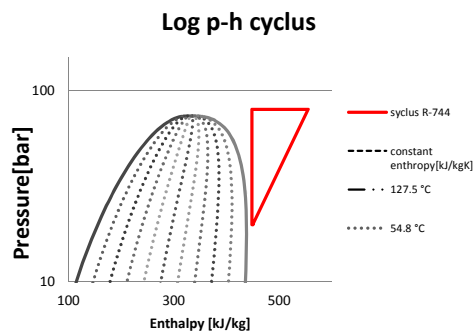


**Experiment no:** 4  
**Date:** 22.05.2012  
**Operator:** Obrist/Roman  
**Mode:** comp.test    1500 rpm  
**Measured points** 31

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>	-	1.0	± 0.01	1.05 %	
Compressor Speed	[rpm]	1500	± 3.00	0.2 %	
Mass flow R744	[kg/h]	1029	± 2.11	0.2 %	
Mass flow water/ethyleneglycol	[kg/h]	0.0	± 0.00	48.9 %	
Ambient temperature	[°C]	20.0	± 0.06	0.3 %	
Supply power	[kW]	35.6	± 0.07	0.2 %	
Power consumption compressor	[kW]	31.1	± 0.21	0.7 %	
Danfoss VSD efficiency		87.38 %	± 0.01	0.71 %	
Volumetric efficiency		62.2 %	± 0.16 %	0.25 %	
Isentropic efficiency		61.5 %	± 0.45 %	0.72 %	
Oil circulation rate (OCR)		0.0220 %	± 0.445 %	238.27 %	Uncertainty high due to on/off valve
Heat rejection	[kW]	30.6	± 0.11	0.4 %	
Cooling capacity	[kW]	0.0	± 0.00	0.0 %	
Pressure, evaporator, inlet	[bar]	55.3	± 0.14 0.00	0.3 %	
Pressure, throttle valve,in	[bar]	80.1	± 0.20	0.3 %	
Temperature, throttle valve, in	[°C]	54.8	± 0.04	0.1 %	
Temperature, throttle valve out	[°C]	-1.3	± 0.03	2.0 %	

### Compressor

			Total Deviation	Total uncertainty	Comment
Inlet suction pressure	[bar]	19.8	± 0.05	0.3 %	
Inlet temperature	[°C]	-10.1	± -0.05	0.5 %	
Inlet super heat	[K]	9.7	± 0.05	0.5 %	
Outlet pressure	[bar]	79.9	± 0.20	0.3 %	
Outlet temperature	[°C]	127.5	± 0.04	0.03 %	
Pressure ratio	[-]	4.0	± 0.015	0.4 %	
Lubricant return mass flow rate:	[kg/h]	0.2	± 0.54	238.3 %	on/off valve
Temperature, lubricant return:	[°C]	50.1	± 1.44	2.9 %	
Compressor Speed	[rpm]	1500	± 3.00	0.2 %	
Torque	[Nm]	198	± 1.41	0.7 %	
Power consumption	[kW]	31.1	± 0.21	0.7 %	
Massflow R-744	[kg/h]	1029	± 2.11	0.2 %	
Specific volume (suction line)	[m³/kg]	0.02	± 0.00	0.1 %	
Density CO2 (suction line)	[kg/m³]	48.3	± 0.04	0.1 %	
Volumetric efficiency	[%]	<u>62.2 %</u>	± 0.16 %	0.25 %	
Isentropic efficiency	[%]	<u>61.5 %</u>	± 0.45 %	0.72 %	

Aircooler						
<b>Gascooler TAG 2</b>			<b>Total Deviation</b>	<b>Total uncertainty</b>	<b>Comment</b>	
Specific heat difference	<i>kJ/kg</i>	95.5	±	0.36	0.4 %	
Capacity	<i>[kW]</i>	27.3	±	0.12	0.4 %	
Temperature difference R-744	<i>°C</i>	65.1	±	0.07	0.1 %	
Mass flow air	<i>kg/h</i>	-				
Effect	<i>%</i>		±			
Pressure drop	<i>bar</i>	0.1	±	0.00	4.8 %	
Mass flow R744	<i>kg/h</i>	1029	±	2.11	0.2 %	
Inlet temperature		122.1	±			
Outlet temperature		56.95				
			±			
			±			
Watercooler						
<b>Gascooler TAG 3</b>			±			
Specific heat difference	<i>kJ/kg</i>	1.5		0.48	30.8 %	
Cooling capacity	<i>kW</i>	0.4	±		0.0 %	
Mass flow water	<i>Kg/h</i>		±			
Temperature difference R-744	<i>°C</i>	0.8		0.08	9.5 %	
Pressure drop	<i>bar</i>	0.0		0.00	6.9 %	
Mass flow R-744	<i>kg/h</i>	1029	±	2.11	0.2 %	
Temperature difference water	<i>°C</i>	1.8		0.09	5.2 %	
Gascooler 4a						
<b>R744 side</b>			<b>Total Deviation</b>	<b>Total uncertainty</b>	<b>Comment</b>	
Inlet temperature	<i>°C</i>	56.1	±	0.05	0.1 %	
Outlet temperature	<i>°C</i>	42.1	±	0.05	0.1 %	
Specific heat difference	<i>kJ/kg</i>	0.04	±	0.00	2.0 %	
Temperature difference	<i>°C</i>	14.0	±	0.08	0.6 %	
Mass flow R744	<i>Kg/h</i>	1029	±	2.11	0.2 %	
Cooling capacity	<i>kW</i>	10.9	±	0.22	2.0 %	
Pressure drop	<i>bar</i>	0.03	±	0.00	3.8 %	
<b>Glycol side</b>						
Specific heat difference	<i>kJ/kg</i>	0.05	±	0.34	723.7 %	
Temperature difference	<i>°C</i>	13.5	±	0.10	0.7 %	
Mass flow glycol	<i>Kg/h</i>	-3	±	0.00	0.1 %	
Cooling capacity	<i>kW</i>	-0.04	±	0.00	0.2 %	
Pressure drop	<i>Pa</i>	0.00	±	0.00	2.5 %	

Gascooler 4b							
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**R744 side**

Inlet temperature	°C	56.1	±	0.1 %
Outlet temperature	°C	55.0	±	0.1 %
Specific heat difference	<i>kJ/kg</i>	2.0	±	38.9 %
Temperature difference	°C	1.1	±	7.9 %
Mass flow R744	<i>kg/h</i>	1029	±	0.2 %
Cooling capacity	<i>kW</i>	0.00	±	39.0 %
Pressure drop	<i>Bar</i>	0.04	±	5.0 %

**Glycol side**

Specific heat difference	<i>kJ/kg</i>	120.0	±	155.5 %
Temperature difference	°C	34.3	±	0.4 %
Mass flow glycol	<i>Kg/h</i>	-1	±	0.1 %
Cooling capacity	<i>kW</i>	-329	±	0.1 %
Pressure drop	<i>bar</i>	0.01	±	7.1 %

IHX							
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**HP side**

			Total Deviation	Total uncertainty	Comment
Specific heat difference	<i>kJ/kg</i>	1.6	±	0.50	31.5 %
Temperature difference	°C	0.7	±	0.06	8.6 %
Mass flow R744	<i>kg/h</i>	1029	±	2.11	0.2 %
Cooling capacity	<i>kW</i>	0.5	±	0.00	0.0 %
Pressure loss	<i>bar</i>	1.8	±	0.00	0.0 %

**LP side**

Specific heat difference	<i>kJ/kg</i>	10.1	±	0.46	4.6 %
Temperature difference	°C	38.7	±	0.06	0.1 %
Mass flow R744	<i>Kg/h</i>	1029	±	2.11	0.2 %
Cooling capacity	<i>kW</i>	0.0	±	0.00	0.0 %
Pressure loss	<i>bar</i>	0.03	±	0.00	7.2 %
Superheat IHX inlet	[°C]	10.2			

Evaporator 6a							
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**R744 side**

			Total Deviation	Total uncertainty	Comment
Pressure inlet	<i>bar</i>	55.3	±	0.14	0.25 %
Temperature difference	°C	-4.1	±	0.00	0.0 %
Mass flow R744	<i>kg/h</i>	1029	±	2.11	0.2 %
Heat difference R744	<i>kJ/kg</i>	-202	±	-0.10	0.0 %
Cooling capacity	<i>kW</i>	-57.62	±	-0.03	0.0 %
Pressure drop	<i>bar</i>	0.02	±	0.00	2.2 %

**Glycol side**

Specific heat difference	<i>kJ/kg</i>	6.17	±	77	1247.8 %
Temperature difference	°C	1.78	±	0.07	3.9 %
Mass flow glycol	<i>Kg/h</i>	0	±	0.00	48.9 %
Cooling capacity	<i>kW</i>	0.00	±	1	14083870.0 %
Pressure drop	<i>bar</i>	0.01	±	0.00	5.7 %

Evaporator 6b							
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**R744 side**

Pressure inlet	<i>bar</i>	55.3	±	0.14	0.25 %
Specific heat to R744	<i>kJ/kg</i>	0.3	±	0.00	0.0 %
Temperature difference	°C	19.1	±	0.03	0.2 %
Mass flow R744	<i>kg/h</i>	1029	±	2.1	0.2 %
Cooling capacity	<i>kW</i>	0.0	±	0.00	0.0 %
Pressure drop	<i>bar</i>	0.03	±	0.00	2.4 %

**Glycol side**

Specific heat out	<i>kJ/kg</i>	18960.0	±	66873.1	352.7 %
Temperature difference	°C	3259.7	±	8.19	0.3 %
Mass flow glycol	<i>Kg/h</i>	-0	±	0.00	48.9 %
Cooling capacity	<i>kW</i>	0.1	±	0.22	356.1 %
Pressure drop	<i>bar</i>	0.01	±	0.00	5.3 %