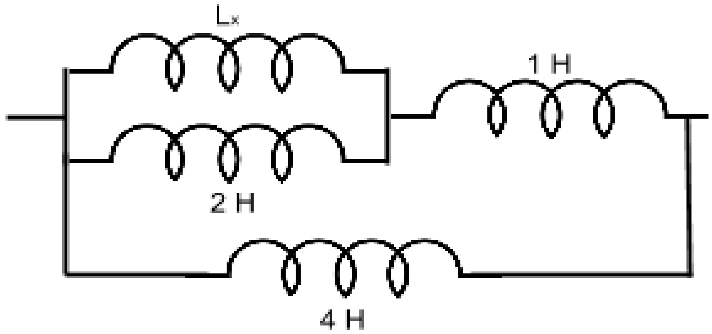
Inductor Example (determine equivalent inductance)

What should the value of the inductance L_x be to yield a total equivalent inductance of $\frac{4}{3}\ H$?



<u>Solution</u>

Set up an equation for the equivalent inductance, recalling that in series: $L_{equivalent} = \Sigma L_i$ and in parallel: $L_{equivalent} = \left[\Sigma(\frac{1}{L_i})\right]^{-1}$

Let L' be the equivalent inductance of the top 3 inductors: L_x in parallel with the 2_H and together in series with 1_H.

$L' = [\frac{1}{L_x} + \frac{1}{2}]^{-1} + 1$ Simplifying, we obtain: $L' = \frac{3L_x+2}{L_x+2}$

L' is added in parallel with the 4_H inductor as follows:

$$L_{equivalent} = \left[\frac{1}{4} + \frac{1}{L'}\right]^{-1}$$

Plugging in the expression for L' we obtain: $L_{equivalent} = \frac{4(3L_x+2)}{7L_x+10}$

Equating this to the required equivalent inductance of $\frac{4}{3}\ H$ and solving yields: $L_x = 2\ H$

Answer: $\boldsymbol{L_x = 2\ H}$