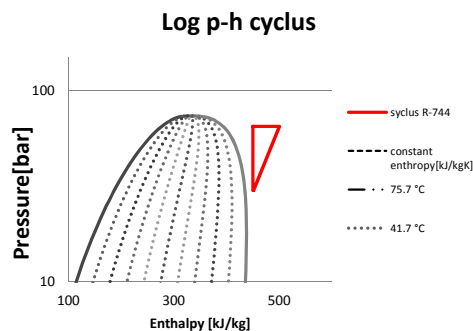


Experiment no: 4
Date: 22.05.2012
Operator: Obrist/Roman
Mode: comp.test 2000 rpm
Measured points 52

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	-	1.1	± 0.01	1.14 %	
Compressor Speed	[rpm]	2000	± 4.00	0.2 %	
Mass flow R744	[kg/h]	2732	± 5.51	0.2 %	
Mass flow water/ethyleneglycol	[kg/h]	0.0	± 0.00	19.2 %	
Ambient temperature	[°C]	20.5	± 0.10	0.5 %	
Supply power	[kW]	41.8	± 0.08	0.2 %	
Power consumption compressor	[kW]	35.9	± 0.22	0.6 %	
Danfoss VSD efficiency		86.07 %	± 0.01	0.65 %	
Volumetric efficiency		81.9 %	± 0.45 %	0.55 %	
Isentropic efficiency		73.6 %	± 0.56 %	0.76 %	
Oil circulation rate (OCR)		0.9100 %	± 0.559 %	48.18 %	Uncertainty high due to on/off valve
Heat rejection	[kW]	38.5	± 0.18	0.5 %	
Cooling capacity	[kW]	0.0	± 0.00	0.0 %	
Pressure, evaporator, inlet	[bar]	62.2	± 0.16 0.00	0.3 %	
Pressure, throttle valve,in	[bar]	63.7	± 0.16	0.3 %	
Temperature, throttle valve, in	[°C]	41.7	± 0.07	0.2 %	
Temperature, throttle valve out	[°C]	-1.3	± 0.03	2.0 %	

Compressor

			Total Deviation	Total uncertainty	Comment
Inlet suction pressure	[bar]	30.0	± 0.08	0.3 %	
Inlet temperature	[°C]	5.3	± 0.06	1.1 %	
Inlet super heat	[K]	10.8	± 0.06	0.5 %	
Outlet pressure	[bar]	65.1	± 0.16	0.3 %	
Outlet temperature	[°C]	75.7	± 0.06	0.08 %	
Pressure ratio	[-]	2.2	± 0.008	0.4 %	
Lubricant return mass flow rate:	[kg/h]	25.1	± 12.20	48.6 %	on/off valve
Temperature, lubricant return:	[°C]	63.2	± 0.22	0.4 %	
Compressor Speed	[rpm]	2000	± 4.00	0.2 %	
Torque	[Nm]	172	± 1.12	0.7 %	
Power consumption	[kW]	35.9	± 0.22	0.6 %	
Massflow R-744	[kg/h]	2732	± 5.51	0.2 %	
Specific volume (suction line)	[m³/kg]	0.01	± 0.00	0.2 %	
Density CO2 (suction line)	[kg/m³]	73.9	± 0.13	0.2 %	
Volumetric efficiency	[%]	<u>81.9 %</u>	± 0.45 %	0.55 %	
Isentropic efficiency	[%]	<u>73.6 %</u>	± 0.56 %	0.76 %	

Aircooler						
Gascooler TAG 2				Total Deviation	Total uncertainty	Comment
Specific heat difference	<i>kJ/kg</i>	49.8	±	0.39	0.8 %	
Capacity	<i>[kW]</i>	37.8	±	0.31	0.8 %	
Temperature difference R-744	<i>°C</i>	32.2	±	0.11	0.3 %	
Mass flow air	<i>kg/h</i>	-				
Effect	<i>%</i>		±			
Pressure drop	<i>bar</i>	0.2	±	0.00	0.8 %	
Mass flow R744	<i>kg/h</i>	2732	±	5.51	0.2 %	
Inlet temperature		74.8	±			
Outlet temperature		42.57				
			±			
			±			
Watercooler						
Gascooler TAG 3			±			
Specific heat difference	<i>kJ/kg</i>	-0.3		0.00	0.0 %	
Cooling capacity	<i>kW</i>	-0.2	±		0.0 %	
Mass flow water	<i>Kg/h</i>		±			
Temperature difference R-744	<i>°C</i>	0.3		0.12	49.1 %	
Pressure drop	<i>bar</i>	0.0		0.00	0.8 %	
Mass flow R-744	<i>kg/h</i>	2732	±	5.51	0.2 %	
Temperature difference water	<i>°C</i>	2.3		0.11	4.6 %	
Gascooler 4a						
R744 side				Total Deviation	Total uncertainty	Comment
Inlet temperature	<i>°C</i>	42.3	±	0.08	0.2 %	
Outlet temperature	<i>°C</i>	39.1	±	0.04	0.1 %	
Specific heat difference	<i>kJ/kg</i>	0.01	±	0.00	7.1 %	
Temperature difference	<i>°C</i>	3.2	±	0.09	2.7 %	
Mass flow R744	<i>Kg/h</i>	2732	±	5.51	0.2 %	
Cooling capacity	<i>kW</i>	5.0	±	0.36	7.1 %	
Pressure drop	<i>bar</i>	0.04	±	0.00	4.6 %	
Glycol side						
Specific heat difference	<i>kJ/kg</i>	0.04	±	0.38	865.5 %	
Temperature difference	<i>°C</i>	12.5	±	0.11	0.9 %	
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	1.5 %	

Gascooler 4b					
R744 side					
Inlet temperature	°C	42.3	±	0.1 %	
Outlet temperature	°C	42.9	±	0.1 %	
Specific heat difference	<i>kJ/kg</i>	1.4	±	32.8 %	
Temperature difference	°C	0.6	±	16.5 %	
Mass flow R744	<i>kg/h</i>	2732	±	0.2 %	
Cooling capacity	<i>kW</i>	0.00	±	32.8 %	
Pressure drop	<i>Bar</i>	0.04	±	4.9 %	
Glycol side					
Specific heat difference	<i>kJ/kg</i>	86.7	±	214.5 %	
Temperature difference	°C	24.8	±	0.6 %	
Mass flow glycol	<i>Kg/h</i>	-2	±	0.1 %	
Cooling capacity	<i>kW</i>	-270	±	0.1 %	
Pressure drop	<i>bar</i>	0.01	±	6.1 %	

IHX					
HP side			Total Deviation	Total uncertainty	Comment
Specific heat difference	<i>kJ/kg</i>	2.2	±	0.45	20.2 %
Temperature difference	°C	0.2	±	0.10	42.4 %
Mass flow R744	<i>kg/h</i>	2732	±	5.51	0.2 %
Cooling capacity	<i>kW</i>	1.7	±	0.34	20.2 %
Pressure loss	<i>bar</i>	1.8	±	0.00	0.0 %
LP side					
Specific heat difference	<i>kJ/kg</i>	28.9	±	0.55	1.9 %
Temperature difference	°C	23.4	±	0.06	0.3 %
Mass flow R744	<i>Kg/h</i>	2732	±	5.51	0.2 %
Cooling capacity	<i>kW</i>	0.2	±	0.00	0.0 %
Pressure loss	<i>bar</i>	0.04	±	0.00	10.2 %
Superheat IHX inlet	<i>[°C]</i>	5.2			

Evaporator 6a					
R744 side			Total Deviation	Total uncertainty	Comment
Pressure inlet	<i>bar</i>	62.2	±	0.16	0.25 %
Temperature difference	°C	-4.1	±	0.00	0.0 %
Mass flow R744	<i>kg/h</i>	2732	±	5.51	0.2 %
Heat difference R744	<i>kJ/kg</i>	-206	±	-0.09	0.0 %
Cooling capacity	<i>kW</i>	-156.33	±	-0.07	0.0 %
Pressure drop	<i>bar</i>	0.04	±	0.00	1.5 %
Glycol side					
Specific heat difference	<i>kJ/kg</i>	7.65	±	88	1152.1 %
Temperature difference	°C	2.20	±	0.08	3.7 %
Mass flow glycol	<i>Kg/h</i>	0	±	0.00	19.2 %
Cooling capacity	<i>kW</i>	0.00	±	2	13469452.5 %
Pressure drop	<i>bar</i>	0.01	±	0.00	3.0 %

Evaporator 6b					
R744 side					
Pressure inlet	<i>bar</i>	62.2	±	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>	2732	±	5.5	0.2 %
Cooling capacity	<i>kW</i>	0.0	±	0.00	0.0 %
Pressure drop	<i>bar</i>	0.04	±	0.00	1.4 %
Glycol side					
Specific heat out	<i>kJ/kg</i>	18944.8	±	66873.0	353.0 %
Temperature difference	°C	3255.3	±	8.19	0.3 %
Mass flow glycol	<i>Kg/h</i>	-0	±	0.00	19.2 %
Cooling capacity	<i>kW</i>	0.1	±	0.35	353.5 %
Pressure drop	<i>bar</i>	0.01	±	0.00	4.2 %