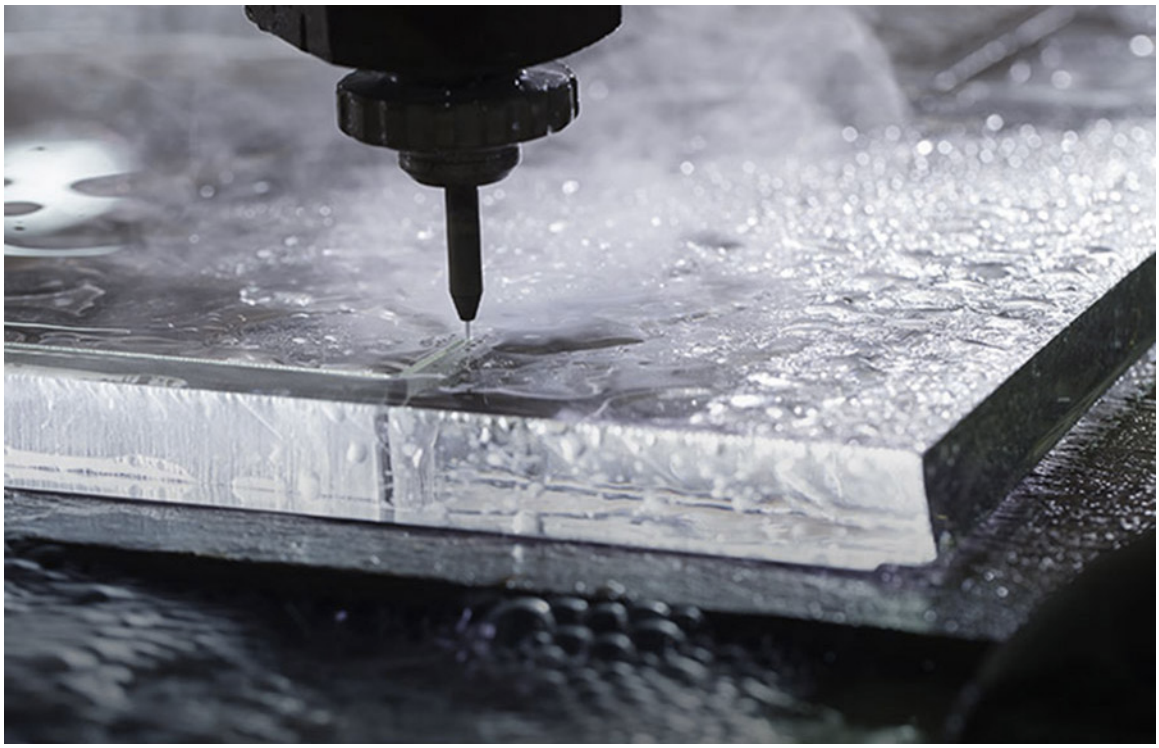


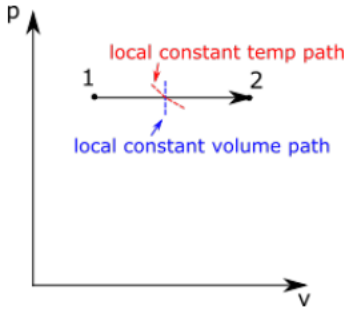
Specific Heats
Incompressible Substance Model

Specific heats, c_p or c_v, and specific heat ratio, k

$$c_v \coloneqq \left.\frac{\partial u}{\partial T}\right|_v$$

$$c_p \coloneqq \left.\frac{\partial h}{\partial T}\right|_p$$

$$k \coloneqq \frac{c_p}{c_v}$$



In general: $c_v(T, p)$ and $c_p(T, p)$

$c_p \geq c_v \Rightarrow k \geq 1$

$k_{air} = 1.4$

Incompressible Substance Model

If a substance is modeled as being incompressible, then its specific volume remains constant, i.e., v = constant, and the specific internal energy is a function solely of temperature, i.e., $u = u(T)$.

Properties of Selected Ideal Gases

Substance	Formula	MW	R [kJ/(kgK)]	c_P (300 K) [kJ/(kgK)]	c_v (300 K) [kJ/(kgK)]	T_{crit} [K]	P_{crit} [MPa]
Air	-	28.97	0.28700	1.005	0.7177	132.5	3.786
Ammonia	NH_3	17.031	0.48817	2.095	1.607	405.4	11.333
Carbon dioxide	CO_2	44.010	0.18892	0.8435	0.6546	304.1	7.377
Nitrogen	N_2	28.013	0.29680	1.038	0.7409	126.2	3.396
Oxygen	O_2	31.999	0.25983	0.9143	0.6544	154.6	5.043
Propane	C_3H_8	44.094	0.18855	1.666	1.478	369.8	4.247
R134a	CH_2F_4	102.03	0.08149	0.8367	0.7552	374.2	4.059
Water	H_2O	18.015	0.46152	1.868	1.407	647.1	22.064

Source: EES 2020

Selected Specific Heats at Constant Pressure, c_p

Substance	Temperature [K]	c_p [kJ/(kgK)]
Copper	300	0.3894
Lead	300	0.129
Water (saturated liquid)	275	4.214
	300	4.181
	325	4.182
	350	4.195
	375	4.218
	400	4.255
Air (ideal gas)	275	1.004
	300	1.005
	325	1.006
	350	1.008
	375	1.010
	400	1.013
	500	1.029
	600	1.051
	700	1.075
	800	1.099
	900	1.121
	1000	1.141

Source: EES 2020