Isentropic expansion factor =

@wikipedia

Synonym: Heat Capacity Ratio () = Adiabatic Index () = Isentropic expansion factor () = Isentropic exponent ()

Ratio between Isobaric heat capacity C_P and Isochoric heat capacity C_V :

(1) $$\gamma = \frac{C_P}{C_V}$$

Since (1) is the ratio it can be equivalently represented by intensive properties:

(2) $$\gamma = \frac{c_P}{c_V} = \frac{c_{Pm}}{c_{Vm}} = \frac{c_{Pv}}{c_{Vv}}$$

where

c_P	Isobaric molar heat capacity	c_{Pm}	Isobaric specific heat capacity	c_{Pv}	Isobaric volumetric heat capacity
c_V	Isochoric molar heat capacity	c_{Vm}	Isochoric specific heat capacity	c_{Vv}	Isochoric volumetric heat capacity

The Heat Capacity Ratio can be equivalently represented as ratio of Isothermal Compressibility β_T and Isentropic Compressibility β_S :

(3) $$\gamma = \frac{c_P}{c_V} = \frac{\beta_T}{\beta_S} = \kappa$$

wich is often denoted as κ and referred as Isentropic exponent.

The Heat Capacity Ratio for ideal gases is:

(4) $$\gamma = 1 + \frac{2}{f}$$

where

f	number of molecular freedom degrees

Heat capacity ratio for various fluids [1]:

Temp	Fluid		Temp	Fluid		Temp	Fluid	
181 °C	H_2	1.597	200 °C	Dry air	1.398	20 °C	NO	1.400
76 °C		1.453	400 °C		1.393	20 °C	N_2O	1.310
20 °C		1.410	1000 °C		1.365	181 °C	N_2	1.470
100 °C		1.404	15 °C		1.404			
400 °C		1.387	0 °C	CO_2	1.310	20 °C	Cl_2	1.340

1000 °C		1.358	20 °C		1.300	115 °C	CH_4	1.410
2000 °C		1.318	100 °C		1.281	74 °C		1.350
20 °C	He	1.660	400 °C		1.235	20 °C		1.320
20 °C	H_2O	1.330	1000 °C		1.195	15 °C	NH_3	1.310
100 °C		1.324	20 °C	CO	1.400	19 °C	Ne	1.640
200 °C		1.310	181 °C	O_2	1.450	19 °C	Xe	1.660
180 °C	Ar	1.760	76 °C		1.415	19 °C	Kr	1.680
20 °C		1.670	20 °C		1.400	15 °C	SO_2	1.290
0 °C	Dry air	1.403	100 °C		1.399	360 °C	Hg	1.670
20 °C		1.400	200 °C		1.397	15 °C	C_2H_6	1.220
100 °C		1.401	400 °C		1.394	16 °C	C_3H_8	1.130

In express analysis of petroleum fluids (including liquid water and vapour) the Heat Capacity Ratio can be assumed $\gamma \sim 1.3$.

See also

Physics / Thermodynamics / Thermodynamic process

[Mayer's relation]

References

White, Frank M. (October 1998). *Fluid Mechanics* (4th ed.). New York: McGraw Hill. ISBN 978-0-07-228192-7.