# Morse Test: Indicated Power of a Multi-Cylinder Engine

Indicated power of each cylinder and of a multi-cylinder engine from the brake power with all cylinders firing and with each cylinder cut out in turn (Morse test).

**Method:** Morse test: IP_i = BP − BP_i with cylinder i cut out at constant speed; IP = Σ IP_i

## Input parameters

Unit system: SI

| Parameter | Value | Unit |
|---|---|---|
| Brake power, all cylinders firing | 32.000 | kW |
| Brake power with cylinder 1 cut out (0 if not tested) | 22.500 | kW |
| Brake power with cylinder 2 cut out (0 if not tested) | 22.200 | kW |
| Brake power with cylinder 3 cut out (0 if not tested) | 22.800 | kW |
| Brake power with cylinder 4 cut out (0 if not tested) | 22.400 | kW |
| Brake power with cylinder 5 cut out (0 if not tested) | 0 | kW |
| Brake power with cylinder 6 cut out (0 if not tested) | 0 | kW |

## Calculated results

| Parameter | Value | Unit |
|---|---|---|
| Indicated power (sum over tested cylinders) | 38.100 | kW |
| Friction power IP − BP | 6.1000 | kW |
| Mechanical efficiency | 83.990 | % |
| Cylinders tested | 4.0000 | |

**Notes for this case**

- Keep the speed constant during each cut-out by reducing the brake load; friction is assumed unchanged.
- Indicated power is the sum over the cylinders tested: enter a reading for every cylinder of the engine (up to six), or IP is understated.

## Formula and method

$$IP_i = BP - BP_{-i}, \quad IP = \sum IP_i, \quad \eta_m = \frac{BP}{IP}$$

### Variables

| | | |
|---|---|---|
| $BP$ | Brake power, all cylinders firing | W |
| $BP_1$ | Brake power with cylinder 1 cut out (0 if not tested) | W |
| $BP_2$ | Brake power with cylinder 2 cut out (0 if not tested) | W |
| $BP_3$ | Brake power with cylinder 3 cut out (0 if not tested) | W |
| $BP_4$ | Brake power with cylinder 4 cut out (0 if not tested) | W |
| $BP_5$ | Brake power with cylinder 5 cut out (0 if not tested) | W |
| $BP_6$ | Brake power with cylinder 6 cut out (0 if not tested) | W |
| $IP$ | Indicated power (sum over tested cylinders) | W |
| $FP$ | Friction power IP − BP | W |
| $\eta_m$ | Mechanical efficiency | - |
| $\mathcal{Z}$ | Cylinders tested | - |

### Method and standards

Morse test.

### Assumptions and limits

- Friction unchanged with a cylinder cut out.
- Up to six cylinders. The engine's cylinder count is not an input, so the calculator cannot check that every cylinder was cut out; a missing cylinder understates IP.

### References

- Morse test: IP_i = BP − BP_i with cylinder i cut out at constant speed; IP = Σ IP_i

## Report details

| | |
|---|---|
| Report reference | FCC-ZTP1-1TZQ (the same inputs always give the same reference) |
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| Calculator | Morse Test: Indicated Power of a Multi-Cylinder Engine |
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| Release checks | 2 reference cases of this calculator, computed independently, are checked on every release |

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

### This calculator online

https://calc.firecad.com/automotive/engine/morse-test

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.