Using the equation in the article "Repurposing TOKO Inductors"

The equation to determine the number of turns required based on the inductance you want is:

$$N = \sqrt{\frac{L \times 1000}{A_L}}$$

Where:

- N is the number of turns;
- L is the value of inductance in µH; and
- A_L is the inductance factor for this inductor.

The original winding on TOKO 17SNS1879HMS

I had determined that the inductance factor A_L for this inductor, with the cap half way in was 32. The original inductor, with the cap half way in, measured as 40 mH[1].

Using the middle value of 40 mH:

$$N = \sqrt{\frac{L \times 1000}{A_L}}$$

$$N = \sqrt{\frac{40\,000 \times 1000}{32}}$$

The L value must be in µH units, I measured 40 mH which is 40 000 µH

$$N = \sqrt{\frac{40\,000\,000}{32}}$$

$$N = \sqrt{\frac{40\,000\,000}{32}}$$

$$N = \sqrt{1\,250\,000}$$

$$N = 1118.034$$

$$N \sim 1100$$

[1] You want to do your calculations with the cap half way in as once you have rewound the coil this gives you an equal amount of inductance range in both directions.

Calculating the number of turns required

L1 and L5 need to be 16 µH.

$$N = \sqrt{\frac{L \times 1000}{A_L}}$$

$$N = \sqrt{\frac{16 \times 1000}{32}}$$

$$N = \sqrt{\frac{16\ 000}{32}}$$

$$N = \sqrt{500}$$

$$N = 22.3$$

$$N \sim 22$$

L2 and L4 need to be 11 µH.

$$N = \sqrt{\frac{L \times 1000}{A_L}}$$

$$N = \sqrt{\frac{11 \times 1000}{32}}$$

$$N = \sqrt{\frac{11\ 000}{32}}$$

$$N = \sqrt{343.75}$$

$$N = 18.54$$

$$N \sim 18$$

You could use 18 turns or 19 turns – it does not matter as you have enough adjustment to compensate for any error.

Calculating the A_L of the TOKO 17SNS1879HMS

After I had stripped off the original windings I separately wound ten turns, twenty turns and thirty turns on the former, inserted the cap half way down, measured the inductance in each case, ran the equation above and came up with an average A_L value of 32 for this inductor.

Here is what my lab notebook tells me I did.

No. Turns	Inductance (µH)	Calculated A_L value
10	5.4	54.0
20	10.7	26.8
30	14.4	16.0
	Average A_L Value	~ 32

You can see what happens when you move from a symmetrical single layer winding (10 turns) to one where some turns lay on top of the first layer, some turns got interleaved with the first layer (20 turns) and then there are three or even four layers (30 turns) with random interleaving. Practically it does not matter as you have so much adjustment available via the cap.

Calculating the A_L value

First the original equation needs to be rearranged:

$$N = \sqrt{\frac{L \times 1000}{A_L}}$$

$$N^2 = \frac{L \times 1000}{A_L}$$

$$N^2 \times A_L = L \times 1000$$

$$A_L = \frac{L \times 1000}{N^2}$$

Now we can drop in the values from row one of the table:

$$A_L = \frac{L \times 1000}{N^2}$$

$$A_L = \frac{5.4 \times 1000}{10^2}$$

$$A_L = \frac{5400}{100}$$

$$A_L = 54$$

Let's try the value from row three of the table:

$$A_L = \frac{L \times 1000}{N^2}$$

$$A_L = \frac{14.4 \times 1000}{30^2}$$

$$A_L = \frac{14400}{900}$$

$$A_L = 16$$

Calculating the average value

$$Ave.Value\ of\ A_L = \frac{A_{L1} + A_{L2} + A_{L3}}{3}$$

$$\boldsymbol{Ave.Value\ of\ A_L = \frac{54 + 26.8 + 16}{3}}$$

$$Ave.Value\ of\ A_L = \frac{96.8}{3}$$

$$Ave.Value\ of\ A_L = 32.27$$

$$Ave.Value\ of\ A_L \sim 32$$

The original winding

I had determined that the inductance factor A_L for this inductor, with the cap half way in was 32.

The original inductor, with the cap half way in, measured as 40 mH.

Using the middle value of 40 mH:

$$N = \sqrt{\frac{L \times 1000}{A_L}}$$

$$N = \sqrt{\frac{40\ 000 \times 1000}{32}}$$

The L value must be in µH units, I measured 40 mH which is 40 000 µH

$$N = \sqrt{\frac{40\,000\,000}{32}}$$

$$N = \sqrt{\frac{40\,000\,000}{32}}$$

$$N = \sqrt{1\,250\,000}$$

$$N = 1118.034$$

$$N \sim 11004$$