34.16 A 4-stroke, 8 cylinder engine produces $200hp$ at $4800rpm$. The cylinders have a bore of $105mm$ and a stroke of $75mm$. What is the mean effective pressure?

A. $1bar$

B. $2bar$

C. $4bar$

D. $7bar$

Relate power and Mean Effective Pressure using the equation under Internal Combustion Engines. Solve for MEP.

$$hp = (MEP)\frac{Lan}{K}$$

$$MEP = \frac{hp \cdot K}{Lan}$$

Solve for n, as defined in the Reference handbook.

$$n = \frac{2N \times Number\,of\,cylinders}{Number\,of\,strokes\,per\,cycle}$$

$$n = \frac{(2)\,(4800)\,(8)}{(4)} = 19,200$$

Convert the stroke units to m and the calculate the area in m^2. Select the value for K which is suited for SI units.

$$L = 75mm\left(\frac{1m}{1000mm}\right) = 0.075m$$

$$a = \frac{\pi}{4}D^2 = \frac{\pi}{4}(0.105m)^2 = 0.00866m^2$$

$$K = 0.4566$$

Substitute and solve for MEP.

$$MEP = \frac{(200)\,(0.4566)}{(0.075)\,(0.00866)\,(19,200)} = 7.3bar$$

The reference handbook states the resulting units are kPa, however this should be corrected to bar.

For validation, consider repeating the solution using imperial units and converting to bar at the end.

$$L = 0.246ft$$

$$a = 13.42in^2$$

$$K = 33,000$$

$$MEP = \frac{(200)(33,000)}{(0.246)(13.42)(19,200)} = 104.1psi\left(\frac{1atm}{14.7psi}\right)\left(\frac{1.01325bar}{1atm}\right) = 7.2bar$$

Answer D