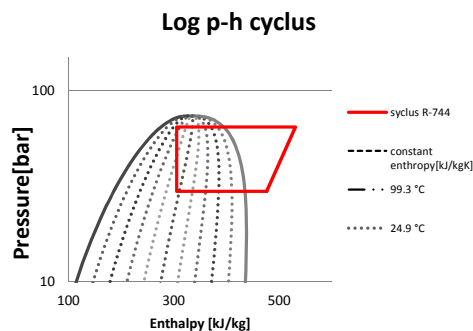


**Experiment no:** 4  
**Date:** 24.05.2012  
**Operator:** Obrist/Roman  
**Mode:** comp.test    1500 rpm  
**Measured points** 30

Components		Description
Compressor		Piston compressor
Gascooler/condenser		Air fan
Gasscooler condenser		Water to sink
Gascooler/condenser	4a/b	Heat to glycol
Internal heat exchanger		
Evaporator	6a/b	R-774/glycol
Separator		
Oil separator		



### System performance

			Total Deviation	Total uncertainty	Comment
<b>COP</b>	-	4.1	± 0.05	1.30 %	
Compressor Speed	[rpm]	1500	± 3.00	0.2 %	
Mass flow R744	[kg/h]	1708	± 3.94	0.2 %	
Mass flow water/ethyleneglycol	[kg/h]	33.3	± 0.07	0.2 %	
Ambient temperature	[°C]	20.0	± 0.08	0.4 %	
Supply power	[kW]	30.5	± 0.17	0.6 %	
Power consumption compressor	[kW]	26.1	± 0.26	1.0 %	
Danfoss VSD efficiency		85.54 %	± 0.01	0.80 %	
Volumetric efficiency		79.0 %	± 0.23 %	0.29 %	
Isentropic efficiency		73.9 %	± 0.62 %	0.84 %	
Oil circulation rate (OCR)		0.0031 %	± 0.618 %	31.57 %	Uncertainty high due to on/off valve
Heat rejection	[kW]	107.1	± 1.35	1.3 %	
Cooling capacity	[kW]	76.4	± 0.19	0.2 %	
Pressure, evaporator, inlet	[bar]	32.5	± 0.08 0.00	0.3 %	
Pressure, throttle valve,in	[bar]	64.3	± 0.35	0.5 %	
Temperature, throttle valve, in	[°C]	24.9	± 0.22	0.9 %	
Temperature, throttle valve out	[°C]	-1.3	± 0.03	2.1 %	

### Compressor

			Total Deviation	Total uncertainty	Comment
Inlet suction pressure	[bar]	29.7	± 0.08	0.3 %	
Inlet temperature	[°C]	25.1	± 0.14	0.6 %	
Inlet super heat	[K]	31.1	± 0.14	0.4 %	
Outlet pressure	[bar]	64.6	± 0.34	0.5 %	
Outlet temperature	[°C]	99.3	± 0.36	0.36 %	
Pressure ratio	[-]	2.2	± 0.013	0.6 %	
Lubricant return mass flow rate:	[kg/h]	0.1	± 0.02	31.6 %	on/off valve
Temperature, lubricant return:	[°C]	39.4	± 0.10	0.3 %	
Compressor Speed	[rpm]	1500	± 3.00	0.2 %	
Torque	[Nm]	166	± 1.66	1.0 %	
Power consumption	[kW]	26.1	± 0.26	1.0 %	
Massflow R-744	[kg/h]	1708	± 3.94	0.2 %	
Specific volume (suction line)	[m³/kg]	0.02	± 0.00	0.1 %	
Density CO2 (suction line)	[kg/m³]	63.3	± 0.07	0.1 %	
Volumetric efficiency	[%]	<u>79.0 %</u>	± 0.23 %	0.29 %	
Isentropic efficiency	[%]	<u>73.9 %</u>	± 0.62 %	0.84 %	

Aircooler						
<b>Gascooler TAG 2</b>				<b>Total Deviation</b>	<b>Total uncertainty</b>	<b>Comment</b>
Specific heat difference	<i>kJ/kg</i>	59.3	±	0.56	0.9 %	
Capacity	<i>[kW]</i>	28.1	±	0.27	1.0 %	
Temperature difference R-744	<i>°C</i>	43.4	±	0.10	0.2 %	
Mass flow air	<i>kg/h</i>	-				
Effect	<i>%</i>		±			
Pressure drop	<i>bar</i>	0.1	±	0.00	2.8 %	
Mass flow R744	<i>kg/h</i>	1708	±	3.94	0.2 %	
Inlet temperature		96.2	±			
Outlet temperature		52.87				
			±			
			±			
Watercooler						
<b>Gascooler TAG 3</b>			±			
Specific heat difference	<i>kJ/kg</i>	2.0		0.71	36.1 %	
Cooling capacity	<i>kW</i>	0.9	±		0.0 %	
Mass flow water	<i>Kg/h</i>		±			
Temperature difference R-744	<i>°C</i>	1.3		0.13	9.7 %	
Pressure drop	<i>bar</i>	0.0		0.00	4.3 %	
Mass flow R-744	<i>kg/h</i>	1708	±	3.94	0.2 %	
Temperature difference water	<i>°C</i>	1.6		0.09	5.3 %	
Gascooler 4a						
<b>R744 side</b>				<b>Total Deviation</b>	<b>Total uncertainty</b>	<b>Comment</b>
Inlet temperature	<i>°C</i>	51.6	±	0.11	0.2 %	
Outlet temperature	<i>°C</i>	25.0	±	0.21	0.9 %	
Specific heat difference	<i>kJ/kg</i>	0.15	±	0.00	1.0 %	
Temperature difference	<i>°C</i>	26.6	±	0.24	0.9 %	
Mass flow R744	<i>Kg/h</i>	1708	±	3.94	0.2 %	
Cooling capacity	<i>kW</i>	71.5	±	0.74	1.0 %	
Pressure drop	<i>bar</i>	0.07	±	0.00	4.9 %	
<b>Glycol side</b>						
Specific heat difference	<i>kJ/kg</i>	0.08	±	0.67	860.9 %	
Temperature difference	<i>°C</i>	22.2	±	0.19	0.9 %	
Mass flow glycol	<i>Kg/h</i>	2892	±	0.87	0.0 %	
Cooling capacity	<i>kW</i>	62.58	±	0.15	0.2 %	
Pressure drop	<i>Pa</i>	0.00	±	0.00	2.5 %	

Gascooler 4b					
<b>R744 side</b>					
Inlet temperature	°C	51.6	±	0.9 %	
Outlet temperature	°C	25.3	±	0.6 %	
Specific heat difference	<i>kJ/kg</i>	69.2	±	119.9 %	
Temperature difference	°C	26.3	±	0.7 %	
Mass flow R744	<i>kg/h</i>	1708	±	0.2 %	
Cooling capacity	<i>kW</i>	0.00	±	119.9 %	
Pressure drop	<i>Bar</i>	0.02	±	10.8 %	
<b>Glycol side</b>					
Specific heat difference	<i>kJ/kg</i>	37.7	±	685.5 %	
Temperature difference	°C	10.9	±	0.7 %	
Mass flow glycol	<i>Kg/h</i>	1446	±	0.1 %	
Cooling capacity	<i>kW</i>	109110	±	0.2 %	
Pressure drop	<i>bar</i>	0.01	±	12.2 %	

IHX					
<b>HP side</b>			<b>Total Deviation</b>	<b>Total uncertainty</b>	<b>Comment</b>
Specific heat difference	<i>kJ/kg</i>	30.2	±	2.01	6.6 %
Temperature difference	°C	0.1	±	0.30	400.7 %
Mass flow R744	<i>kg/h</i>	1708	±	3.94	0.2 %
Cooling capacity	<i>kW</i>	14.3	±	0.95	6.6 %
Pressure loss	<i>bar</i>	1.8	±	0.00	0.1 %
<b>LP side</b>					
Specific heat difference	<i>kJ/kg</i>	72.1	±	80.39	111.6 %
Temperature difference	°C	30.3	±	0.14	0.5 %
Mass flow R744	<i>Kg/h</i>	1708	±	3.94	0.2 %
Cooling capacity	<i>kW</i>	0.0	±	0.00	0.0 %
Pressure loss	<i>bar</i>	0.20	±	0.00	0.5 %
Superheat IHX inlet	<i>[°C]</i>	-10.3			

Evaporator 6a					
<b>R744 side</b>			<b>Total Deviation</b>	<b>Total uncertainty</b>	<b>Comment</b>
Pressure inlet	<i>bar</i>	32.5	±	0.08	0.25 %
Temperature difference	°C	-4.1	±	0.00	0.0 %
Mass flow R744	<i>kg/h</i>	1708	±	3.94	0.2 %
Heat difference R744	<i>kJ/kg</i>	161	±	0.09	0.1 %
Cooling capacity	<i>kW</i>	76.42	±	0.04	0.1 %
Pressure drop	<i>bar</i>	2.03	±	0.03	1.3 %
<b>Glycol side</b>					
Specific heat difference	<i>kJ/kg</i>	3.72	±	143	3839.9 %
Temperature difference	°C	1.11	±	0.05	4.8 %
Mass flow glycol	<i>Kg/h</i>	33	±	0.07	0.2 %
Cooling capacity	<i>kW</i>	0.03	±	6074	17629505.0 %
Pressure drop	<i>bar</i>	1.69	±	0.01	0.5 %

Evaporator 6b					
<b>R744 side</b>					
Pressure inlet	<i>bar</i>	32.5	±	0.08	0.25 %
Specific heat to R744	<i>kJ/kg</i>	10.6	±	0.16	1.5 %
Temperature difference	°C	19.1	±	0.03	0.2 %
Mass flow R744	<i>kg/h</i>	1708	±	3.9	0.2 %
Cooling capacity	<i>kW</i>	0.0	±	0.00	1.2 %
Pressure drop	<i>bar</i>	0.03	±	0.00	6.1 %
<b>Glycol side</b>					
Specific heat out	<i>kJ/kg</i>	23.2	±	193.5	834.4 %
Temperature difference	°C	6.7	±	0.07	1.0 %
Mass flow glycol	<i>Kg/h</i>	33	±	0.07	0.2 %
Cooling capacity	<i>kW</i>	0.8	±	7.64	988.6 %
Pressure drop	<i>bar</i>	0.01	±	0.00	11.7 %