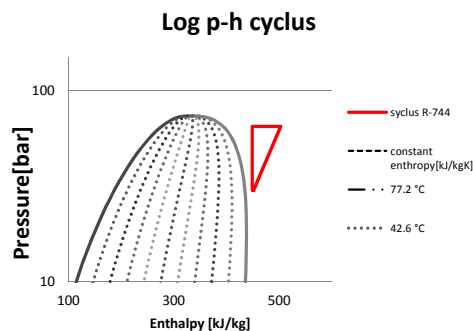


Experiment no: 4
Date: 22.05.2012
Operator: Obrist/Roman
Mode: comp.test 800 rpm
Measured points 84

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
COP	-	1.0	± 0.02	1.90 %	
Compressor Speed	[rpm]	800	± 1.60	0.2 %	
Mass flow R744	[kg/h]	987	± 2.04	0.2 %	
Mass flow water/ethyleneglycol	[kg/h]	0.0	± 0.00	15.0 %	
Ambient temperature	[°C]	20.3	± 0.07	0.4 %	
Supply power	[kW]	16.7	± 0.03	0.2 %	
Power consumption compressor	[kW]	14.3	± 0.18	1.2 %	
Danfoss VSD efficiency		85.51 %	± 0.01	1.26 %	
Volumetric efficiency		73.2 %	± 0.40 %	0.54 %	
Isentropic efficiency		66.0 %	± 0.87 %	1.32 %	
Oil circulation rate (OCR)		0.3568 %	± 0.873 %	117.81 %	Uncertainty high due to on/off valve
Heat rejection	[kW]	14.7	± 0.06	0.4 %	
Cooling capacity	[kW]	0.0	± 0.00	0.0 %	
Pressure, evaporator, inlet	[bar]	62.7	± 0.16 0.00	0.3 %	
Pressure, throttle valve,in	[bar]	65.2	± 0.16	0.3 %	
Temperature, throttle valve, in	[°C]	42.6	± 0.06	0.1 %	
Temperature, throttle valve out	[°C]	-1.3	± 0.03	2.0 %	

Compressor

			Total Deviation	Total uncertainty	Comment
Inlet suction pressure	[bar]	30.1	± 0.08	0.3 %	
Inlet temperature	[°C]	5.3	± 0.05	1.0 %	
Inlet super heat	[K]	10.7	± 0.05	0.5 %	
Outlet pressure	[bar]	65.1	± 0.16	0.3 %	
Outlet temperature	[°C]	77.2	± 0.05	0.07 %	
Pressure ratio	[-]	2.2	± 0.008	0.4 %	
Lubricant return mass flow rate:	[kg/h]	3.5	± 4.18	118.2 %	on/off valve
Temperature, lubricant return:	[°C]	48.6	± 0.70	1.4 %	
Compressor Speed	[rpm]	800	± 1.60	0.2 %	
Torque	[Nm]	171	± 2.16	1.3 %	
Power consumption	[kW]	14.3	± 0.18	1.2 %	
Massflow R-744	[kg/h]	987	± 2.04	0.2 %	
Specific volume (suction line)	[m³/kg]	0.01	± 0.00	0.2 %	
Density CO2 (suction line)	[kg/m³]	74.1	± 0.12	0.2 %	
Volumetric efficiency	[%]	<u>73.2 %</u>	± 0.40 %	0.54 %	
Isentropic efficiency	[%]	<u>66.0 %</u>	± 0.87 %	1.32 %	

Aircooler						
Gascooler TAG 2			Total Deviation	Total uncertainty	Comment	
Spesific heat difference	<i>kJ/kg</i>	51.1	±	0.38	0.7 %	
Capacity	<i>[kW]</i>	14.0	±	0.11	0.8 %	
Temperature difference R-744	<i>°C</i>	32.9	±	0.09	0.3 %	
Mass flow air	<i>kg/h</i>	-				
Effect	<i>%</i>		±			
Pressure drop	<i>bar</i>	0.1	±	0.00	4.3 %	
Mass flow R744	<i>kg/h</i>	987	±	2.04	0.2 %	
Inlet temperature		75.2	±			
Outlet temperature		42.34				
			±			
			±			
Watercooler						
Gascooler TAG 3			±			
Spesific heat difference	<i>kJ/kg</i>	0.0		0.00	0.0 %	
Cooling capacity	<i>kW</i>	0.0	±		0.0 %	
Mass flow water	<i>Kg/h</i>		±			
Temperature differenca R-744	<i>°C</i>	0.1		0.11	129.5 %	
Pressure drop	<i>bar</i>	0.0		0.00	3.6 %	
Mass flow R-744	<i>kg/h</i>	987	±	2.04	0.2 %	
Temperature difference water	<i>°C</i>	2.6		0.11	4.3 %	

Gascooler 4a						
R744 side			Total Deviation	Total uncertainty	Comment	
Inlet temperature	<i>°C</i>	42.3	±	0.06	0.1 %	
Outlet temperature	<i>°C</i>	39.3	±	0.03	0.1 %	
Spesific heat difference	<i>kJ/kg</i>	0.01	±	0.00	7.2 %	
Temperature difference	<i>°C</i>	3.0	±	0.07	2.4 %	
Mass flow R744	<i>Kg/h</i>	987	±	2.04	0.2 %	
Cooling capacity	<i>kW</i>	1.8	±	0.13	7.2 %	
Pressure drop	<i>bar</i>	0.05	±	0.00	4.1 %	
Glycol side						
Spesific heat difference	<i>kJ/kg</i>	0.05	±	0.38	782.2 %	
Temperature difference	<i>°C</i>	13.8	±	0.11	0.8 %	
Mass flow glycol	<i>Kg/h</i>	-3	±	0.00	0.0 %	
Cooling capacity	<i>kW</i>	-0.04	±	0.00	0.2 %	
Pressure drop	<i>Pa</i>	0.00	±	0.00	1.7 %	

Gascooler 4b					
R744 side					
Inlet temperature	°C	42.3	±	0.1 %	
Outlet temperature	°C	44.8	±	0.2 %	
Specific heat difference	<i>kJ/kg</i>	5.3	±	9.0 %	
Temperature difference	°C	2.5	±	4.7 %	
Mass flow R744	<i>kg/h</i>	987	±	0.2 %	
Cooling capacity	<i>kW</i>	0.00	±	9.0 %	
Pressure drop	<i>Bar</i>	0.04	±	2.1 %	
Glycol side					
Specific heat difference	<i>kJ/kg</i>	106.3	±	194.9 %	
Temperature difference	°C	30.3	±	0.5 %	
Mass flow glycol	<i>Kg/h</i>	-2	±	0.1 %	
Cooling capacity	<i>kW</i>	-333	±	0.1 %	
Pressure drop	<i>bar</i>	0.01	±	9.8 %	

IHX					
HP side			Total Deviation	Total uncertainty	Comment
Specific heat difference	<i>kJ/kg</i>	0.7	±	0.19	25.7 %
Temperature difference	°C	0.2	±	0.09	45.6 %
Mass flow R744	<i>kg/h</i>	987	±	2.04	0.2 %
Cooling capacity	<i>kW</i>	0.2	±	0.00	0.0 %
Pressure loss	<i>bar</i>	1.8	±	0.00	0.0 %
LP side					
Specific heat difference	<i>kJ/kg</i>	36.0	±	0.66	1.8 %
Temperature difference	°C	21.8	±	0.05	0.2 %
Mass flow R744	<i>Kg/h</i>	987	±	2.04	0.2 %
Cooling capacity	<i>kW</i>	0.0	±	0.00	0.0 %
Pressure loss	<i>bar</i>	0.04	±	0.00	5.1 %
Superheat IHX inlet	<i>[°C]</i>	3.3			

Evaporator 6a					
R744 side			Total Deviation	Total uncertainty	Comment
Pressure inlet	<i>bar</i>	62.7	±	0.16	0.25 %
Temperature difference	°C	-4.1	±	0.00	0.0 %
Mass flow R744	<i>kg/h</i>	987	±	2.04	0.2 %
Heat difference R744	<i>kJ/kg</i>	-205	±	-0.09	0.0 %
Cooling capacity	<i>kW</i>	-56.30	±	-0.03	0.0 %
Pressure drop	<i>bar</i>	0.05	±	0.00	1.0 %
Glycol side					
Specific heat difference	<i>kJ/kg</i>	7.75	±	105	1360.7 %
Temperature difference	°C	2.24	±	0.08	3.7 %
Mass flow glycol	<i>Kg/h</i>	0	±	0.00	15.0 %
Cooling capacity	<i>kW</i>	0.00	±	1	13484425.4 %
Pressure drop	<i>bar</i>	0.01	±	0.00	2.6 %

Evaporator 6b					
R744 side					
Pressure inlet	<i>bar</i>	62.7	±	0.16	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>	987	±	2.0	0.2 %
Cooling capacity	<i>kW</i>	0.0	±	0.00	0.0 %
Pressure drop	<i>bar</i>	0.05	±	0.00	0.9 %
Glycol side					
Specific heat out	<i>kJ/kg</i>	18946.1	±	66873.0	353.0 %
Temperature difference	°C	3255.7	±	8.19	0.3 %
Mass flow glycol	<i>Kg/h</i>	-0	±	0.00	15.0 %
Cooling capacity	<i>kW</i>	0.1	±	0.33	353.3 %
Pressure drop	<i>bar</i>	0.01	±	0.00	3.0 %