```
"Scenario 12 - constant volume then constant pressure heat removal"

F$ = 'Steam_IAPWS'                                  "water"

"Initial state - case A - subcooled liquid"

PA[1] = 1000[kPa]                                   "initial pressure>p_outside"
TA[1] = 25[C]                                       "initial temperature inside and outside"
vol[1] = 2e-3[m3]                                   "1 liter volume"

vA[1] = volume(F$, T=TA[1], P=PA[1])                "specific volume at state 1"
hA[1] = enthalpy(F$, T=TA[1], P=PA[1])              "specific enthalpy at state 1"
uA[1] = intenergy(F$, T=TA[1], P=PA[1])             "specific internal energy at state 1"
sA[1] = entropy(F$, T=TA[1], P=PA[1])               "specific entropy at state 1"
mass_A = vol[1]/vA[1]                               "mass of H2O"

"Add heat - go to state 2A the volume is constant until p_outside"
vol[3] = 1.995e-3[m3]                               "final volume"
Q = -1[kW]                                          "rate of adding heat"

"state 2A - final state of constant volume"
P[2]=101.325[kPa]                                   "p_outside"
PA[2]=P[2]                                          "pressure at state 2=p_outside"
vA[2]=vA[1]                                         "constant volume"
uA[2] = uA[1]+Q*time12/mass_A                       "determine internal energy from 1st law"
uA[2] = intenergy(F$,v=vA[2], P=PA[2])              "internal energy at state 2"
hA[2] = enthalpy(F$, P=PA[2], v=vA[2])              "specific enthalpy at state 2"
sA[2] = entropy(F$, P=PA[2], v=vA[2])               "specific entropy at state 2"
TA[2] = temperature(F$, P=PA[2], v=vA[2])           "temperature at state 2"

"state 3A - constant pressure"
PA[3] = PA[2]                                       "constant pressure"
vA[3]=vol[3]/mass_A                                 "specific volume at state 3"
TA[3]=temperature(F$,v=vA[3], P=PA[3])              "temperature at state 3 "
hA[3] = enthalpy(F$, v=vA[3], P=PA[3])              "specific enthalpy at state 3"
uA[3] = intenergy(F$,v=vA[3], P=PA[3])              "internal energy at state 3"
//vA[3] = volume(F$,u=uA[3], P=PA[3])               "specific volume at state 3"
sA[3] = entropy(F$, u=uA[3], P=PA[3])               "specific entropy at state 3"

uA[3] = uA[2]+Q*time23/mass_A-PA[2]*(vA[3]-vA[2])   "determine internal energy from 1st law"

"initial state - case B - two phase"
PB[1] = 1000[kPa]                                   "pressure at state 1"
xB[1] = 0.1                                         "quality at state 1B"
TB[1] =temperature(F$, P=PB[1], x=xB[1])            "temperature at state 1"
vB[1] = volume(F$, T=TB[1], x=xB[1])                "specific volume at state 1"
hB[1] = enthalpy(F$, T=TB[1], x=xB[1])              "specific enthalpy at state 1"
uB[1] = intenergy(F$, T=TB[1], x=xB[1])             "specific internal energy at state 1"
sB[1] = entropy(F$, T=TB[1], x=xB[1])               "specific entropy at state 1"
mass_B = vol[1]/vB[1]                               "mass of H2O"

 "state 2B - final state of constant volume"
PB[2]=P[2]                                          "pressure at state 2=p_outside"
vB[2]=vB[1]                                         "constant volume"
uB[2] = uB[1]+Q*time_B12/mass_B                     "determine internal energy from 1st law"
uB[2] = intenergy(F$,v=vB[2], P=PB[2])              "internal energy at state 2"
hB[2] = enthalpy(F$, P=PB[2], v=vB[2])              "specific enthalpy at state 2"
sB[2] = entropy(F$, P=PB[2], v=vB[2])               "specific entropy at state 2"
TB[2] = temperature(F$, P=PB[2], v=vB[2])           "temperature at state 2"

"state 3B - end of constant pressure"
PB[3] = PB[2]                                       "constant pressure"
vB[3]=1e-3[m3]/mass_B                               "specific volume at state 3"
TB[3]=temperature(F$,u=uB[3], P=PB[3])              "temperature at state 3"
hB[3] = enthalpy(F$, u=uB[3], P=PB[3])              "specific enthalpy at state 3"
uB[3] = intenergy(F$,v=vB[3], P=PB[3])              "internal energy at state 3"
sB[3] = entropy(F$, u=uB[3], P=PB[3])               "specific entropy at state 3"
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uB[3] = uB[2]+Q*time_B23/mass_B-PB[2]*(vB[3]-vB[2])  "determine internal energy from 1st law"

"initial state - case C - superheated vapor"
PC[1] = 150[kPa]                              "pressure at state 1"
TC[1] =130[C]                                 "temperture at state 1B"
vC[1] = volume(F$, T=TC[1], P=PC[1])          "specific volume at state 1"
hC[1] = enthalpy(F$, T=TC[1],P=PC[1])         "specific enthalpy at state 1"
uC[1] = intenergy(F$, T=TC[1],P=PC[1])        "specific internal energy at state 1"
sC[1] = entropy(F$, T=TC[1], P=PC[1])         "specific entropy at state 1"
mass_C = vol[1]/vC[1]                         "mass of H2O"

 "state 2C - final state of constant volume"
PC[2]=P[2]                                    "pressure at state 2 =p_outside"
vC[2]=vC[1]                                   "constant volume"
uC[2] = uC[1]+Q*time_C12/mass_C               "determine internal energy from 1st law"
uC[2] = intenergy(F$,v=vC[2], P=PC[2])        "internal energy at state 2"
hC[2] = enthalpy(F$, P=PC[2], v=vC[2])        "specific enthalpy at state 2"
sC[2] = entropy(F$, P=PC[2], v=vC[2])         "specific entropy at state 2"
TC[2] = temperature(F$, P=PC[2], v=vC[2])     "temperature at state 2"

 "state 3C - end of constant pressure"
PC[3] = PC[2]                                 "constant pressure"
vC[3]=1e-3[m3]/mass_C                         "specific volume at state 3"
TC[3]=temperature(F$,u=uC[3], P=PC[3])        "temperature at state 3"
hC[3] = enthalpy(F$, u=uC[3], P=PC[3])        "specific enthalpy at state 3"
uC[3] = intenergy(F$,v=vC[3], P=PC[3])        "internal energy at state 3"
sC[3] = entropy(F$, u=uC[3], P=PC[3])         "specific entropy at state 3"

uC[3] = uC[2]+Q*time_C23/mass_C-PC[2]*(vC[3]-vC[2])  "determine internal energy from 1st law"
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Parametric Table: Case C12

	$time_{C12}$ [s]	vC_2 [m3/kg]	TC_2 [C]	PC_2 [kPa]
Run 1	0	*1.221*	*130*	*150*
Run 2	0.01006	*1.221*	*126*	*148.4*
Run 3	0.02012	*1.221*	*122.1*	*146.9*
Run 4	0.03018	*1.221*	*118.1*	*145.3*
Run 5	0.04024	*1.221*	*114.2*	*143.7*
Run 6	0.0503	*1.221*	*110.3*	*142.2*
Run 7	0.06036	*1.221*	*109.6*	*141.6*
Run 8	0.07042	*1.221*	*109.5*	*141.1*
Run 9	0.08048	*1.221*	*109.4*	*140.7*
Run 10	0.09054	*1.221*	*109.3*	*140.2*
Run 11	0.1006	*1.221*	*109.3*	*139.8*
Run 12	0.1107	*1.221*	*109.2*	*139.4*
Run 13	0.1207	*1.221*	*109.1*	*138.9*
Run 14	0.1308	*1.221*	*109*	*138.5*
Run 15	0.1408	*1.221*	*108.9*	*138*
Run 16	0.1509	*1.221*	*108.8*	*137.6*
Run 17	0.161	*1.221*	*108.7*	*137.1*
Run 18	0.171	*1.221*	*108.6*	*136.7*
Run 19	0.1811	*1.221*	*108.5*	*136.3*
Run 20	0.1911	*1.221*	*108.4*	*135.8*
Run 21	0.2012	*1.221*	*108.3*	*135.4*
Run 22	0.2113	*1.221*	*108.2*	*134.9*
Run 23	0.2213	*1.221*	*108.1*	*134.5*
Run 24	0.2314	*1.221*	*108*	*134.1*
Run 25	0.2414	*1.221*	*107.9*	*133.6*

Parametric Table: Case C12

	$time_{C12}$ [s]	vC_2 [m3/kg]	TC_2 [C]	PC_2 [kPa]
Run 26	0.2515	1.221	107.8	133.2
Run 27	0.2615	1.221	107.7	132.7
Run 28	0.2716	1.221	107.6	132.3
Run 29	0.2817	1.221	107.5	131.9
Run 30	0.2917	1.221	107.4	131.4
Run 31	0.3018	1.221	107.3	131
Run 32	0.3118	1.221	107.2	130.5
Run 33	0.3219	1.221	107.1	130.1
Run 34	0.332	1.221	107	129.7
Run 35	0.342	1.221	106.9	129.2
Run 36	0.3521	1.221	106.8	128.8
Run 37	0.3621	1.221	106.7	128.4
Run 38	0.3722	1.221	106.6	127.9
Run 39	0.3823	1.221	106.5	127.5
Run 40	0.3923	1.221	106.4	127
Run 41	0.4024	1.221	106.3	126.6
Run 42	0.4124	1.221	106.2	126.2
Run 43	0.4225	1.221	106.1	125.7
Run 44	0.4326	1.221	106	125.3
Run 45	0.4426	1.221	105.9	124.9
Run 46	0.4527	1.221	105.8	124.4
Run 47	0.4627	1.221	105.7	124
Run 48	0.4728	1.221	105.6	123.6
Run 49	0.4829	1.221	105.5	123.1
Run 50	0.4929	1.221	105.4	122.7
Run 51	0.503	1.221	105.3	122.3
Run 52	0.513	1.221	105.2	121.8
Run 53	0.5231	1.221	105.1	121.4
Run 54	0.5332	1.221	105	121
Run 55	0.5432	1.221	104.9	120.5
Run 56	0.5533	1.221	104.8	120.1
Run 57	0.5633	1.221	104.7	119.7
Run 58	0.5734	1.221	104.6	119.2
Run 59	0.5835	1.221	104.5	118.8
Run 60	0.5935	1.221	104.4	118.4
Run 61	0.6036	1.221	104.3	117.9
Run 62	0.6136	1.221	104.2	117.5
Run 63	0.6237	1.221	104.1	117.1
Run 64	0.6338	1.221	104	116.6
Run 65	0.6438	1.221	103.9	116.2
Run 66	0.6539	1.221	103.8	115.8
Run 67	0.6639	1.221	103.6	115.3
Run 68	0.674	1.221	103.5	114.9
Run 69	0.6841	1.221	103.4	114.5
Run 70	0.6941	1.221	103.3	114.1
Run 71	0.7042	1.221	103.2	113.6
Run 72	0.7142	1.221	103.1	113.2
Run 73	0.7243	1.221	103	112.8
Run 74	0.7344	1.221	102.9	112.3
Run 75	0.7444	1.221	102.8	111.9
Run 76	0.7545	1.221	102.7	111.5
Run 77	0.7645	1.221	102.6	111.1
Run 78	0.7746	1.221	102.5	110.6
Run 79	0.7846	1.221	102.3	110.2
Run 80	0.7947	1.221	102.2	109.8

Parametric Table: Case C12

	$time_{C12}$	vC_2	TC_2	PC_2
	[s]	[m3/kg]	[C]	[kPa]
Run 81	0.8048	1.221	102.1	109.4
Run 82	0.8148	1.221	102	108.9
Run 83	0.8249	1.221	101.9	108.5
Run 84	0.8349	1.221	101.8	108.1
Run 85	0.845	1.221	101.7	107.7
Run 86	0.8551	1.221	101.6	107.2
Run 87	0.8651	1.221	101.5	106.8
Run 88	0.8752	1.221	101.3	106.4
Run 89	0.8852	1.221	101.2	106
Run 90	0.8953	1.221	101.1	105.5
Run 91	0.9054	1.221	101	105.1
Run 92	0.9154	1.221	100.9	104.7
Run 93	0.9255	1.221	100.8	104.3
Run 94	0.9355	1.221	100.7	103.8
Run 95	0.9456	1.221	100.6	103.4
Run 96	0.9557	1.221	100.4	103
Run 97	0.9657	1.221	100.3	102.6
Run 98	0.9758	1.221	100.2	102.2
Run 99	0.9858	1.221	100.1	101.7
Run 100	0.9959	1.221	99.97	101.3