

Table 1 Specifications of the test engine

Number of cylinders	1
Bore x Stroke	98 x 110 mm
Displacement volume	830 cm ³
Compression ratio	17.6

Table 2 Composition of the natural gas

CH ₄	88.9 vol.%
C ₃ H ₈	3.67 vol.%
C ₂ H ₆ + C ₂ H ₄	6.37 vol.%
n-C ₄ H ₁₀	0.56 vol.%
i-C ₄ H ₁₀	0.46 vol.%
Unknown	0.04 vol.%

Table 3 Experimental conditions (equivalence ratio of natural gas, ϕ_{gas} , of 0.42)

Engine speed	1200 rpm
Equivalence ratio of natural gas, ϕ_{gas}	0.42
Indicated mean effective pressure	≈ 0.44 MPa
Energy ratio of natural gas	89 HV%
Energy ratio of diesel fuel	11 HV%
Injection pressure of diesel fuel	100 MPa
Injection timing of diesel fuel, θ_{pilot}	-39°CA ATDC to 1°CA ATDC
Intake air temperature	60°C
Intake O ₂	21.5 vol.%
Intake O ₃	0 to 560 ppm

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Table 4 Experimental conditions (equivalence ratios of natural gas, ϕ_{gas} , varied)

Engine speed	1200 rpm			
Equivalence ratio of natural gas, ϕ_{gas}	0.33	0.39	0.45	0.53
Indicated mean effective pressure	≈ 0.35 MPa	≈ 0.44 MPa	≈ 0.48 MPa	≈ 0.54 MPa
Energy ratio of natural gas	85 HV%	87 HV%	88 HV%	90 HV%
Energy ratio of diesel fuel	15 HV%	13 HV%	12 HV%	10 HV%
Injection pressure of diesel fuel	100 MPa			
Injection timing of diesel fuel, θ_{pilot}	-69°CA ATDC to 1°CA ATDC			
Intake air temperature	60°C			
Intake O ₂	21.5 vol.% for θ_{pilot} from -19°CA ATDC to 1°CA ATDC 20.6 vol.% for θ_{pilot} from -69°CA ATDC to -29°CA ATDC			
Intake O ₃	0 to 520 ppm for θ_{pilot} from -19°CA ATDC to 1°CA ATDC 0 to 280 ppm for θ_{pilot} from -69°CA ATDC to -29°CA ATDC			

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