Gas Turbine Referred (Corrected) Flow, Speed, Power and Fuel

Refers measured gas turbine or compressor flow, speed, power, fuel flow and exhaust temperature to ISA sea-level conditions with theta and delta.

Input parameters

Unit system: SI

Parameter	Value	Unit
Measured inlet stagnation temperature	35.000	°C
Measured inlet stagnation pressure	1.0050	bar
Measured air flow	70.000	kg/s
Measured shaft speed	3,000.0	rpm
Measured shaft power (0 for a jet engine)	20.000	MW
Measured fuel flow	1.2500	kg/s
Measured exhaust gas temperature	546.85	°C
Reference temperature (ISA 288.15 K)	15.000	°C
Reference pressure (ISA 1.01325 bar)	1.0132	bar

Calculated results

Parameter	Value	Unit
Temperature ratio T_{01}/T_ref	1.0694	
Pressure ratio p_{01}/p_ref	0.99186	
Referred air flow	72.983	kg/s
Referred speed	2,901.0	rpm
Referred power	19.499	MW
Referred fuel flow	1.2187	kg/s
Referred exhaust temperature	766.78	K

Notes for this case

- Referred values follow from the non-dimensional groups ṁ√T/p, N/√T, P/(p√T) and T/T_{01} at the same Mach numbers; they neglect changes in γ and Reynolds number. Use them to compare test points taken on different days.

Formula and method

$$\theta = \frac{T_{01}}{T_{ref}}, \quad \delta = \frac{p_{01}}{p_{ref}}, \quad \dot{m}_{ref} = \frac{\dot{m}\sqrt{\theta}}{\delta}, \quad N_{ref} = \frac{N}{\sqrt{\theta}}$$

$$P_{ref} = \frac{P}{\delta\sqrt{\theta}}, \quad \dot{m}_{f,ref} = \frac{\dot{m}_f}{\delta\sqrt{\theta}}, \quad T_{ex,ref} = \frac{T_{ex}}{\theta}$$

Variables

T_{01}	Measured inlet stagnation temperature	K
p_{01}	Measured inlet stagnation pressure	Pa
$\dot{m}$	Measured air flow	kg/s
N	Measured shaft speed	rad/s

P	Measured shaft power (0 for a jet engine)	W
$\dot{m}_f$	Measured fuel flow	kg/s
T_{ex}	Measured exhaust gas temperature	K
T_{ref}	Reference temperature (ISA 288.15 K)	K
p_{ref}	Reference pressure (ISA 1.01325 bar)	Pa
θ	Temperature ratio T_{01}/T_ref	-
δ	Pressure ratio p_{01}/p_ref	-
$\dot{m}\sqrt{\theta}/\delta$	Referred air flow	kg/s
$N/\sqrt{\theta}$	Referred speed	rad/s
$P/(\delta\sqrt{\theta})$	Referred power	W
$\dot{m}_f/(\delta\sqrt{\theta})$	Referred fuel flow	kg/s
T_{ex}/θ	Referred exhaust temperature	K

Method and standards

Referred (corrected) parameters from dimensional analysis.

Assumptions and limits

- Constant γ; Reynolds number effects neglected.

Report details

Report reference	FCC-QD6T-ZDCF (the same inputs always give the same reference)
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Calculator	Gas Turbine Referred (Corrected) Flow, Speed, Power and Fuel
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Release checks	3 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/boilers-power-plant/gas-turbines-combined-cycle/gas-turbine-referred-parameters

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.