Combustion Chamber Pressure Loss Factor (Cold and Hot Loss)

Fits the pressure loss factor PLF = K1 + K2(T02/T01 − 1) of a gas turbine combustor from a cold and a hot test and predicts the loss at another condition.

Input parameters

Unit system: SI

Parameter	Value	Unit
Chamber inlet area	0.30000	m²
Maximum cross-sectional area	0.55000	m²
Cold loss coefficient (from a cold run)	12.000	
Test: air mass flow	60.000	kg/s
Test: inlet stagnation temperature	426.85	°C
Test: outlet stagnation temperature	1,226.8	°C
Test: inlet static pressure	15.000	bar
Test: stagnation pressure loss	0.45000	bar
Operating: air mass flow	66.000	kg/s
Operating: inlet stagnation temperature	441.85	°C
Operating: outlet stagnation temperature	1,276.8	°C
Operating: inlet static pressure	16.200	bar
Air specific heat	1.0050	kJ/(kg·K)
Air ratio of specific heats	1.4000	
Air gas constant	0.28700	kJ/(kg·K)

Calculated results

Parameter	Value	Unit
Test: inlet velocity	26.773	m/s
Test: pressure loss factor	56.493	
Hot (fundamental) loss coefficient	38.932	
Test: loss as a fraction of inlet stagnation pressure	2.9947	%
Operating: inlet velocity	27.852	m/s
Operating: pressure loss factor	57.466	
Operating: stagnation pressure loss	0.52382	bar
Operating: loss as a fraction of inlet stagnation pressure	3.2273	%

Notes for this case

- The dynamic head uses the reference velocity: inlet density, air mass flow and the maximum chamber area. Typical design PLF: tubular about 35, tubo-annular 25, annular 18.

Formula and method

$$PLF = \frac{\Delta p_0}{\dot{m}^2/(2\rho_1 A_m^2)} = K_1 + K_2\left(\frac{T_{02}}{T_{01}} - 1\right)$$

Variables

A_1	Chamber inlet area	m²
A_m	Maximum cross-sectional area	m²
K_1	Cold loss coefficient (from a cold run)	-
$\dot{m}_d$	Test: air mass flow	kg/s
$T_{01,d}$	Test: inlet stagnation temperature	K
$T_{02,d}$	Test: outlet stagnation temperature	K
$p_{1,d}$	Test: inlet static pressure	Pa
$\Delta p_{0,d}$	Test: stagnation pressure loss	Pa
$\dot{m}$	Operating: air mass flow	kg/s
T_{01}	Operating: inlet stagnation temperature	K
T_{02}	Operating: outlet stagnation temperature	K
p_1	Operating: inlet static pressure	Pa
c_p	Air specific heat	J/(kg·K)
γ	Air ratio of specific heats	-
R	Air gas constant	J/(kg·K)
$C_{1,d}$	Test: inlet velocity	m/s
PLF_d	Test: pressure loss factor	-
K_2	Hot (fundamental) loss coefficient	-
$\Delta p_0/p_{01}$	Test: loss as a fraction of inlet stagnation pressure	-
C_1	Operating: inlet velocity	m/s
PLF	Operating: pressure loss factor	-
Δp_0	Operating: stagnation pressure loss	Pa

Method and standards

Combustor pressure loss correlation from cold and hot tests.

Assumptions and limits

- One chamber geometry; Reynolds number effects neglected.

Report details

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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/combustor-pressure-loss-factor

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.