufacturer of plastic coil bobbins since 1971, has developed a range of standard, plastic bobbins to cover the “in between” lamination range (EI150 to EI300) that help address the needs of the larger transformer industry.



The finished article- 15kVA bobbin wound assembled transformer using a 3” x 6” bobbin with UL94V0 flammability, Class N 200°C

Lamination Centre Limb Size	USA/ UK reference	Stack Heights
1 ½ “	EI 150/ 120	1” to 3”
1 ¾”	EI 175/ 248	1 ¾” to 3”
2 1/8”	EI 212/ 638	2 ¼” to 4”
2 ½ “	EI 250/ 750	2 ¾” to 5 1/8”
3”	EI 300/ 9A	2” to 6”

Table 1- Miles Platts bobbin availability for USA/ UK inch size lamination sizes

Combining their knowledge of plastic injection molding, high performance engineering polymers, coil winding techniques and electrical transformer design requirements Miles Platts was able to tool multiple bobbin sizes to allow standard stack heights (See Table 1), higher temperature materials, and the ability to customize as needed. These enhancements keep costs and labor times below what a core tube design would cost. This paper is designed to address the advantages of using plastic coil bobbins vs. core tubes in applications between EI150 and EI300 including:

- Isolation paths- creepage & clearance
- Solid insulation providing high voltage breakdown resistance
- Mechanical strength and robustness
- Low cost modifications
- Reduced winding set up times
- Reduced winding times
- Reduced stacking times
- Reduced losses to breakdown & scrap

# Technical & production gains using Miles Platts engineering plastic coil bobbins for transformers up to 15kVA.



Brian Hatley- Technical Sales Manager, Miles Platts

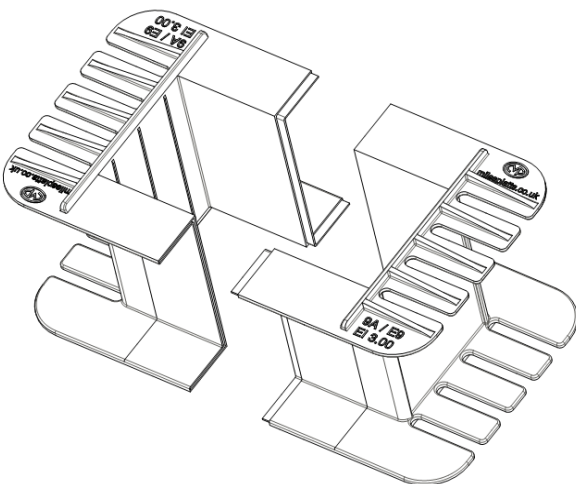
## Engineering polymers- designed for the job!

Engineering polymers are often defined as 'metal replacement' materials due to their high strength performance giving rigidity and stiffness, however they also inherently possess the important characteristic for transformer designers of electrical insulation.

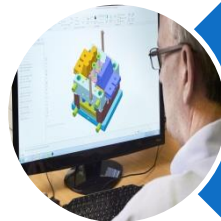
Working with leading polymer suppliers such as Du Pont, Miles Platts have an excellent selection of materials that provide UL94V0 flammability rating and have established UL1446 electrical insulation systems up to Class R, 240°C.

In addition to choosing polymers that meet specific electrical safety criteria such as CTI grouping or glow wire ignition temperatures, different polymers can be chosen to suit working temperatures or other application requirements such as toughness or ductility.

Recent developments in engineering polymer also include environmental considerations such as phosphor free, non- halogenated flame retardant systems.



Two piece, 3" bobbin with tongue and groove construction for creepage & clearance paths, lamination lead-in edges and robust wire slots



Designed for designers!

Miles Platts have been designing & manufacturing coil bobbins for over 40 years and combine their engineering expertise in plastic with a sound understanding of coil-winding and electrical isolation to add unique features to help transformer designers.

## Isolation paths

A distinct advantage that plastic coil bobbins has over core tubes is the removal of the need to include margins. With a plastic coil bobbin, the winding can extend out to the edge of the winding window, without the need for tape or margins with no fear of winding to core shorts. This allows more copper (turns or area) than a standard tube will allow, giving either lower flux or lower temperatures (or both).

## Mechanical strength & robustness

The polymer wall thickness has been designed to provide mechanical strength for the thicker gauge wires (including rectangular) but at the same time not consume too much space for winding. A common misconception is that a thicker wall section will provide greater strength, however, with thermoplastic molding, careful design techniques provide strength & rigidity using less material (similar to modern construction techniques of buildings or bridges).

Miles Platts bobbins are designed to endure the physical persuasion of mallets (mallets are used to overcome the nature of the wire to take a more oval than rectangular shape). Use of a well designed mandrel with external flange support will also assist to keep the bobbin from damage.

# Technical & production gains using Miles Platts engineering plastic coil bobbins for transformers up to 15kVA.



Brian Hatley- Technical Sales Manager, Miles Platts

## Affordable tooling modifications

Miles Platts mold tools are developed in a process to allow ease of modification. Examples of typical modifications include:

- Perfect Layer Winding grooves on bobbins allow a >95% fill factor giving the maximum amount of winding space available. Perfect wound coils have fewer hot spots and failures in the field
- Modification of flange layout to allow bus bars, odd size wires or drive slots
- Chamfers to ease the insertion of the laminations and sacrificial ribs to pack the laminations tightly and reduce vibration

## Designed for automation

Automation requires consistency. The Miles Platts bobbins offer consistent dimensions, strength & stability to easily allow automated winding and assembly processes. The repeatability of the plastic bobbin allows faster production speeds and lower overall costs.

## Reduced set-up and bobbin assembly

Paper tubes typically need to be cut to length, and then after being mounted to the mandrel, tubes need Nomex or other insulation wrapped around them. This is costly in both labor, material and require assembly.



Two spindle, simultaneous automatic winding of EI212 plastic, 3 flange bobbins

The dimensionally consistent, robust & durable nature of a plastic bobbin allows speedy placement onto the winding mandrel without fear of compromising the insulation path from winding to core.

The plastic injection molding process provides a bobbin with solid insulation from the winding to the core without any join lines that may cause electrical breakdown. There is no need for a base wrap of insulation and the magnet wire can be wound straight into the winding window.



Bobbin wound EI3.00/ 9A x 5" coil ready for insertion of lamination

## Reduced winding times

A main reason bobbins are used in small transformers is to speed up the winding process, as there is no need to stop on every layer to add margins and tape. This benefit is extended to larger units and the mechanical strength as well as the consistency of the bobbin allows for repeatability in manufacture.

# Technical & production gains using Miles Platts engineering plastic coil bobbins for transformers up to 15kVA.



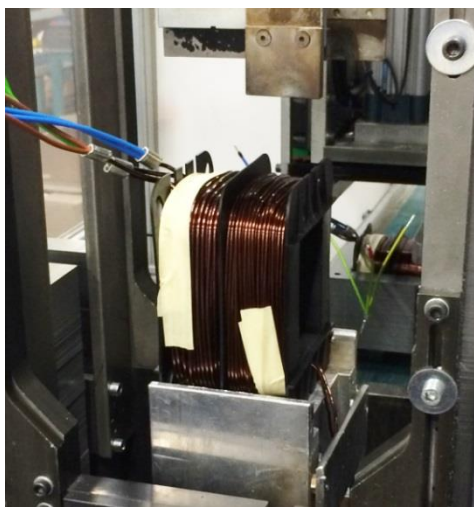
Brian Hatley- Technical Sales Manager, Miles Platts

## Reduced stacking times

The dimensional stability of the molded plastic bobbin simplifies the insertion of laminations. The accuracy and robustness of the lamination window allows high speed (automated) insertion of the laminations easier and quicker.

Where laminations are interleaved a degree of automation can still be employed to speed up the process as the accurate and consistent nature of the lamination window lends itself to high speed insertion without fear of broaching the insulation. On a paper tube constructed transformer a breakdown in the paper insulation at this late in the process is a costly failure to endure.

Miles Platts bobbins are designed with features to ease the insertion of the lamination such as chamfered lead-in edges and sacrificial ribs to ensure the laminations are packed tightly to prevent vibration and 50Hz hum.



Fully automated block laminating and welding of a bobbin wound EI212/ 638 coil.

## Reduced losses to breakdown

Plastic bobbins remove the following common transformer faults

- Winding to core (window) – caused by narrow margins and/or missing tape wraps
- Winding to core (lamination window) – caused by the lamination cutting into the paper tube during stacking

## Overall appearance

Due to the nature of the winding, larger transformers have always appeared rougher and less aesthetically pleasing than smaller transformers. While we in the industry understand how a unit looks does not always affect its performance, the addition of a Miles Platts plastic bobbin on larger units, will help increase the customer perception of overall construction, appearance and quality.

## Conclusion

Historically, due to material and availability problems, transformer designers chose to use paper tubes over plastic bobbins for large laminations. Engineers became accustomed to paper tubes despite their many flaws. Labor and material were thrown at the insulation breakdown problems, including the addition of margin, tapes, and extra insulation. Miles Platts has used over 40 years of engineering expertise along with the development of better plastics materials to remove most, if not all, of the problems core tubes create. The benefits of using a plastic bobbin include:

- Availability of multiple stack heights
- Meeting UL insulation system requirements
- Stronger construction
- Increased creepage and clearance distance
- Reduction of insulation failures
- Reduction of labor time in setup, winding, stacking and assembly
- Reduction of costly Nomex and tapes

To summarize, Miles Platts bobbins can achieve **ALL** of your engineering goals (better, faster, cheaper),

- Improved product reliability by removing failures
- Increased throughput in winding and stacking
- Lower costs by removing labor and material

## Miles Platts Ltd

[www.milesplatts.co.uk](http://www.milesplatts.co.uk)