

Review on Manufacturing Process Study of coils used in Industrial and Commercial Application

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Abstract – It's an review of understudy outhouse project report based on coils used mostly in industrial and commercial application with their manufacturing process and timing study was done ZECO Aircon Ltd. Thane past one year where Creating ideal products that perform even in the harshest of conditions while still bracing the practice of energy efficiency.

Key Words: Aircon, Coil Condensing, heat transfer rate

1. INTRODUCTION

ZECO manufactures all types of coils with 1/2" and 3/8" tube for commercial and industrial applications. These include water, steam, evaporator, condenser & custom coils. Which has applications in commercial / Industrial Air-conditioning, Window / Split Air conditioners, Refrigeration Systems, Bus / Car / Railway /Ship Air-conditioning, Specialized steam / Hot water coils.

1.1 Air cored coil

We'll use the term 'air core coil' to describe an inductor that does not depend upon a ferromagnetic material to achieve its specified inductance. This covers the cases where there really is just air inside as well as windings upon a different insulator such as bakelite, glass or PTFE etc. [1]

1.2 The single layer coil

A single layer coil has two advantages. Firstly, like all air core coils, it is free from 'iron losses' and the non-linearity mentioned above. Secondly, single layer coils have the additional advantage of low self-capacitance and thus high self-resonant frequency. These coils are mostly used above about 3 MHz [2]

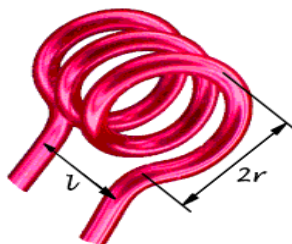


Fig. 1 : single layer coil

where L is the inductance in henrys, r is the coil radius in metres, l is the coil length in metres (>0.8r) and N is the number of turns as shown in Fig. 1 .

In the simple case of a single layer solenoidal coil the inductance may be estimated as follows

$$L = 0.001 N^2 r^2 / (228r + 254l)$$

This formula applies at 'low' frequencies. At frequencies high enough for skin effect to occur a correction of up to about - 2% is made.

To construct a self-supporting air cored coil take a length of plain 1 millimeter diameter copper wire and hold one end in a bench vice. Take the other end in a pair of pliers and pull until the wire has stretched slightly - this will straighten it. Using a 5 millimeter diameter drill bit wrap the wire around it until enough turns have been applied. Using 'long nosed' pliers bend the ends of the coil to get them into a radial position.

Small reductions in the inductance obtained can be achieved by pulling the turns apart slightly. This will also reduce self-resonance.

Other combinations of wire and coil diameter may be tried but best results are usually obtained when the length of the coil is the same as its diameter. This property also leads to a disadvantage of the air cored coil: microphony. If need good frequency stability in the presence of vibration then wind the coil on a support made from a suitable plastic or ceramic former.

1.3 The multi-layer coil

This type of winding is very common because it's simple to construct with a winding machine and a mandrel. Let's consider it in some detail. The first question is to have a fixed length of wire then what dimensions of the winding give the greatest inductance? Put another way, what is the most efficient shape?

The ratio of the winding depth to length, which is c/b, needs to be close to unity; so the winding should have a square cross section as shown in Fig. 2

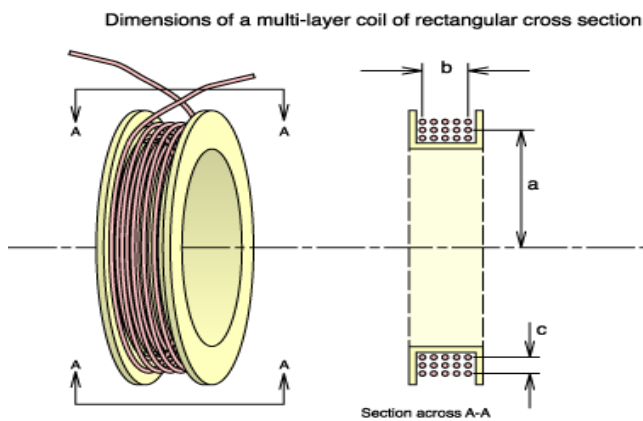


Fig. 2 : Dimensions of a multi-layer coil of rectangular cross section

This makes sense because only with the square is the average distance between turns at a minimum (a circular cross section would be even better, but that is hard to construct). Keeping the turns close together maintains a high level of magnetic coupling ('flux linkages') between them, and so the general rule that the inductance of a coil increases with the square of the number of turns is maintained.

Each uses the same length of wire but the diameter of the coil varies. The inductance of any one turn is linearly proportional to its diameter; so want a large diameter to get the most inductance. Also need all turns in the winding to be as close as possible to all the others. The coil on the left fulfills these requirements, but it has a problem because, in making the diameter large, have sufficient wire to give it many turns. Since the inductance of the winding as a whole varies as the square of the number of turns the left hand coil won't have high L.

2. Manufacturing Process

Fin press machine is to release heat. More specifically, to release the heat the refrigerant absorbed while it was flowing through the evaporator, very much the same way the radiator releases the heat from engine coolant that the coolant absorbed while it was flowing through the engine.

RI and UL certified coils (for performance and safety) are manufactured in 1/2" and 3/8" dia. Imported machine helps to manufacture all the cooling, heating, Dx, and condensing coils with great accuracy to get max heat transfer rate. The entire coils are tested for leakage before dispatch to supply trouble free product.C [1]

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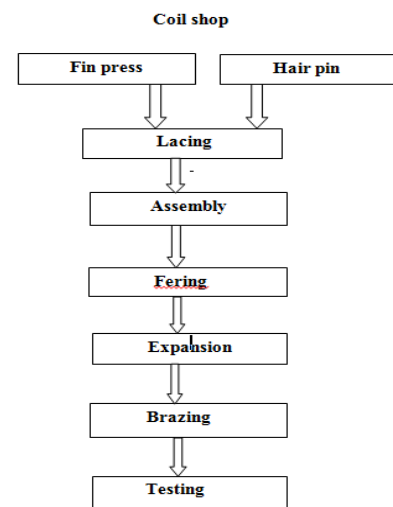


Fig. 3 : Manufacturing Process Step of coil in ZECO industry



Fig 4: Coil shop in ZECO industry

2.1 Aluminium Fin Generation Press

Fins are manufactured on imported fin press. Progressive die with vacuum chamber, computerized setting of collar height helps to make continuous and accurate fins. Wide range of fins (Sine wave, slit (Louvered), rippled edge fins) are manufactured in 1/2" and 3/8" dia.



Fig 5: Aluminum Fin Generation Press



Fig 6 : Fin press 1/2' coil

2.2 Hair-Pin Bender

Hair pin bends in 1/2" and 3/8" dia are made on imported Burr-Oak machines. Automatic sequence wise operations (Straightening, cutting and bending) are performed on this machine which increases productivity and hence suitable for mass production. Wrinkle free hair pin bend with minimum leg variation (Max 0.2mm) are manufactured on this machine



Fig 7: Hair Pin Bender

2.3 Heating Coil

ZECO manufactures all types of coils with 1/2" and 3/8" tube for commercial and industrial applications. These include Water, Steam, Evaporator, and Condenser & Custom Coils. Coil production stands at about 60,000 sq. ft. in Ø1/2" & Ø3/8" tube each per month and very few can compete with ZECO on parameters of quality, response time and value.



Following is application of heating coil Commercial / Industrial Air-conditioning, Window / Split Air conditioners, Refrigeration Systems, Bus / Car / Railway /Ship Air-conditioning, Specialized steam / Hot water coils.

3. Raw Material:

At ZECO sourcing of raw material plays a very important role. We import copper tube from across the globe to meet the international standards, plain and internally grooved. The Aluminium foil used is available in original Aluminium / blue colour with or without hydrophilic coating. The casing and end sheets are available in Galvanized Iron / Stainless steel.

4. Design:

ZECO has a strategic alliance with Uni labs s.r.l. Italy for coil selection software. All coils are selected on specially designed coil software.

5. Testing:

Quality control engineers are very picky when it comes to clearing a coil for dispatch. All coils are leak tested, and depending on their application each coil is pressurized with dry air / nitrogen. Each coil is pressurized ranging from 300 psi to 550 psi and dipped in the water tank for locating leaks.

6. Types of coil available:

Chilled water coil, Hot water coil, Brine coil, DX coil (Refrigerant based), High-efficiency heat transfer coils (specially designed), Al fins are used to increase surface area of coil for efficient heat transfer. Options are available with Cu, SS-304 etc. We do provide IGT tube (Inner groove tube) in DX coil for efficient cooling. Hydrophilic coated blue Al fins are also available for anticorrosive treatment. Drain Pan with multi sloping in AL/ SS-304 construction duly insulated with Closed cell Nitrile / PUF. We manufacture all types of coils having tube diameter 1/2", 3/8" and 5/8" tube for commercial and industrial applications.

Zeco Aircon Ltd is a manufacturer of commercial & industrial coils. We manufacture all types of coils. i.e evaporator, condenser, steam, water & custom coils for specific requirement. We enjoy a countrywide reputation for excellence in manufacturing if commercial & industrial coils for critical needs. "If it's a coil we can build it", is the motto of coil manufacturing division. Designer and technicians take pride in living up to the motto.

7. Mark of Quality:

Each coil manufactured at Zeco is subjected to pre-defined quality tests. Starting from the raw material, which is inspected for inconsistencies, to the phase-wise quality inspections during each step the coils are reviews for quality workmanship. Finally, coil is tested at 350 to 450 PSIG. [3] Each coil is shrink-wrapped and then crated depending upon

