For a long solenoid with a current $I$, we assume the field inside $B_{in}$, is uniform and constant and the field outside $B_{out}$ is 0.

To evaluate the magnetic field inside consider a rectangular Amperian loop (dashed line in cut-away view) of a height $AB$ and a width $AC$. Let the number of wires enclosed by the loop be $\Delta N$.

![hollow core]

Determine the magneto-motive force (mmf) $M$ along the loop $ABCD A$ and the current enclosed: $I_{encl}$.

A) $M = +B \Delta L$ and $I_{encl} = I$.
B) $M = -B \Delta L$ and $I_{encl} = I$.
C) $M = +B \Delta L$ and $I_{encl} = I \Delta N$.
D) $M = -B \Delta L$ and $I_{encl} = I \Delta N$.

The total magneto-motive force is given by $M = M_{AB} + M_{BC} + M_{CD} + M_{DA}$.
Since $B \perp \Delta S$, $M_{BC} = M_{DA} = 0$.
Since the magnetic field outside is 0, $M_{CD} = 0$.
So, $M = M_{AB} = +B \Delta L$.
By inspection $I_{encl} = I \Delta N$.
Answer C.

30.04-02'Amperes'Law'Long'Solenoid 2004-10-19